U.S. DEPARTMENT OF THE INTERIOR
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CHEMICAL COMPOSITION OF FERROMANGANESE CRUSTS IN THE WORLD OCEAN: A REVIEW AND COMPREHENSIVE DATABASE

Edited by
F.T. Manheim and C.M. Lane-Bostwick

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By Frank T. Manheim and Candice M. Lane-Bostwick

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Atlantic-Gulf Branch
Woods Hole, MA 02543

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September 1988

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A REVIEW AND COMPREHENSIVE DATABASE

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I INTRODUCTION by F.T. Manheim

We define ferromanganese oxide crusts (hereafter referred to only as crusts) as encrustations forming largely on hard substrates that are at least periodically kept free from detrital sedimentation by strong currents, steep slopes, or both. In near-shore or hydrothermal environments where metal supply is much greater than it is in most of the open ocean, crusts may also form on soft sediments. Thus, the open ocean crusts, which are largely found in raised areas like seamounts and ridges, contrast with abyssal nodules, which are found lying on or in soft sediments, usually at depths greater than 4500 m. The chemical composition, mineralogy, and source of metals for crusts are significantly different than for abyssal nodules (Figs. II-1 to II-4).

In the years before the increased interest in crusts (1981) most investigations categorized ferromanganese oxide phases in the oceans under the blanket term "nodules", which confuses terminology as well as understanding of habitats. In the historical summary we refer to the collective "nodules" as ferromanganese oxide deposits, whereas abyssal nodules, specified or presumed, are referred to simply as abyssal nodules. The abyssal nodules will not be discussed in this report except for comparison or background purposes, since an extensive literature exists for them (see Glasby, 1977; Meylan and others, 1981; Haynes and others, 1982; McKelvey and others, 1983; Murdmaa and Skornyakova, 1986, and Baturin, 1986 for background references).

The pioneering German "Midpac I" investigation of cobalt-rich ferromanganese oxide phases in the Central Pacific in 1981 set in motion several series of events. On the scientific front, interest in the processes causing cobalt enrichment in seamount "nodules" and crusts was heightened. Recognition of the possible resources in cobalt rich crusts within 200 miles of U.S. and territorial coasts stimulated environmental impact studies pursuant to possible lease sales by the Minerals Management Service and cooperative reconnaisance cruises by the U.S. Geological Survey. Interest in cobalt resources was among background factors cited in supporting documentation for the declaration of an Exclusive Economic Zone by President Reagan in March, 1983.

Crusts pose more serious problems than do abyssal nodules (see definition in Chapter II) in terms of a comprehensive chemical overview. Unlike nodules, crusts tend to occur in a highly localized manner on and around seamounts and ocean ridges, to some extent on certain current-swept terraces and plateaus, and on some steep island slopes. Their habitat is often rough and irregular. Systematic and effective sampling and definitive descriptions of these habitats have not yet been accomplished.

Second, unlike nodules, which form as discrete hard objects in a soft sediment matrix, crusts generally adhere to hard substrates in such a fashion that they cannot easily be separated from underlying substrate during recovery. Third, there is a complete spectrum of occurrence from oxide layers that are little more than stains to those that are as much as 25 cm oxide thick. Elemental composition of crusts varies from nearly pure manganese or iron oxides (both frequently hydrothermal in origin) to the fairly consistent admixtures that characterize cobalt-rich crusts. What do we choose as "dividing lines", and how does one compare chemical compositions from such diverse material? Finally,

earlier literature data information is often highly variable in quality, and less consistent and reliable than are data from newer, targeted cruises. Earlier crust specimens were often by-products of sampling for igneous rocks, and sample preservation, contamination, labelling, and analytical efforts were less carefully controlled. Yet, the regional coverage provided by this material is valuable, and warrants effort to whenever possible retain the useful information in it.

Our primary effort has been to collect and evaluate all available samples and information, to analyze new samples by means of well-controlled and defined analytical procedures, and to present all information through the end of 1987 in a consistent and complete form. As a part of this effort, we have classified and normalized all data for mapping purposes so that information from diverse sources can be compared over larger geographic areas, as discussed below.

For resolving the difficult problem of contamination and water treatment, described later, we have chosen a basic procedure that normalizes data to a constant Fe+Mn content. As the basis of the vernadite (δMnO_2) mineral phase that dominates most crusts, Fe+Mn oxide content will naturally tend to vary inversely with degree of substrate contamination and water content. When the effect of the latter two variables is minimized, Fe and Mn have been shown to have an inverse relationship. There are occasional exceptions to this but they do not invalidate its general utility; in fact, these cases may involve geochemical or mineralogical phenomena of special interest. We are aware that iron is involved in phases other than the oxide phase, like silicates and phosphates. However, we believe that complications and limitations such as on geographical distribution of samples introduced by making more refined corrections outweigh the benefits of more precise correction at this time. Investigators who wish to use other means of dealing with the comparability problem have the complete basic information in our database to create their own models.

The goal of this report is to present the data base in a form that can be used in computer-addressable and paper format, along with a basic set of descriptive output like regional means, frequency plots, interelement plots, and contoured maps based on gridded data. These enhance the description of the database as well as offer examples of the kinds of treatments that may yield useful information to investigators.

Magnetic tapes and floppy disks will be made available to major information repositories, primarily the National Geologic Data Center (NOAA), in Boulder Colorado, from which the data can be readily retrieved. Our office will not continue complete encoding and support of newly available information, as has been done to date. However, we will be glad to assist inquiries about the interpretation and retrieval of data from the database and may update selected portions of the data.

II HISTORY OF INVESTIGATION By F.T. Manheim

Ferromanganese oxide crusts are members of a family of manganese and iron oxide precipitates that are widely distributed in the lithosphere. Scientists as early as Alexander von Humboldt and Jens Jakob Berzelius in the late 18th and early 19th century (Boussingault, 1882) recognized that manganese oxide precipitates are omnipresent wherever aqueous media are in contact with solid surfaces for a long period of time in the presence of oxygen. On land, oxide concretions and crusts are widespread in lakes and bogs of glaciated terranes, e.g. in Scandinavia, Britain, northern Germany, and European Russia, and were used as early as 800-500 B.C. for iron production (Arrhenius, 1959; Tylecote, 1962; R. Maddin, 1987, oral communication). The iron was reduced with charcoal at temperatures around 1100°C with the aid of a bellows, and the resulting sponge was hammered to remove slag and impurities. Further forging and hammering produced nails, swords, and iron implements of all kinds. Swedenborg (1734) in his great monograph on iron (De Ferro) gives a knowledgeable account of both the location of lake and bog ores, as well as a quite "modern" summary of their origin by precipitation from solution, with metal supply attributed to soil leaching and ground water. Bog and lake ore was used in North America in the Colonial era and into the 19th century; it continued to be used in Sweden until the early 1920's for local iron production (Naumann, 1922). Although historically the ores served only as a source of iron, they were temporarily used in Finland as a source of manganese during World War II, when that country was cut off from external supply (Vaasjoki, 1956).

The freshwater nodule deposits had been largely forgotten until the awakening of interest in abyssal manganese nodules in the 1960's. New studies showed extensive freshwater nodules in Green Bay, Wisconsin, as well as in other lakes (Callender and Bowser, 1976 and references cited). Though all natural freshwater ferromanganese oxides have much lower trace metal content than do marine oxides, the Green Bay as well as Blake Plateau crusts and deep ocean nodules were revealed to have potential use as catalyst material for petroleum refining, as demonstrated by American and foreign patents and reports in the middle 1970's (Van Heck and others, 1973, and authors cited in Hubred, 1981).

The most widely noted ferromanganese oxide phase, abyssal nodules, was discovered in the deep oceans by the Challenger Expedition of 1873-4 (Murray, 1876; Buchanan, 1876). The 532 page report on bottom materials from the Challenger expedition (Murray and Renard, 1891) long yielded the dominant body of deepsea information on manganese oxide concretions, and the archived collection of concretions in the British Museum has continued to serve scientific research up to the present time. The Challenger dredge hauls yielded not only the classical black manganese nodules from abyssal depths (4500-6000m), often containing nuclei of sharks' teeth, whale earbones, pumice, volcanic rock or fragments of nodules, but also supplied a less noted variety of oxide coatings, layerings, and crusts (even slabs) of ferromanganese oxide material from lesser depths, some as shallow as 370m.

The chemist on board H.M.S. Challenger, J.Y. Buchanan, and his coworkers analyzed the newly-discovered deep-ocean concretions, demonstrating that they contained significant minor admixtures of copper, nickel and cobalt (Buchanan, 1876). These and other elements including thorium and thallium, which were not to be

further investigated for another 60 years, were first detected qualitatively by the then quite new spectroscope. In a later paper, Buchanan (1891) showed that the abyssal manganese nodules contained much higher concentrations of minor metals than did shallow marine (estuarine) nodules from Loch Fyne in Scotland (TableII-1). He also demonstrated that the oxidation state of the deep ocean forms was considerably higher than that of the nearshore forms (Manheim, 1965). However, Buchanan apparently did not analyze any of the crusts from shallower oceanic depths for trace constituents. The differences in chemical composition and origin between the abyssal nodules and crusts remained as a task for much later investigators, and is the principal subject for this database effort. Typical crusts from the Mid Pacific area are shown in (Figs. II-1 to II-4).

Table II-1. Chemical composition of marine ferromanganese oxides from deep ocean and littoral manganese nodules (from Buchanan, 1891). Samples I-V are deep-ocean concretions, whereas M-R represent littoral nodules from Loch Fyne, at water depths of 100-190m. Samples marked with * refer to sum of NiO + CoO. Available oxygen (O) determined by iodometric titration according to Bunsen. X refers to the state of oxidation of O in MnO_x. All values are in weight percent.

Sample	O (avail)	MnO (total)	NiO	Co_3O_4	X
I	5.47	25.76	1.11	0.19	1.945
II	5.80	26.94	1.32	0.19	1.95
III	5.27	23.91	0.90	0.21	1.97
IV	4.07	18.69	0.68	0.19	1.95
V	4.25	19.30	0.42	0.34	1.97
M	3.96	31.35	0.02*		1.56
N	2.48	27.90	0.02*		1.39
P	3.60	28.54	0.05*		1.56
Q	3.35	29.34	0.03*		1.51
K	6.28	37.15			1.75
R	3.38	29.55			1.51

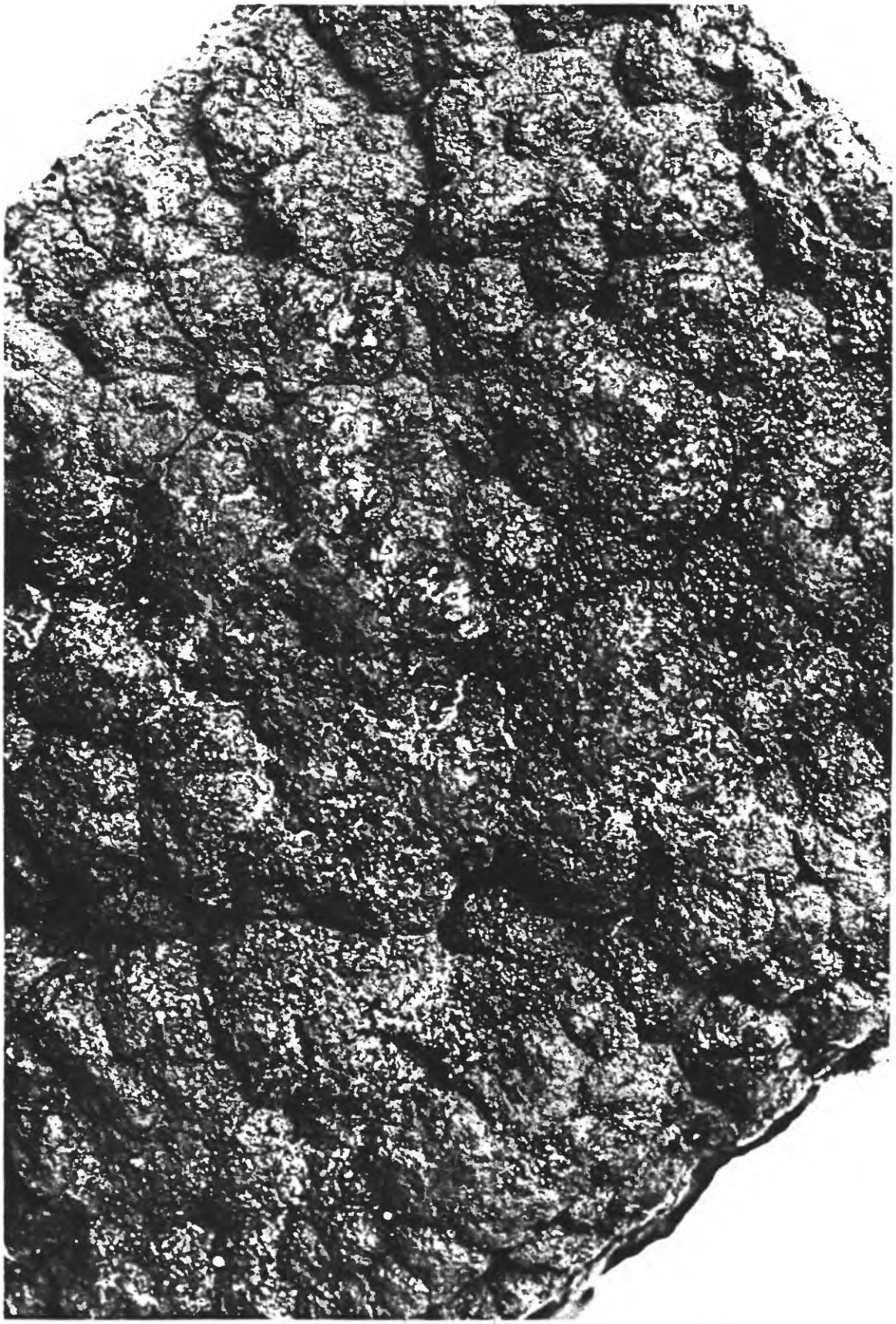


Figure II - 1 Typical botryoidal surface of thick crust, Line Islands Mid-Pacific area (Midpac I expedition)

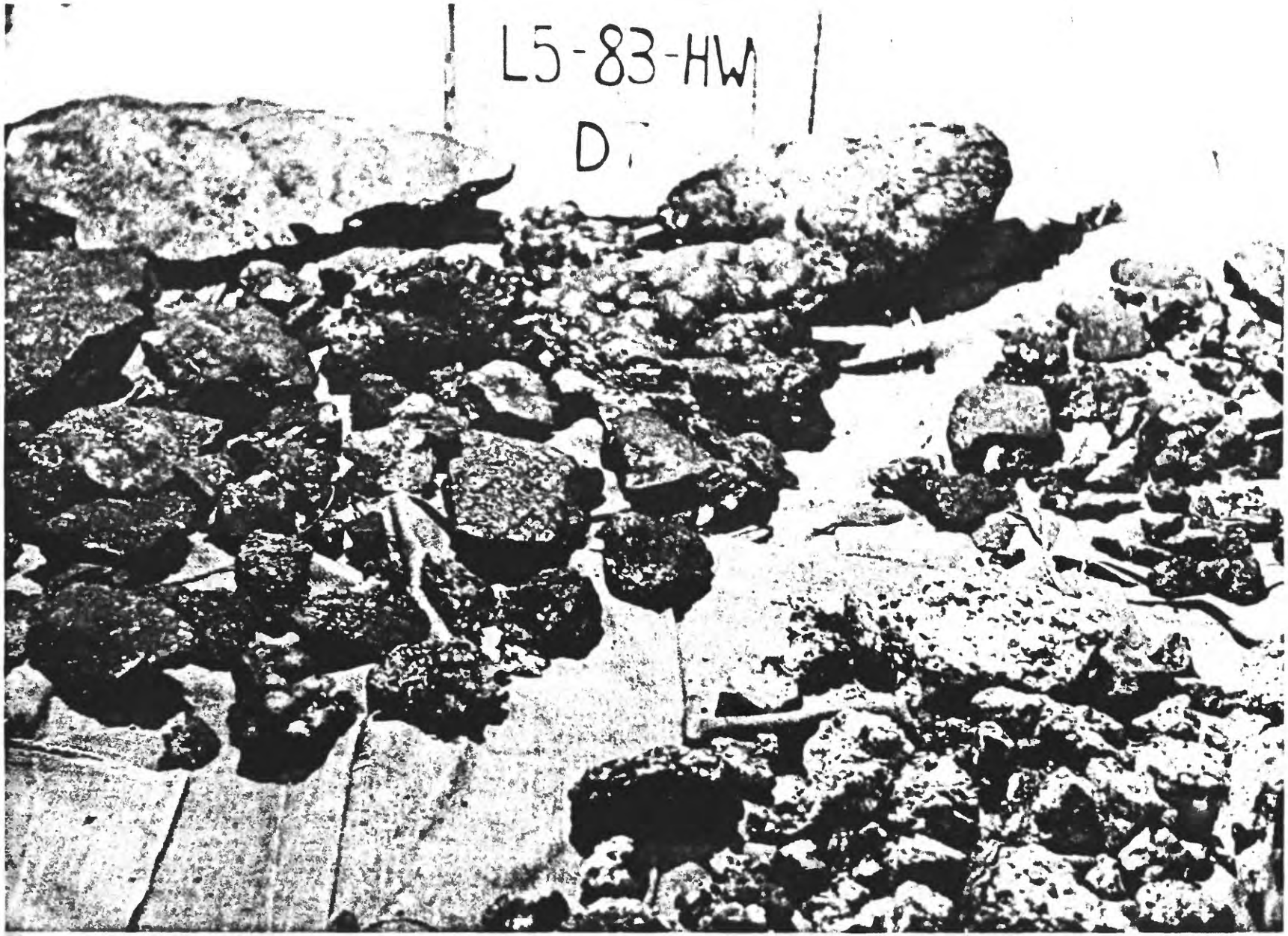


Figure II - 2 Crusts on hyaloclastic breccia, Necker Ridge, Mid-Pacific Mountains area (S.P. Lee expedition)

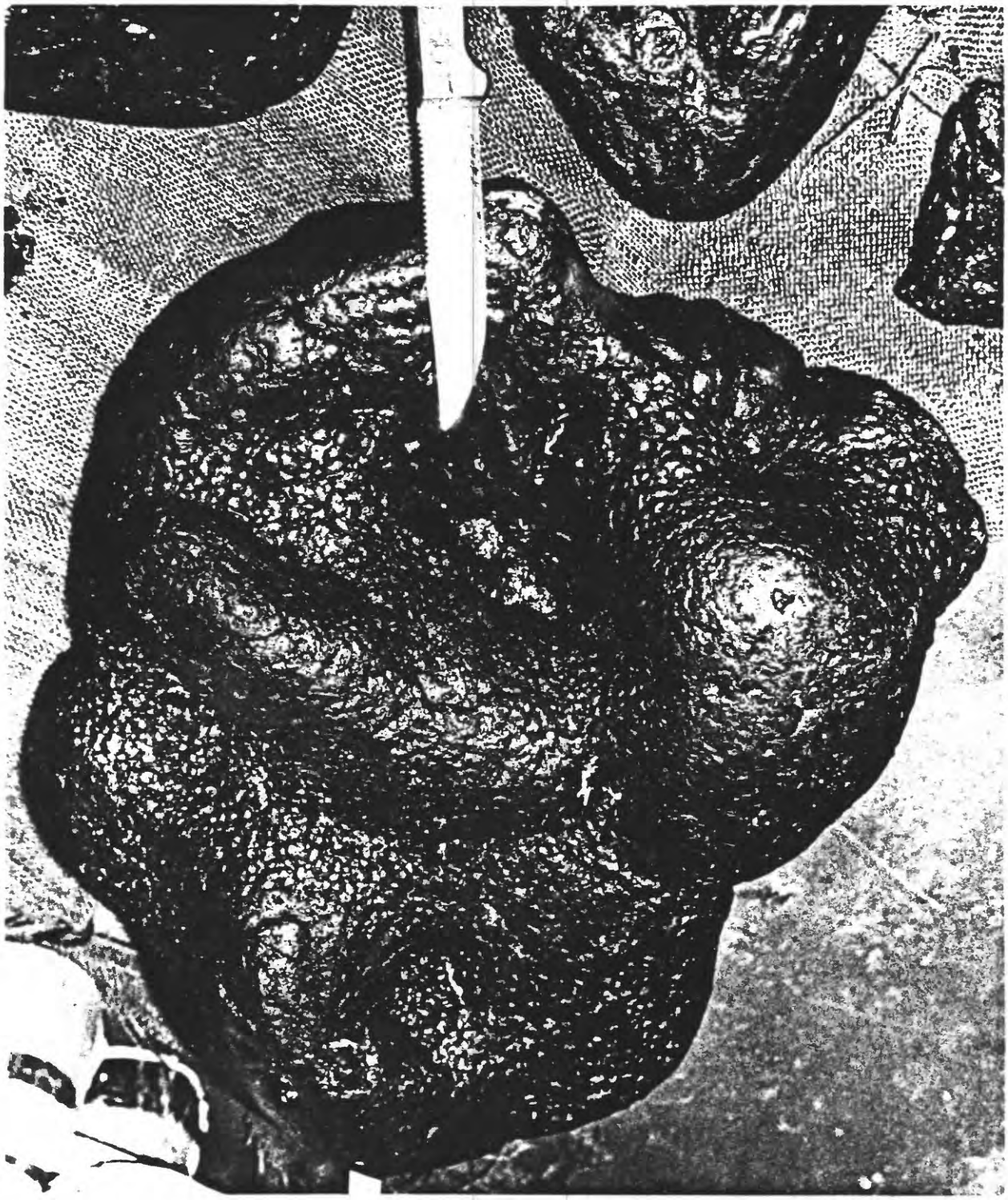


Figure II - 3 Closeup of crusts on altered basalt, Necker Ridge, Mid -Pacific Mountains area (S. P. Lee expedition)

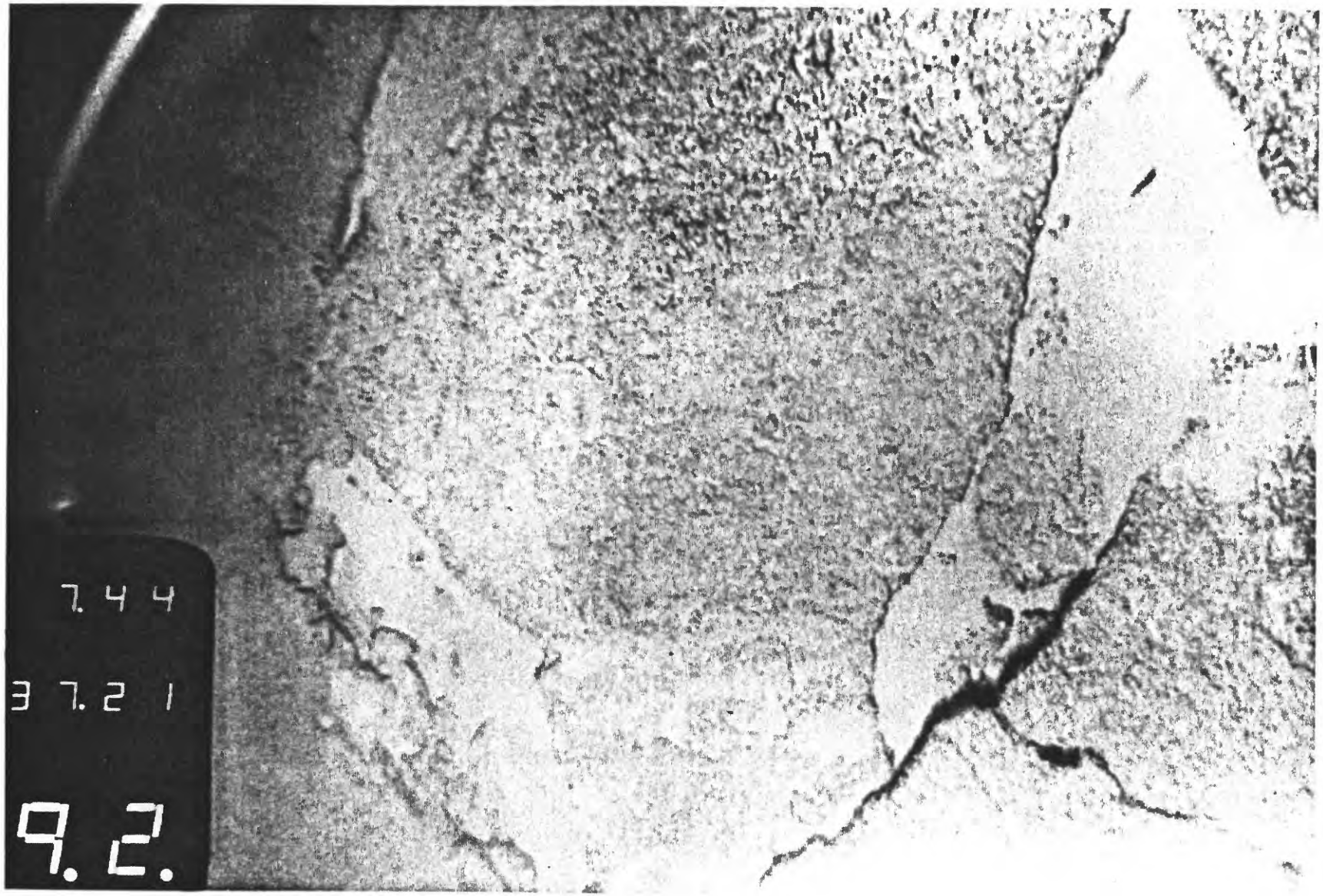


Figure II - 4 Massive ferromanganese pavements and slabs on Blake Plateau off South Carolina, approximately 31 N 78 56' W, water depth ~760m.

Shallow marine oxides

The Challenger Expedition was not, as commonly assumed, the discovery voyage for marine ferromanganese concretions. That distinction seems to belong to a little-known and, from the scientific point of view, poorly documented Sofia Expedition of 1868, under leadership of the Swedish explorer, A.E. Nordenskiold (Manheim, 1978). The Sofia recovered nodules east of Novaya Zemlya in the Kara Sea, in less than 200m water depth. These were later analyzed chemically and reported by Lindstrom (1884).

The extensive historical literature on shallow marine oxides (<200m water depth) was first retrieved from diverse sources by Manheim (1965), and later reviewed by Calvert and Price (1977). Recently, work by J. Ingri has brought the subject up to date, while providing detailed documentation of the formation of ferromanganese concretions and crusts in the Gulf of Bothnia, between Sweden and Finland (Ingri, 1985). The Baltic and Bothnian concretions are rapidly-formed, sometimes on partly-reducing glacio-marine sediments, are dominated by iron, and have cobalt, nickel and copper concentrations on the order of 100-256 ppm, 50-750 ppm, and 10-90 ppm, respectively.

Post - World War II advances; Mero's nodule mining initiative

After World War II, E.D. Goldberg and his colleagues at the Scripps Institution of Oceanography began a series of studies (Goldberg, 1954; Goldberg and Arrhenius, 1958) that established the concept of metal scavanging on the active catalytic surfaces of manganese oxides on the sea floor. Most of the "nodules" reported by Goldberg (1954) were from abyssal depths (5000m) and had .30 percent Co content or less, but a few specimens from the Cape Johnson and Sylvania seamounts had cobalt content as high as .70 percent. As discussed more fully later, seamount and other ferromanganese oxide crusts were normally not distinguished from nodules in most scientific literature until the 1980's, and therefore in the following narrative "nodules" in papers before this period will include diverse oxide phases.

Interestingly, some "nodules" reported from ocean ridge areas in Goldberg's pioneering paper showed very low cobalt, on the order of .03 percent Co or less. We now know that these samples, from elevated rift zones off the coast of Mexico in the east Pacific margin, were formed rapidly under the influence of hydrothermally discharging fluids. The importance of hydrothermal phenomena was not suspected until the paper of Bostrom and Peterson (1966), and was not fully confirmed until the shipboard studies of the late 1970's (e.g. Moore and Vogt, 1976), and the direct observations by submersibles of the early 80's (Rona and others, 1983, and references cited therein). These revealed the now famous hot (350°C) fluid vents, unique benthic organism communities such as foot-long clams and tubeworms, and both sulfide and oxide deposits.

Interest in the economic potential of deep ocean (abyssal) manganese nodules was ignited by the work of John Mero in the early 60's (Mero, 1959-1962). Mero not only provided the first set of extensive minor metal analyses on "nodules", but aggressively advocated commercial exploitation of nodules. The first focused Russian studies of Pacific Ocean manganese nodules commenced about the same time (Skornyakova, 1960). Major Russian research studies from 1960 through 1975 by

the Institute of Oceanology (Bezrukov, 1976) were undoubtedly stimulated by the perceived economic potential of nodules.

Association between higher cobalt (up to 1.6 percent) content and manganese oxide phases from shallower water sites especially on seamounts was probably first recognized in print by Menard (1964). Mero's book of the next year (Mero, 1965) established that the "D" region centering on topographic highs in the central Pacific Ocean had the highest average cobalt concentrations (mean of 1.2 percent) for "nodules" of any region in the world oceans. Mero speculated that either the basaltic rocks of the seamounts were enriched in cobalt, or that the strong currents known around the seamounts contributed to more oxidizing conditions. Whereas we now understand that hydrothermal fluids and their associated oxide precipitates have low cobalt and trace element content (Manheim, 1986 and references cited), in the 1960's quite an opposite relationship between cobalt and vulcanism was postulated by Arrhenius and coworkers (Arrhenius, Mero and Korkisch, 1964, and Arrhenius and Bonatti, 1965). Cobalt-rich seamount nodules were ascribed to rapidly formed vulcanogenic origin, whereas the low-cobalt continental margin phases (now known to be rapidly formed under influence of submarine vulcanism) were thought to be slowly accumulated. British investigator D.S. Cronan drew attention to the correlations between water depth and cobalt content of the ferromanganese phases, based on existing data and new analyses performed as a part of his PhD dissertation at Imperial College, University of London (Cronan, 1967; Cronan and Tooms, 1969; Cronan, 1977). He has continued world-wide research on manganese phases (Cronan, 1980, 1986).

The 1970's: the Scripps Institution Nodule Data Bank (SNDB)

Searching for explanations to the anomalous cobalt content of seamount nodules, Cronan (1977) expanded on the earlier idea of Mero (1965) that enrichment in cobalt might be aided by higher oxidizing conditions on seamounts. This concept was encouraged by the studies of Burns (1965, 1976), who reported that cobalt is oxidized to the Co (III) state and substitutes for Mn (IV), a reaction that can form the basis of highly efficient coprecipitation of cobalt from solution. The trivalent behavior of cobalt was later documented by Murray and Dillard (1979), Varentsov and others. (1980) and Dillard and others (1982) by photoelectron spectroscopy, though the "oxidizing environment" hypothesis was later criticized by Halbach and Manheim (1984). Two other United Kingdom specialists on ferromanganese oxide phases, S.E. Calvert and N.B. Price, had emphasized two separate metal sources for abyssal nodules: one from ambient water (hydrogenetic), and another from metals released by diagenetic alteration from bottom sediments (Price and Calvert, 1970). The former type of deposition was empirically observed to produce vernadite (δMnO_2; Chukhrov and others, 1978), an iron-rich, poorly crystalline mineral form that dominates crusts. The latter often produced todorokite, a more manganese-rich MnO_2 mineral that is often found in nodules as well as in hydrothermal manganese oxides (Turner and Buseck, 1981).

Chemical and mineralogical partitioning systems to explain chemical composition in ferromanganese phases generally were elaborated from the 1970's. These and other chemical models that partially treat crust phases are documented in books on ferromanganese oxides edited by Glasby (1977), Bischoff and Piper (1979) and Baturin (1986), as well as in results from several National Science Foundation programs; Ferromanganese Nodules, Nazca Plate, and MANOP (see Heath, 1981 and Dymond and others, 1984 for extensive references).

The general linkage between cobalt content and ferromanganese oxide phases associated with raised areas of the ocean was documented in statistical summaries of chemical data from the Scripps Institution Nodule Data Bank, initiated and led from 1972 to 1980 by J. Frazer and M. Fisk (1980). A summary of variability of cobalt content by environment and water depth (Table II-2, Frazer and Fisk, 1981) provided a statement of relationships that have been confirmed and refined by the present study. A source of confusion common to all studies up to recent time is the fact that no distinction between nodules and crusts was made in Frazer and Fisk's statistical summaries and most other work prior to 1982. Table II-2 shows clearly that there is a systematic inverse relationship between cobalt and water depth for oxides samples from seamounts of all oceans, not merely the Central Pacific, though the latter area exhibits the highest cobalt concentrations and the sharpest increase in cobalt content with decreasing water depth. The present studies suggest that virtually the entire cobalt anomaly is due to presence of crusts and their related phases, as distinguished from sediment-hosted nodules.

Though the existence of cobalt-enriched ferromanganese phases associated with seamounts had been noted and discussed, as indicated above, frequent exceptions to the cobalt-water depth relationships were observed, as for example, around the Hawaiian Islands (Frank and others, 1976; Craig and others, 1982). Moreover, although the origin of >1 percent nickel and copper in high-value abyssal nodules from the Clarion-Clipperton zone was explained by their relationship to plankton productivity and mobilization of metals from host sediments (Horn and others, 1972; Heath, 1981 and publications cited), no convincing explanation of cobalt distributions in "seamount nodules" were found.

Table II-2. Cobalt concentration in "nodules" from various geographic regions and water depths (Frazer and Fisk, 1980).

Environment	Water Depth (thousands of meters)							
	<1	1-2	2-3	3-4	4-5	5-6	>6	All Depths
Mid Pacific Abyssal	-	-	-	0.39 (27)	0.36 (158)	0.27 (354)	0.24 (30)	0.30 (569)
CC Zone Abyssal	-	-	-	0.20 (9)	0.26 (540)	0.23 (223)	0.37 (1)	0.25 (773)
Other Abyssal	-	-	-	0.22 (156)	0.20 (617)	0.21 (348)	0.24 (10)	0.21 (1131)
Mid-Pacific Seamounts	1.34 (6)	0.79 (89)	0.59 (25)	0.49 (17)	-	-	-	0.74 (137)
Other Seamounts	0.64 (6)	0.57 (37)	0.43 (48)	0.22 (111)	-	-	-	0.34 (202)
Ridges	0.40 (30)	0.45 (13)	0.36 (27)	0.33 (35)	-	-	-	0.37 (105)
Active Spreading Centers	-	0.38 (3)	0.33 (33)	0.25 (151)	-	-	-	0.26 (187)
Marginal Highs	0.14 (14)	0.34 (42)	0.19 (70)	0.20 (31)	-	-	-	0.23 (157)
All Environments	0.46 (56)	0.61 (184)	0.34 (203)	0.25 (537)	0.24 (1315)	0.24 (925)	0.25 (41)	0.27 (3261)

() = number of samples

National studies:

Japanese studies

The first significant Japanese investigations of deep ocean nodules were carried out by the Japanese Geological Survey from 1969 through 1972 (Mizuno, 1974 and references cited). Construction of the oceanographic vessels, *Hakurei Maru* I in 1974 and *Hakurei Maru* II in 1980 largely for ocean minerals investigations, greatly increased research capability and led to series of reports on nodule areas (see references in Nakao, 1986 and SIO references, Chapter XI). The narrow focus of these cruises on abyssal nodules almost completely excluded recovery of crusts on adjacent seamounts. However, Japanese university cruises recovered crusts on seamounts around the Japanese islands (e.g., Harada and others, 1985; Usui, 1985; Usui and others, 1987).

On the industrial front a number of Japanese companies collectively identified as the "DOMCO" group had participated in the OMI (Ocean Management Inc.) consortium along with INCO of Canada, SEDCO (U.S.), and AMR of Germany (Preussag, A.G., Metallgesellschaft, and Salzgitter, A.G.) in the 1970's. It appears that except for experimental cruises and engineering studies on the Continuous Line Bucket Dredge system by Y. Masuda (e.g., Masuda and others, 1971; Masuda, 1972) and preliminary processing and mineral assessment studies, independent Japanese studies of ocean minerals were limited.

A national Japanese large-scale project directed toward achieving feasibility of a manganese nodule mining system began in 1981, after most international consortia had greatly reduced or eliminated research efforts (Broadus, 1987). Interest in crusts began in Japan in 1984 and 1985 with the formation of study committees and task forces. One effort is sponsored by the Ministry of International Trade and Industry (MITI) and its associated agencies, Metal Mining Agency of Japan (MMAJ), Deep Ocean Resarch and Development Co. (DORD), and DOMA, a trade association of non-ferrous metal mining companies. The Japan Research Association, a consortium of mining companies associated with the Japanese Center for Marine Science and Technology (JAMSTEC) has begun an independent effort. Y. Masuda is currently associated with this group, and participated in a recent USGS-Bureau of Mines cruise (November, 1986; Hein and others, 1988). First significant government-supported field studies of crusts are scheduled in 1987-88.

French studies

French efforts under the leadership of CNEXO (Centre National pour l'Exploitation des Oceans) and other organizations coalesced in 1974-1976 to form AFERNOD (Association Francaise pour l'Etude et la Recherche des Nodules polymetalliques) (Bastien-Thiry, 1978). This government-sponsored organization conducted extensive seagoing investigations, later supported by use of the Seabeam swath-mapping system.

One notable exception to the paucity of French published literature has been the proceedings of a major conference on ferromanganese "nodules" held at Gif sur Yvette, France, edited by C. Lalou (1979). A famous "battle" between protagonists of extremely slow deposition of ferromanganese crusts (T.L. Ku from

the University of Southern California) and those favoring rapid precipitation (C. Lalou and her colleagues at the Centre des Faibles Radioactivites, C.N.R.S., Gif sur Yvette, France) was fought on the "turf" of the notable "Techno" crust, found at 4000m water depth at the base of a volcanic ridge north of the Tuamotu Ridge in the south Pacific (French Polynesia) and reported in this volume (Lalou and others, 1979a and 1979b). Since then, the radiogenic and other evidence has become overwhelming in favor of the concept that normal deep ocean crusts form very slowly, on the order of a few millimeters per million years (Halbach and others, 1984; Manheim, 1986 and references cited), as was already suggested by Bender and others, (1970) and Bhat and others, (1973).

Russian studies

Soviet studies have been extensive since the early 1960's (Skornyakova, 1960) although with the exception of selected translated articles they are often not well-known or cited in Western literature. Soviet work by the Institute of Oceanology in Moscow under the leadership of P.L. Bezrukov during the 1960's through middle 1970's was characterized by geographic breadth and often solid quality. It culminated in a monograph on Pacific Ocean ferromanganese oxide concretions, edited by Bezrukov (1976). An English translation as prepared under the auspices of the Canadian Department of Energy, Mines, and Resources in 1978, and has been duplicated informally in the U.S..

Some of the contributions of the Soviet studies include the first contoured nodule metal maps including cobalt (Skornyakova and Andrushchenko, 1972), maps of frequency (density) of nodule occurrence, and early emphasis on rarer constituents, including components like tungsten, available oxygen, and sulfur (Isaeva, 1967). The metallogenic maps revealed two large cobalt anomaly areas, one in the north Central Pacific and another in the French Polynesia area, which were outlined in greater detail in later years. It should be emphasized, however, that in the light of present knowledge the cobalt anomalies on "nodule" maps by all authors to date appear to be not due to nodules, but rather are a mixed signal whose high cobalt values are almost entirely due to seamount crusts. The apparent "nodule" relationship was created by the practice of lumping true nodules with crusts. In fact, no true nodule map has been available to date, a circumstance which precludes any valid conclusions about nodule variability.

V. Chukhrov has been among the leaders in study of nodule and crust mineralogy, including use of electron microscopy and diffraction proposed the widely accepted term "vernadite" for the "δMnO_2" phase that dominates crusts (Chukhrov and others, 1978a). Soviet workers were among the earliest workers to publish "polygon" studies, including detailed maps of nodule frequency (density) and chemical composition in small areas (N.S. Skornyakova and coworkers, in Bezrukov, 1976). An exceptionally detailed update of Soviet and Western nodule work is available in new books by Murdmaa and Skornyakova, 1986 and especially Baturin, 1986, and a new book on crusts, edited by A.P. Lisitsin, is said to be in press.

After 1976, field investigation of nodules appears to have been taken over by the Ministry of Geology, which utilized its own prospecting vessels for the purpose, maintained little communication with the Institute of Oceanology. This work, along with the Institute of Oceanology studies, was also used as support for a Soviet "pioneering investor" claim with the United Nations Preparatory

Commission for the Law of the Sea Agreement. The claim, filed in 1984, coincides with that of the Deepsea Ventures Co. claim in the Clarion-Clipperton Zone (R. Kaufman, Deepsea Ventures Co., 1986, and P. Hoagland, Woods Hole Oceanographic Institution, oral communications).

Head of the ocean prospecting work for the Soviet Ministry of Geology is Y.B. Kazmin, resident in the "Sevmorgeologiya", or Northern Enterprise for Offshore Geological Exploration, in Leningrad. Most ship deployment is from Vladivostok in the Soviet Far East. Two volumes of short summaries (Egiazarov, 1980, 1985) and a small monograph by Kazmin (1984) are available on the work of the Ministry with regard to the ocean manganese phases. However, though Kazmin's book has an unusually global approach to concretions (in contrast with most studies focusing on the Pacific Ocean), it provides little substantive new data. It does offer some new interpretive approaches, including factor analysis studies (otherwise little used in Soviet work to date), generalized or schematic maps, often using a z statistic or standard deviation-based contour interval of metal concentration in concretions. Most interesting to scientists it reports perhaps the first global geochemical budget for metal sources in total ocean concretions. Only a brief discussion of crusts as distinguished from nodules, incidental to some regional summaries, is presented in the volume. Moreover, an erroneous linkage of hydrothermal manganese to cobalt-rich crusts suggests that these phases have not been intensively studied or well-understood in the Ministry work.

German studies and the 1981 Midpac I Expedition

German field research on nodules began in 1972 with cruises on the R/V Valdivia. The studies involved cooperation between industrial groups (Arbeitsgemeinschaft Meerestechnisch gewinnbare Rohstoffe, or AMR), which later joined the international consortium, Ocean Management Inc. (OMI), The German Geological Survey (BGR), and academic scientists. Although some detailed site data and technical developments were held confidential, a great deal of information has been published on the wide-ranging German and cooperative studies (see Halbach and Fellerer, 1980; Glasby, 1982).

The breakthrough development for crust research was the German Midpac I" voyage of 1981, headed by Professor Peter Halbach of the Technical University, Clausthal-Zellerfeld (Federal Republic of Germany) (Figs. II-5, II-6). The results of this work (Halbach and others, 1982, Halbach, 1982, Halbach and Manheim, 1984) concluded the following:

1. The dominant ferromanganese oxide phase on seamounts is crusts which form on or envelope hard substrates like altered basalts, hyaloclastites (volcanic breccias) and phosphatized limestones (Fig.II-7). Nodules, or round, concretionary forms resembling the abyssal "nodules" are also found in a great variety of shapes and sizes, but these are chemically unlike the abyssal types, having higher cobalt and iron like their associated crusts.

2. Crusts vary in cobalt concentration from <.4 percent at water depths of >4000m,and often exceed 1.0 percent Co at depths <2000m to the shallowest sites at 1100m (Fig. II-8). Nickel showed a roughly similar trend, reaching to.7 percent Ni. On the other hand, copper concentrations are no higher than.10 percent, much lower than for abyssal nodules.

3. Crusts increased in thickness toward the upper flanks of seamounts (were sparse on summits which often were characterized by sediment caps) and frequently exceeded 2cm thickness.

4. Enrichment in cobalt and nickel was observed in the uppermost millimeters of crusts, whereas these elements were depleted in a lower, phosphate-enriched layer.

5. Well-crystallized hydrothermal oxides with very low concentrations of trace constituents were occasionally observed. These appeared to be remnants of hydrothermal precipitation probably associated with early seamount development, and not linked with normal crust development.

6. Based on the preliminary data, seamount slopes having water depth less than 2500m had metal weight and value (for cobalt, nickel, manganese, as well as molybdenum) per square meter significantly greater than a corresponding areas of abyssal nodules in the Clarion Clipperton Zone (Table II-3).

7. Unlike abyssal nodules, crusts occurred extensively within 200 miles of the U.S. territory, presumably placing them within national jurisdiction for mineral recovery.

8. The preliminary findings warranted the suggestion that seamount crusts might become viable economic mineral targets if suitable technology for recovering crusts was developed.

The cruise results attracted wide attention, especially in the United States. New cruises by the *R/V Sonne*, the vessel used in the Midpac I expedition, were launched in 1984, 1985 and 1986, summarized by Halbach (1986), with cooperating American and other foreign scientists.

Table II-3. Table of metal values in crusts and nodules (from Halbach and Manheim, 1984). MPM refers to crusts from the Mid-Pacific Mountains-Line Islands trend, at water depths of 2600 m or less. MIDPAC refers to samples from all depths encompassed in the MIDPAC-81 cruise (n = 61). CC refers to prime abyssal manganese nodules from the Clarion-Clipperton area (Frazer and Fisk, 1980). Oxide concentrations are 16 kg/m^2 for the crusts (see text) and 8 kg/m^2 for the prime abyssal nodules (Halbach and Fellerer, 1980). Molybdenum metal values for the nodule concentrations are taken from previous studies (Cronan, 1980). Metal prices are for September 1983 (source: U.S. Bureau of Mines commodity specialists). Decimals are for computation only. Totals are rounded to nearest 2%.

		Area											
		MPM Crusts			Line Islands Crusts			MIDPAC Crusts			Nodules(CC)		
Component	Price, $/kg	%	$/tonne	$/m^2	%	$/tonne	$/m^2	%	$/tonne	$/m^2	%	$/tonne	$/m^2
Mn[a]	0.33	25.0	82.50	1.32	25.0	82.50	1.32	24.6	81.18	1.29	25.2	83.16	0.67
Mn[b]	1.50	25.0	375.00	6.00	25.0	375.00	6.00	20.6	369.00	5.90	25.2	370.00	3.02
Co	12.65	0.83	105.00	1.68	1.00	126.50	2.02	0.79	99.93	1.60	0.24	30.36	0.24
Ni	7.02	0.34	23.86	0.38	0.55	38.61	0.62	0.49	34.39	0.55	1.21	84.94	0.68
Cu	1.54	0.07	1.08	0.02	0.07	1.08	0.02	0.065	1.00	0.02	1.00	15.40	0.12
Mo	8.91	0.06	5.34	0.09	0.064	5.70	0.09	0.06	5.35	0.09	0.04	3.56	0.03
Total[c]			220.00	3.50		255.00	4.10		220.00	3.55		220.00	1.75
Total[d]			510.00	8.17		550.00	8.75		510.00	8.10		505.00	4.10

[a] Ferromanganese (78% Mn) not recalculated to 100% Mn basis.

[b] Manganese (99%)

[c] Value of last four components plus ferromanganese. Values per tonne are rounded to nearest $10

[d] Value of last four components plus 99% manganese. Values per tonne are rounded to nearest $10

Figure II - 5 R/V Sonne, docking in Western Samoa at beginning of Midpac I expedition.

Figure II - 6 Dr. Peter Halbach inspecting crusts on Midpac I expedition.

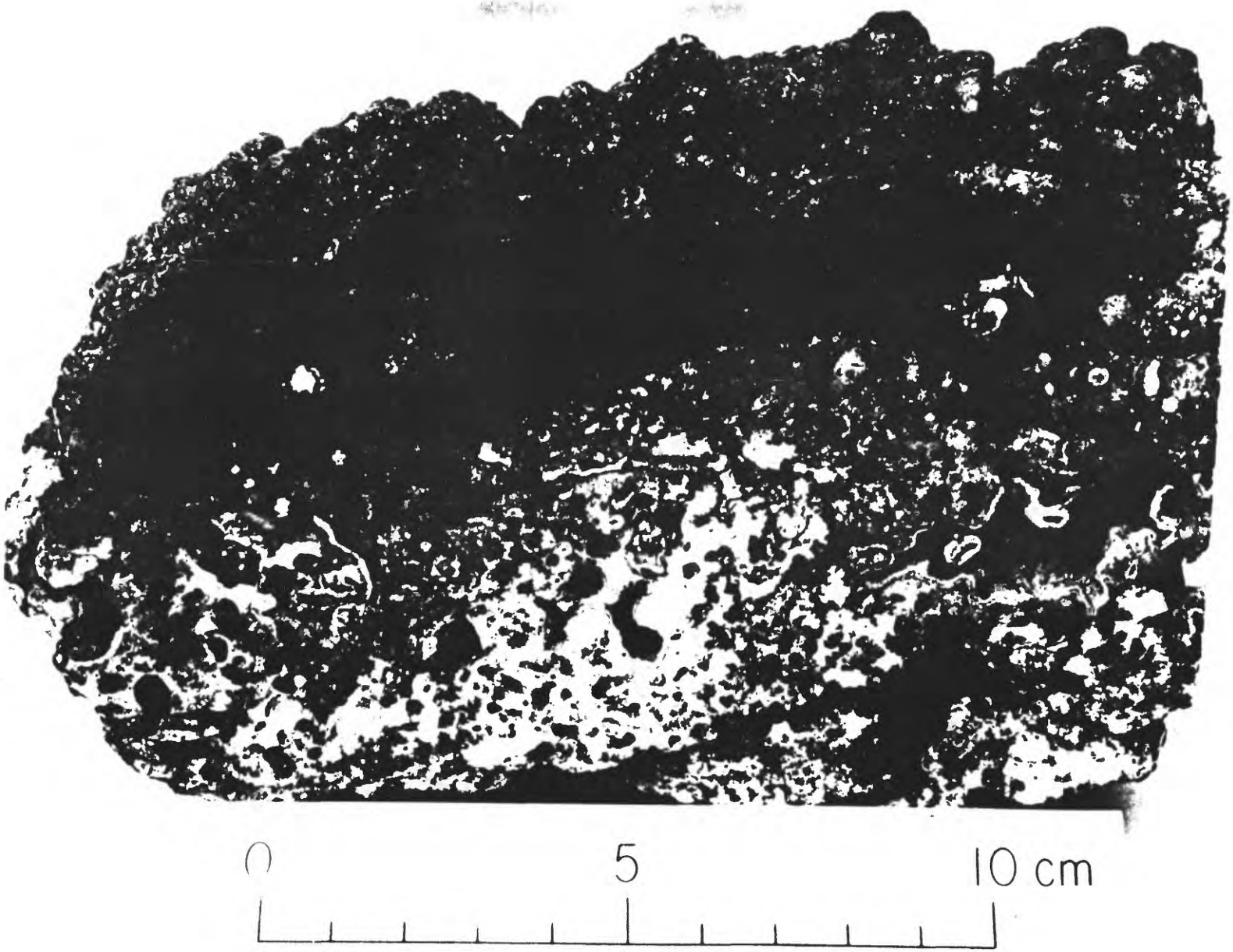


Figure II - 7 Cavernous phosphatized carbonate from Line Islands area, Midpac I expedition.

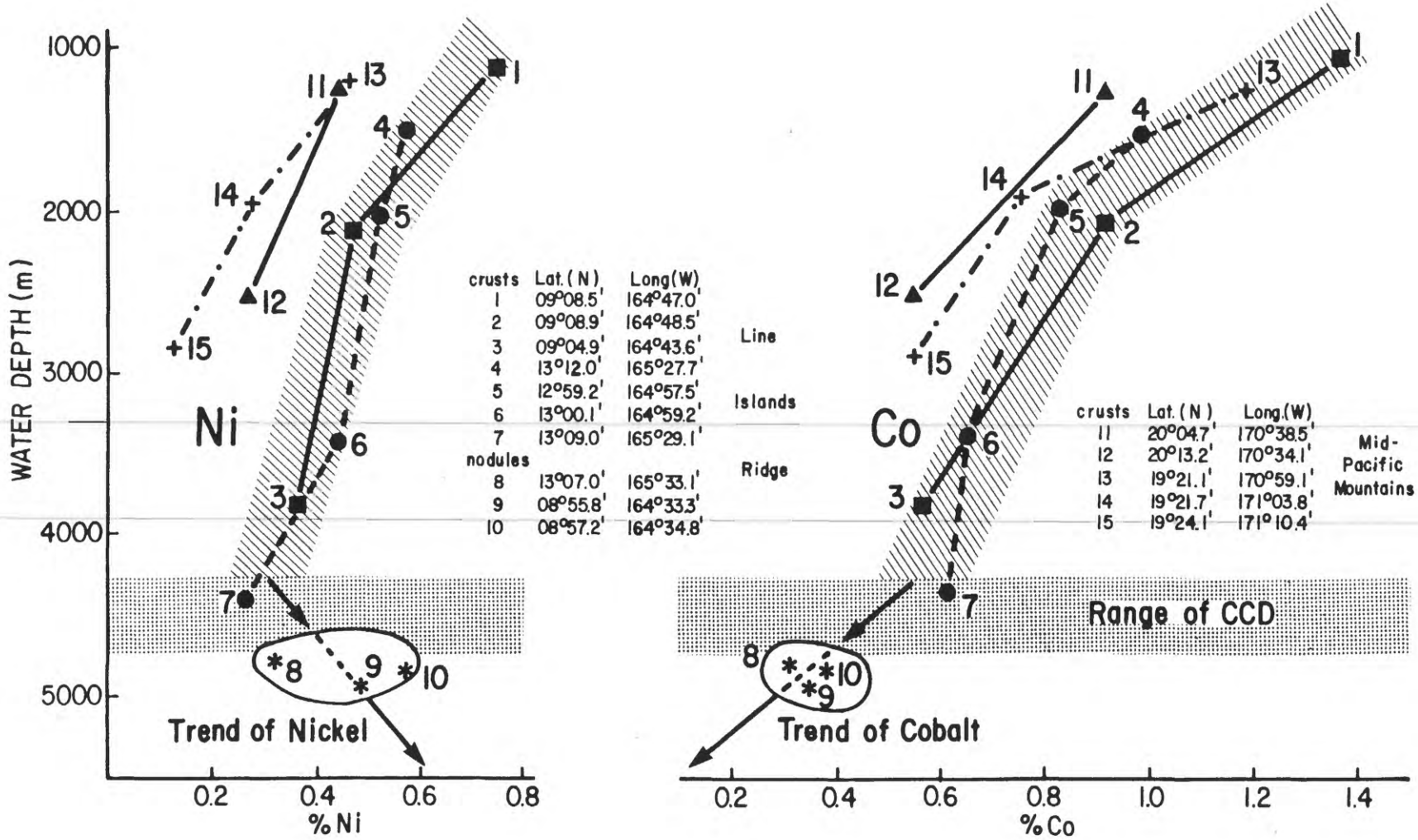


Figure II - 8 Relationships between cobalt, nickel concentrations and water depth for crusts in the Line Islands, Mid-Pacific Mountains region (from Halbach and Manheim, 1984, and Halbach, 1986).

U.S. National program for ferromanganese crust leasing and economic development

The earlier studies led to awareness that cobalt-rich crusts were included among potential economic resources off U.S. coasts. Mention of this potential was included in the background documentation released with the Declaration by President Reagan of a 200-nautical mile U.S. Exclusive Economic Zone in March, 1983. In that year the first of several U.S. Geological Survey cruises focused on crusts confirmed the results of the German survey on R/V Sonne, but found marked regional differences in crust development and metal content from Necker Ridge, south of the Hawaiian Archipelago, to the giant Horizon Tablemount, and a large seamount in the Line Islands trend (Hein and others, 1985). The USGS vessel, S.P. Lee, also undertook cruises in 1984 (Marshall Islands, Schwab and others, 1985; Hein and others, in press), and in the Johnston Island area in 1987 (Figs. 9 and 10). The latter cruise, with support by the U.S. Bureau of Mines and additional support by Minerals Management Service and Japan Resources Association, discovered crusts as thick as 15 cm crusts (J.R. Hein and others, 1988, oral communication) in the course of obtaining quantities of crusts for a processing study. Meanwhile, the U.S. Minerals Management Service had initiated a State - Federal Task Force study program that included extensive crust exploration by the University of Hawaii vessels within the U.S. EEZ areas in the Hawaiian archipelago, Johnston Island and Marshall Islands sectors and shipboard work on the German R/V Sonne. Geochemical aspects of these studies are documented in DeCarlo and others, 1987; Chave and others, 1986.

After several years' study a final draft Environmental Impact Statements and a companion volume were released in early 1987 (MMS, 1987; Dept. Economic Development, 1987 and in 1988). These are the first comprehensive Federal documents detailing all of the complex elements of an offshore mineral leasing program: resource evaluation, possible mining technology, transport and processing, and environment assessment and demographic studies. Although the outcome of leasing or other economic outcomes will not be known for some time, it is likely that this complex document will serve as a model for subsequent U.S. mineral leasing activities within the EEZ (Morgan, 1986).

A major compilation of papers relating to Pacific ocean mineral resources includes several chapters specifically relating to the Central Pacific crust studies (Johnson and Clark, 1986). This document summarizes not only exploration data and resource assessment, potential mining technology, transport, and processing, but a host of potential multiple use conflicts and legal and societal issues that would be related to any offshore mineral recovery effort. In an earlier parallel study, Clark and others. (1985) presented a resource assessment for the Minerals Management Service, offering preliminary estimates on favorable coast prospecting sites on a number of U.S. Trust and affiliated territories.

Ferromanganese crusts are by no means limited to the Central Pacific ocean. A USGS cruise to the Blake Plateau (Manheim and others, 1982; Commeau and others, 1984) had revealed that a large portion of the extensive plateau off Florida-North Carolina was covered by a hard phosphorite pavement. This area was already known to be the site of extensive ferromanganese deposits (Manheim and others, 1980), and leases were sought by the Reynolds International Co. in 1978, presumably seeking oxides for petroleum catalyst material and secondary metal recovery. USGS cruises (Schwab and others, 1985; Hein and others, 1987,

1988) found significant metal potential in the Marshall Islands area, as mentioned earlier. Utilizing archived materials, Aplin and Cronan (1985) published new studies of crusts in the Line Islands sector, including parts of South Pacific areas around the northern part of French Polynesia, and surveys were performed in the Gilbert Islands and other new political areas of the Pacific Ocean (De Carlo and others, in press).

Concluding comments

This summary will not review in detail the current status of ferromanganese crust studies. Recent reviews in several areas may be consulted as follows: geological and geochemical background (Manheim, 1986; Halbach, 1986; Hein and others, 1987, De Carlo and others, 1987); Several papers on crusts and their economic potential are included in a recent compiled volume on sea floor resource assessment (Teleki and others, 1987). Valuable scientific information relating to the German studies of crusts are incorporated in a 1985 PhD dissertation on the Central Pacific crust deposits by D. Puteanus at the Technical University, Clausthal-Zellerfeld, Federal Republic of Germany (Puteanus, 1986). Environmental, demographic, economic, and marine policy background related to potential economic development of cobalt-rich crusts is given by Morgan, 1986; Wiltshire, 1984; Department of Economic Planning, 1987, Clark and Clark, 1986; Johnson and Otto, 1986; and other papers in Johnson and Clark, 1986. Two student-directed reports provide economic assessments of crust recovery: Carnegie-Mellon, 1985; and Bourne and others, 1987.

Finally, much information is lacking upon which to make meaningful resource and economic evaluations of potential crust resources. Chief among missing information elements are the microtopography, thickness and continuity of crusts in prime crust target areas of the sea floor. Surface-towed swath-mapping techniques such as Sea Beam cannot effectively reflect high-angle rugged topography at depth. Recovery of crusts to date has been largely by 19th century technology (rock dredges) and an in situ "ore" survey probably cannot be performed without new equipment permitting accurate mapping of sea floor relief and recovery of a significant amount of intact sea floor material from precisely located sites.

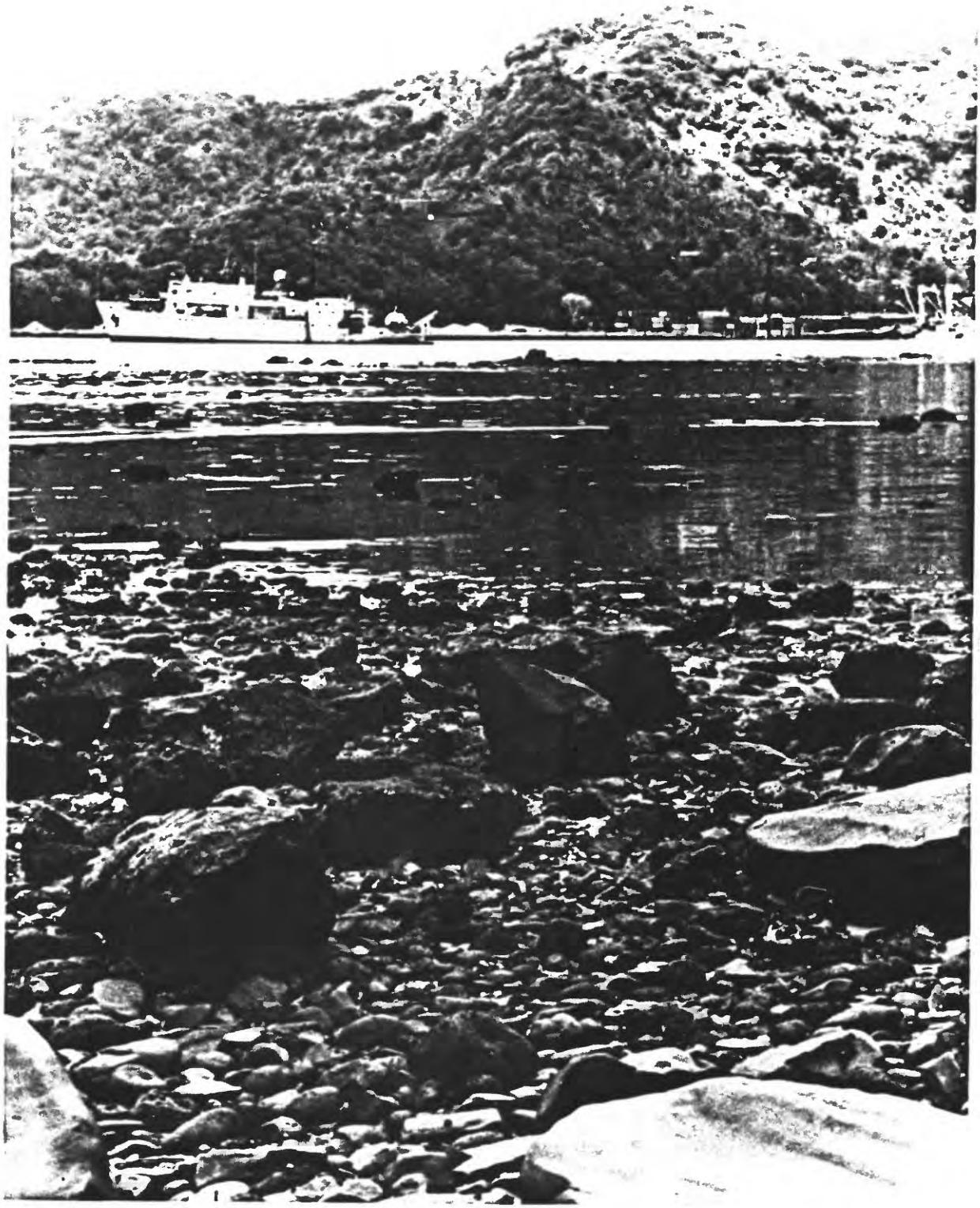


Figure II - 9 R/V S.P. Lee at anchor in Pago Pago harbor, Tutuila, American Samoa, on completion of cruise to Line Islands, 1983.

Figure II-10 Boulder of volcanic mudstone-breccia. This material is similar to crust substrates found in altered state throughout Line Islands and Mid-Pacific Mountains.

III ARCHIVE COLLECTIONS by T.H. Ling

Archive and data search

Beginning in 1983 the USGS searched major oceanographic institution dredge archives for samples and data relevant to the Ferromanganese Crust Data Base. With the cooperation of the institutions more than 600 samples were collectd from twelve institutions and brought to the U.S. Geological Survey Branch of Atlantic Marine Geology in Woods Hole, Mass. for geochemical analysis. This section of the report describes the general sample collection procedure and problems associated with the procedure. All cooperating institutions are listed with quantities and types of samples taken from each facility.

Sampling procedure

Preparation for a sampling visit began with dredge catalogs and sample descriptions sent by the institutions. Where the dredge collections were well organized, catalogued and described, a collection strategy was devised before arriving at the facility. Specific dredges known to contain crust occurrences, favorable geographic location, or a combination of these were targeted for collection. This reduced the tedious and time-consuming process of trial and error search and sample collection. In practice, most of the institution archives were not catalogued and organized sufficiently to avoid at least some trial and error sample selection.

In order not to deplete valuable dredge materials, samples were kept as small as possible yet still consistent with optimum analytical quantities (<50 g). The best way to collect valid samples for chemical analysis was to see the entire contents of the original dredge and then choose a representative sample. However, this was not always possible, due mainly to the large size of some of the dredges and their method of storage at the various archive facilities. Due to time and constraints, it was often impossible or impractical to search entire dredge hauls, some of which were as large as seven hundred pounds. Many were stored in facilities with inadequate lighting.

A few of the institutions visited had their dredge collections well organized and stored in neat bins or storage drawers. Where this was the case, a survey of the entire dredge was facilitated and a good representative sample was easily obtained. These cases were more the exception than the rule. Many dredges were stored in canvas sacks, and these could be spread among the entire collection (Fig. III-1). Whereas complete inspection of this type of dredge was impractical, a roughly representative sampling was attempted by means of a systematic search through a reasonable portion of the dredge. Often more than one type of sample was taken.

The amount of sample taken depended in part on the size of the dredge haul, and the amount of Mn crust on the sample. To get the required amount of crust needed for analysis, more substrate and crust had to be taken from samples which had thin manganese encrustations than from samples which had thicker encrustations. In some cases, guidelines were given as to the maximum allowable amount of sample that could be collected, regardless of the size of the dredge or the type of dredge material contained in the dredge.

Figure III-1 T. H. Ling driving forklift truck during sampling visit to Scripps Institution sample storage area in Camp Edwards Military Reservation, Claremont Mesa, California.

Mn crusts present and collected ranged in thickness from thin stains to crusts up to 10 centimeters thick. Thin crusts generally occurred on fresh volcanic substrates, whereas thicker crusts generally occurred over older, more weathered substrates. Care was taken to prevent a mixing of the two types of crusts during collection or transit. Fairly thin crusts tended to adhere well to fresh substrates. A sample with a thin crust was usually packed intact for transit without any great concern for separation or mixing of crust and substrate. Thicker crusts over more weathered substrated posed a problem in preventing mixing during transit. Thick crusts tend to be friable and brittle and often were easily pulverized. Weathered volcanic substrates and volcano-clastic substrates were often punky and tended to distintegrate. Packing this type of crust and substrate together for transit risked mixing and contamination. For this reason, thick crusts over weathered substrates were separated at the time of collection and packed separately for transit.

Before any separation was done, samples to be collected were observed, described, and photographed. Noted characteristics included crust thickness, substrate, surficial crust morphology, and distinguishing features. Crust thickness was measured at several points. Where there was significant variability, a range was recorded. The dark color of the crusts made it imperative to make special exposure tests if detail was to be seen on each photo.

Much care was taken to prevent metal contamination during the collection, separation and preparation procedures. At no time during any of these procedures were metal objects allowed to touch either the crusts or the substrates. Plastic spatulas and picks were used to separate crusts from substrates. It is, however, recognized that most samples were collected with metal dredges and also might have been contaminated during shipboard operations. Thicker crusts were often easy to separate, cleaving at the weathered zone. Some substrate might adhere to the base of the crust after separation. This was carefully scraped off before preparation for analysis. Thin crusts were generally harder to separate from substrates. A good deal of scraping and picking was done to assure that all bits of substrate adhering to pieces of crust were scraped off.

Table III-1. Individual institution listings

INSTITUTION:	Woods Hole Oceanographic Institution
DATE OF VISIT:	2/20/83 - 3/1/83 (Includes collection of Branch of Atlantic & Gulf of Mexico, U.S. Geological Survey Materials)
SAMPLES TAKEN:	51
GENERAL SAMPLE LOCATION:	Eastern North Atlantic
COOPERATING PERSONNEL:	James Broda
CURATION FACILITY:	One large warehouse. Samples stored in drawers by dredge numbers.
COMMENTS:	This collection is completely catalogued including cataloguing for manganese crust occurrence. This facilitated the collection process greatly. Dredge hauls are stored separately in drawers, making it relatively easy to select a sample which is representative of the entire dredge.

INSTITUTION:	Smithsonian Institute
DATE OF VISIT:	2/14/83-2/17/83
SAMPLES TAKEN:	25
GENERAL SAMPLE LOCATION:	Various locations
COOPERATING PERSONNEL:	William Melson, Timothy O'Hearn
CURATION FACILITY:	One large section of the Mineralogy Department in the Natural History Building.
COMMENTS:	All dredge material at this facility is well catalogued, described and curated. The quantity of stored dredges is small. We were given guidelines as far as how much sample material we could take. All material taken from this institution is considered to be on loan.

INSTITUTION:	Scripps institute of oceanography
DATE OF VISIT:	3/21/83-3/25/83, 4/7/83-4/10/83
SAMPLES TAKEN:	156
GENERAL SAMPLE LOCATION:	Central and Eastern Pacific
COOPERATING PERSONNEL:	Thomas Walsh, Curator, Core and Dredge Facility
CURATION FACILITY:	Dredges are stored at two locations: Seaweed Canyon on the campus, a small garage-like facility where dredge contents are stored in individual drawers by cruise, and Camp Edwards Military Reservation in Clairmont Mesa, where dredges are stored in crates on pallots in an old U.S. Army warehouse.
PROBLEMS:	Catalogued descriptions of this dredge collection are not complete. Many dredges

	in Camp Edwards location were not open. Time-consuming trial and error search and sampling was necessary. Some samples did not have location data readily available.
COMMENTS:	Most dredges were stored in their original canvas sacks in unopened crates stacked three high (Fig. III-1.) Some of the dredges were stored in numerous crates. In these cases, time considerations made it impossible to search the entire dredge contents. Camp Edwards facility did not have functioning lighting or electricity, and this also made the collection process more time-consuming. Some of the samples did not have location data available at the time of collection. Despite the conditions, well over 100 good samples were obtained with the constant help of the facility curator, Mr. Thomas Walsh.

INSTITUTION:	University of Southern California
DATE OF VISIT:	3/26/83
SAMPLES TAKEN:	3
GENERAL SAMPLE LOCATION:	Gulf of California
COOPERATING PERSONNEL:	Suzanne Reynolds
CURATION FACILITY:	One fairly small storage room located under tennis pavilion
COMMENTS:	Dredges stored here are mostly from shallow-water locations.

INSTITUTION:	University of Miami
DATE OF VISIT:	5/2/83-5/6/83
SAMPLES TAKEN:	22
COOPERATING PERSONNEL:	Kjell Hayling
GENERAL SAMPLE LOCATION:	Eastern North Atlantic, Carribean, Bahama Slope
CURATION FACILITY:	Dredged samples were stored in canvas sacks on wooden shelves on the walls of the marine facility building.
COMMENTS:	This collection was well catalogued, including manganese occurrence. However, the dredges themselves are not organized in any order relating to the catalog. Entire dredge contents were usually stored together, so a search through the entire dredge was facilitated and a representative sample could be gotten. We were unable to locate five samples which were in the catalog.

INSTITUTION:	Florida State University
DATE OF VISIT:	5/9/83-5/13/83
SAMPLES TAKEN:	66
GENERAL SAMPLE LOCATION:	Southern Oceans, Antarctic locations
COOPERATING PERSONNEL:	Dennis Cassidy
CURATION FACILITY:	Large refrigerated core and dredge facility
COMMENTS:	Dredge contents, or partialrepresentative portions were neatly stored in small bins on stacking shelves. This facility is immaculately maintained by Mr. Cassidy, and this made the collection effort very easy and time-efficient. Samples open to observation in individual bins made it easy to pick a sample representative of the entire dredge.

INSTITUTION:	Hawaii Institute of Geophysics, University of Hawaii
DATE OF VISIT:	7/8/83-7/22/83
SAMPLES TAKEN:	125
GENERAL SAMPLE LOCATION:	Central Pacific
COOPERATING PERSONNEL:	Chris Mato, Loren Kroenke, Frisbee Campbell, Fritz Theyer, Don Hussong, Barbara Sinton
CURATION FACILITY:	Because of problems in completing a new storage facility at Snug Harbor, there was no systematic storage for dredged materials. Some are stored in a trailer van parked at the Snug Harbor Marine Facility, and the rest is stored in the basement, in the compressor room, and on the catwalks throughout the Hawaii Insitute of Geophysics. Sampling was time consuming. Location data were not available for a portion of samples.
COMMENTS:	Whereas there was an ongoing computer cataloging project, at the time of collection most of the dredges and cruises we were interested in were not yet entered. Most dredges are stored in canvas sacks. Lack of electricity and other problems hindered collection in most locations. Some dredges were quite large and took up as many as 15 canvas sacks. Time constraints made complete searches through these dredges impractical, so some of our samples may unrepresentative of the dredge. In spite of the difficulties, The University of Hawaii collections represent a key resource for crust study in the Pacific ocean, and approximately two weeks were spent at the facility.

INSTITUTION:	University of Washington
DATE OF VISIT:	8/15/83-8/16/83
SAMPLES TAKEN:	30
GENERAL SAMPLE LOCATION:	Western Pacific
COOPERATING PERSONNEL:	Debby Kelly, Paul Johnson
CURATION PERSONNEL:	Samples were already collected prior to my arrival and I did not get to work in the curation facility.
COMMENTS:	The collection process was nearly completed ahead of time, but there may be other samples of interest.

INSTITUTION:	Oregon State University
DATE OF VISIT:	8/17/83-8/19/83
SAMPLES TAKEN:	15
GENERAL SAMPLE LOCATION:	Western Pacific
COOPERATING PERSONNEL:	Elizabeth Asbury
CURATION FACILITY:	Roofed, open-air garage like facility. Most samples are stored in bins on shelves, but some larger dredge contents are stored in sealed crates.
COMMENTS:	Dredges were catalogued for availability, but not for Mn occurrence, making a trial and error search necessary. Collection did not contain much manganese-encrusted material. The dredge collection was being reorganized and recatalogued at the time of visit. Time limited the number of dredges sampled.

INSTITUTION:	U.S. Geological Survey, Branch of Pacific Marine Geology, Menlo Park, CA.
DATE OF VISIT:	8/29/83-8/30/83, 6/4/84-6/7/84
SAMPLES TAKEN:	40
GENERAL SAMPLE LOCATION:	Central and Western Pacific
COOPERATING PERSONNEL:	Dave Clague, Bob Boyer
CURATION FACILITY:	Many dredges are stored in sacks on shelves in the flume room, building B, Deer Creek Marine Building, Palo Alto. Others are stored in USGS warehouses on O'Brien Rd. in Redwood City.
COMMENTS:	The collection process was time consuming due to the lack of systematic cataloguing of the dredges. There may be more of interest.

INSTITUTION:	Naval Oceanographic Research and Development Activity (NORDA), Bay St. Louis, Miss.
DATE OF VISIT:	6/25/83-6/28/83
SAMPLES TAKEN:	18
GENERAL SAMPLE LOCATION:	Eastern Central Atlantic
COOPERATING PERSONNEL:	Julius Egloff
CURATION FACILITY:	Dredges are stored in steel drawers by cruise in a utility building at the facility.
COMMENTS:	Dredges at this facility are not catalogued. It was not too difficult or time consuming to search through the entire dredges in the storage bins for a good representative samples. We do not have location and depth data for a number of NORDA samples.

INSTITUTION:	Lamont-Doherty Geological Observatory
DATE OF VISIT:	6/18/84-6/21/84
SAMPLES TAKEN:	80
GENERAL SAMPLE LOCATION:	Atlantic
COOPERATING PERSONNEL:	Floyd McCoy
CURATION FACILITY:	Dredges are stored in pine boxes stacked on storage shelves in a warehouse room.
COMMENTS:	Lamont has original cruise dredge descriptions available, and they also catalog their dredges for manganese occurrence. This speeded the collection process greatly, since we knew which samples we wanted to collect before arriving. However we could not find a number of targeted dredges.

INSTITUTION:	University of Alaska
DATE OF VISIT:	8/25/84 - 8/26/84
SAMPLES TAKEN:	8
GENERAL SAMPLE LOCATION:	Gulf of Alaska
COOPERATING PERSONNEL:	Donald Taylor
CURATION FACILITY:	Samples stored in trays in storage cabinets located in laboratory.
COMMENTS:	Most of the samples available had only manganese stains. None had thick, separable crusts. Took eight samples for archives.
SPECIAL NOTE:	The U.S. Geological Survey office, Anchorage Alaska indicated that no offshore dredgings or other prospectively useful materials were held at their facilities.

INSTITUTION:	Graduate School of Oceanography, University of Rhode Island, Narragansett
DATE OF VISIT:	Various times during 1983
SAMPLES TAKEN:	None
COOPERATING PERSONNEL:	Jean-Guy Schilling
COMMENTS:	The GSO has a number of crusts from dredgings in Atlantic ridge and seamount areas, but permission was not given to sample during the collection period.

IV COMPUTER DATABASE DEVELOPMENT by C.M. Lane-Bostwick and F.T. Manheim

Introduction and early development

In December 1982, the U.S. Geological Survey in Woods Hole established a central repository of data specifically related to ferromanganese crusts and their chemical composition (Manheim and others, 1983). While field collections were in process (see Chapter III), data encoded in the Scripps Institute of Oceanography Nodule Data Bank (SNDB) were downloaded for incorporation into the database. We utilized the SNDB's format as a model, although a few of their attributes were modified and new attributes were added to reflect the nature of the current data. This modified data format is detailed in Lane and others. (1986).

New crust sample data collected from repositories and on recent cruises and their subsequent chemical analyses were entered on microprocessors using a data entry program, Datastar. Datastar allows a form to be generated to facilitate data entry by inexperienced computer users. These data and data obtained from SNDB were then converted into the format required by the Geological Retrieval and Synopsis Program (GRASP) (Bowen and Botbol, 1975). GRASP was designed to function primarily as a data retrieval system. Its structure is relational allowing the user to join datafiles that have a common key field. This feature was particularly useful for retrieving crust sample data from the SNDB. GRASP also permits basic statistical computations, output to graphics, and creation of subsets of large datafiles based on logical conditions.

SIO Nodule Databank

The SIO data (SNDB) were received in 1983 from the National Geophysical Data Center (NGDC) as two separate files, one for station data and one for chemical data. Each record in the chemical analysis file is linked to a corresponding record in the station data file by a field common to both, the sequence number (SEQNO). This is a unique 7-digit number that incorporates a 10-degree numbered grid system ("Frazer" square) as the first 3 digits with the last 4 digits representing an assigned serial number. We retained this concept in the USGS ferromanganese crust datafiles. However to distinguish our entries from those downloaded from the SNDB, we use a 6 digit number where the first 3 digits are based on the more widely known "Marsden square" system and the last 3 digits are an assigned serial number for each sample within that 10-degree grid segment. The maps of Lane and others. (1986) incorporate both for user convenience.

The SNDB station datafile has over 10,000 records of manganese deposits ("nodules") from institutional archives and literature. The chemical datafile has 6,832 records, each representing a chemical analysis, often with more than one analysis for the same sample. After uploading the total SIO databank sample file from tape, we incorporated those station records that were coded to indicate that chemical data were available. This subset resulted in a datafile that contained 2,842 station records.

In the attributes of the chemical analyses data set, Frazer and others (1978) define 10 separate types of ferromanganese oxide samples that were analyzed, 5 of which pertain or may pertain to ferromanganese encrustations. The next step was to set conditions to search for only those analyses performed on samples defined as 1.) Mn-encrusted sediment, 2.) Mn-coated rock, 3.) crust or pavement,

4.) Mn-coated organic material or 5.) several crusts. This subset resulted in 825 analyses. In addition, observing that samples having cobalt greater than 0.5 percent nearly always occurred on seamounts or other sites suggesting a probable crust environment, samples having Co $\geq$ 0.50 percent were added to the previous subset. Nodule-like seamount crusts were shown on the 1981 Midpac cruise to have similar chemical composition to slab crusts. This addition brought the total number of extracted analyses to 1,095. These analyses were linked to the station datafile and found to be associated with 622 sample-stations (Table IV-1). The SIO station and chemical data extracted as described above are listed in Appendix B and Table 9 of Appendix C, respectively. Trace analyses for rare earth elements are listed separately in Table 10 of Appendix C.

UNIX and PC hardware

During the development of the database, technology was progressing rapidly. The implementation of a Unix based computer system and the improvement of software available for MSDOS IBM-PC compatibles enhanced are graphic and typesetting capabilities. Central to the graphic display of our database have been MAPGEN, PLOTGEN, GRIDS and CONTOUR (Evenden, 1986, Botbol, J., and Evendon, G., in preparation). Table displays were improved by using UNIX troff and tbl software programs. In the PC environment detailed statistical operations were accomplished using Northwest Analytical STATPAK software, data entry with DATASTAR and general computations with LOTUS 1-2-3. All of the above were output on various peripheral devices which have also improved over the years; the most recent output being the gray scale maps of gridded elemental data as shown in Chapter IX.

Table IV-1. Sources of crust samples from SNDB.

Institution	Samples	Major chem. analyses	Trace chem. analyses
HIG	48	80	1
SIO	176	320	52
LDGO	109	134	5
WHOI	9	11	3
FSU	43	54	21
USSR	66	87	4
Unknown	171	409	53
Total	622	1095	139

New data acquisitions (USGS Woods Hole)

New data acquisitions include material collected from institutional archives as enumerated in Chapter III, shipboard samplings from 1981 onward and from miscellaneous smaller collections and literature references. A total of about 2000 analyses from about 1500 stations is incorporated. The total list is included in the data tables. The enumeration of complete sources is shown in Table IV-2. No further attempt has been made to maintain comprehensive support

of this database after April 1988, however selected data sets can be added on a discretionary basis. The arrangement of data categories is displayed and discussed in Chapter VIII (Data), and further explanation and commentary is provided in Lane and others (1986).

Table IV-2. Status of crusts collected by USGS Woods Hole by institution.

Institution	Samples	Major and minor chemical analyses
HIG	402	429
SIO*	159	100
LDGO	76	35
WHOI	81	27
FSU	64	60
UWASH	31	28
NOAA	22	22
UMIAMI	18	26
SMIT	13	8
TUCLZ	306	324
USGS-WH	117	271
USGS-MENLO	106	121
OSU	3	0
NORDA	18	0
UALASKA	8	0
GSJ	15	24
NGDC	288	460
Other	22	22

* Additional samples are available but have not been entered pending receipt of station data

Although the database's primary objective has been to permit computer retrieval and manipulation of data, this output incorporates features intended to facilitate use of a hard paper copy. All chemical data are reported in widely used rock chemical/geochemical tabular format rather than computer format. The first three digits in the sequence number (SEQNO) identify the 10° latitude-longitude block in the station maps (Lane et al, 1986) or any other Marsden-indexed map without having to scale off latitudes and longitudes. Therefore, chemical samples for any area on a map can be located by the first three digits of the sequence numbers by which all chemical tables are listed. Chemical tables are also prefaced by latitude, longitude, depth and lab number to aid in identifications in the hard-copy printout. The SNDB data retain their sequence numbers as assigned by Frazer and Fisk. Maps available in Lane and others, 1986 aid in using their 10° grid numbering system. NGDC data are listed in Appendix A and Table 11 of Appendix C and are prefaced by their 'MMBIB' identifier; a unique field that incorporates author and date of publication of reference where data were obtained.

V ANALYTICAL METHODS: SAMPLE PREPARATION, WATER CONTENT AND MAJOR ELEMENT DETERMINATION BY X-RAY FLUORESCENCE SPECTROMETRY

by J.A. Commeau and F.T. Manheim

Sample preparation technique is critical for valid chemical analyses, as some of the comparisons in Chapter VII show. Analytical data from the general literature is particularly prone to errors of various kinds. Some have been discussed by Frazer and Fisk, 1979, who made a careful evaluation of the data they culled from the literature. Many errors in the Scripps Institution Nodule Data Bank (SNDB) remain; some are definable, whereas others are suggested mainly by internal inconsistencies, or marked deviations when data from a given region are compared with more carefully controlled data.

Principal sources of error are 1) the great specific surface area of crusts and hence their tendency to retain or attract hygroscopic moisture; variable treatment of this moisture can in extreme cases lead to analytical value differences as great as 40-50 percent, as demonstrated in Table V-1, 2) inhomogeneities in samples, especially where segregated mineral phases have differing composition, 3) contamination of samples, either through handling with metal-containing equipment, or by contamination of samples in grinding vessels previously used to prepare samples having a different composition, and 4) by analytical or computational errors. Ferromanganese oxides, with their associated metals, have been a traditionally difficult material to analyze, depending on methods. The iron and manganese can potentially create matrix effects or spectral line influence in emission spectrometric, atomic absorption and X-ray fluorescence techniques; many elements can offer interferences with spectrophotometric techniques. Inductively coupled plasma spectrometry has reduced though not eliminated matrix influences. However, properly controlled methods of any type may yield quality data.

Sample selection and preparation

The basic procedure for selecting crusts was to choose a complete crust thickness, excluding substrate as much as possible. A section that would yield from 5 to 25 grams of sample was sought, but many samples yielded less material. Subsamples had to be scaled to accomodate all analytical uses and duplications, where desired. In a few areas, and where the amount of crust permitted, separate subsampling of crust intervals, especially the top millimeter, was performed. Given the variability of crust thickness and chemical variability with depth in the crust, a top sample would provide a more synoptic analytical base over broad ocean areas than total crust thickness. Normally, macrosampling was limited to.5cm horizons, and no finely detailed subsampling such as was performed using dental drills (Halbach and Puteanus, 1984) was attempted. For thin crusts, large areas were scraped to obtain the required volume of material. These thin crusts provide representative material for geographic areas that otherwise would not yield ferromanganese oxide material, or fill in a range of water depths. Thinner crusts are often found on deeper water flanks of seamounts and sometimes on the top surface of seamounts. They may, of course, also occur in any other position on younger substrates.

Segregation of crusts from underlying substrate was necessary in order to achieve a basis for comparison of crusts. Because crusts, unlike abyssal nodules, adhere to hard substrates, the proportion of crust in recovered rock samples is highly

variable and arbitrary, depending on the type of recovery device, size of material recovered, physical preservation, etc. The chemical analyses show that a few samples from the USGS data set are dominated or strongly influenced by substrate rock. The material in these cases was often (probably dark) basalt, and may have also entered the samples when thin oxide crusts were scraped from surfaces. Much greater substrate contamination is encountered in the data from the SNDB. Samples with large proportions of substrate contaminant have been useful in one respect. They serve in plots of the kind, Si vs Fe + Mn (Chapter IX, Fig. 13) as end member phases, and indirectly help elucidate the chemical influence of less obvious quantities of unavoidable detrital matter in the crusts. Some types of markedly contaminated samples are indicated by special symbols in the chemical tables (Appendix C) and are discussed in Chapter VIII.

Preparation of bowl for grinding

Our grinding was performed in a Phoenix Siebtechnik automatic grinding machine, using agate bowls, lids, and pucks. Several days prior to beginning the powdering operation the metal lip of the bowl and lid is lightly coated with epoxy resin. This prevents contamination of the sample by contact with the steel-encased gate lip during sample handling. Acetone removes unwanted wet epoxy from the agate surface. Prior to grinding crust, crushed glass is ground for 10 minutes to clean off the agate grinding surface. The polish of this surface must be preserved to ensure the most efficient powdering of the sample.

Preparation of crusts for grinding

Substrate is carefully removed and discarded or saved for analysis in special cases (i.e. phosphorite). A mini-slab less than 2 cm thick is cut from the crust perpendicular to the surface and substrate. This slab is used for total analysis. Other sections may be separated into horizons or layers as appropriate. Each section to be powdered is stored in labeled polyethylene or polystyrene vials or bags until processed. Material for SEM or microprobe analysis is taken from a section adjacent and parallel to the section for bulk analysis.

Grinding and sieving

The samples for bulk chemcal analyses (XRF, AA, ICP, etc.) are ground in the described automatic mortar and subsequently sieved to <105 microns. This size fraction is a compromise between an optimally desirable finer size, such as the 74u sieve generally used in Scripps Institution analytical work, and consideration of time and tedium in preparation. Commercial sieve and sizing experts were unable to inform us of any metal-free, automated pulverizing equipment.

1) Grinding. The standard grinding time is 8 minutes. Samples with high silica content may take longer. Approximately 5-25g of sample are powdered per run.

2) Sieving. A 105 micron nylon mesh is secured between two plastic rings and set in a glass baking dish which prevents sample loss due to spillage. A secretarial eraser/brush is used to push the powder through the sieve. The powder is homogenized before splitting into

subsamples, and stored in properly labelled polyethylene or other plastic vials, and lids are sealed with cellophane tape.

3) Cleaning. All parts (bowl, puck, lid, sieve rings, mesh, brushes, glass dish) are thoroughly cleaned between each sample to avoid cross contamination of samples. Loose particles are removed by washing in hot, soapy water with a sponge. Remaining ferromanganese material is removed by washing with 10 percent hydroxylamine hydrochloride ($NH_2OH.HCL$) and 1 percent oxalic acid. The use of rubber gloves during cleaning is recommended. Care should be taken to avoid prolonged contact of the oxalic acid with organic compounds. When no trace of ferromanganese stain remains on a surface it is rinsed with distilled water and then with methanol which speeds drying. The next sample may be started as soon as equipment is dry.

Processing time per sample is approximately 45 minutes with practice. Speed should not be obtained at the expense of contamination. Many sieve meshes and brushes are used so that one is always dry and ready to use. The use of two grinding bowls, pucks, and lids eliminates waiting for drying. Minimum and maximum capacities of grinding apparatus are carefully observed. Overloading results in poor grinding and underloading may damage the bowl interiors. Repairs are expensive and time-consuming.

Water content

Table V-1. Example of differences in reportable manganese concentration, depending on sample treatment. Sample is a ferromanganese oxide-phosphorite pavement from the Blake Plateau. Values are in weight percent. Wt. loss = cumulative loss from original weight.

	Reporting basis	Wt. loss	MnO_2 (total)
A.	Powdered samples, with natural hygroscopic moisture		17.53
B.	Same, after heating at 110°C overnight	6.11	18.67
C.	Same, after heating at 500°C one hour	14.09	20.40
D.	Same, after igniting at 1000°C one hour	28.87	24.64

In the above sample, the MnO_2 value on an ignited basis is 40 percent higher than MnO_2 on an air-dry basis. Some samples have much higher (>20 percent) hygroscopic moisture even if they appear dry. Moreover, still other reporting bases than those mentioned above have been used. The standard reporting basis for this report, as well as for the Scripps Institution Data Bank is oven-dry, heated at 110°C overnight or the equivalent.

Hygroscopic water content on crusts can be determined in two ways. Analytical portions of powder can be dried at 110°C overnight, and kept in desiccators prior to weighing out for analytical purposes. However, the hygroscopic nature of the crust is so great that it can actually draw water from some desiccants, such as

silica gel. In addition, with frequent opening of desiccators it is nearly impossible to avoid rapid water uptake in samples. We therefore prefer to use a well-homogenized powder sample that has been equilibrated with ambient air, and weigh out this material for analytical purposes. Another sample, weighed out at the same time is used for hygroscopic moisture analysis.

About one gram of manganese crust powder is spread evenly in the bottom of evaporating dishes or preferably weighing bottles with well-fitting stoppers. The bottles are placed open in a regular convection oven at 110°C overnight or for an equivalent period of time. Tops are emplaced while the bottles are still hot before containers are moved to a desiccator with a powerful desiccant like fresh P_2O_5 in an aluminum foil dish beneath the sample rack. Desiccant is replaced or hydrous surfaces are peeled off regularly. Weighing before and after heating is performed with a single-pan semi-micro analytical balance having a resolution of.1 mg.

All raw analytical data based on air-dry samples are corrected for hygroscopic moistures as in equation 1, where V (corr) is the corrected analytical value, V is the uncorrected value, and H is the percent hygroscopic water content in the sample split used for hygroscopic moisture analyses.

$$V\ (corr) = V \times 100 / (100-H) \qquad 1)$$

<u>X-ray fluorescence spectrometry</u>

The X-ray fluorescence analysis of major and minor elements of ferromanganese crusts was performed on an automated, software-controlled X-ray spectrometer (Diano XRD8300). All samples and standards were prepared following the methods of Rose and others (1963).

Sample preparation

Sample powders and reference standards were fused using anhydrous lithium tetraborate along with the addition of lanthanum oxide. The fusion process eliminates the effect of mineral and physical properties of samples, including grain size, and addition of lanthanum as La_2O_3, a high-atomic number element, diminishes absorption or enhancement effects.

A crust sample weighing 0.125g is prepared with .125g of high-purity La_2O_3 and 1.00 grams of $Li_2B_4O_7$. The components are pre-mixed by hand by rolling on a weighing paper, and then transferred to a graphite crucible for fusion. Because of the hygroscopic nature of ferromanganese materials the samples are pre-ignited at 500°C for 15 minutes prior to fusion. This is done to prevent the samples from splattering at the higher fusion temperature.

Fusion is then completed at 1100°C for 15 minutes. The fused samples are allowed to cool and the resultant bead is weighed. Fine-grained chromatographic cellulose is added to the bead weight to bring the total weight to 1.500g. This is to prevent differences from sample to sample in final weight owing to ignition loss and the cellulose also acts as a binder when the glass bead is cracked, ground, and finally pressed into a pellet 1 1/2" in diameter.

Analytical conditions

The analyses were performed on an automated vacuum spectrometer system with a ten-position sample carousel, dual-target X-ray tube (W and Cr) with a front flow proportional counter and a rear sealed proportional counter. All instrument junctions and all software for data-handling, manipulation and storage are performed by the XRD0780 microprocessor board installed on the machine.

Intensity ratios of reference materials are used in establishing calibration curves for each element. A series of multiple linear regression equations is available in the software to provide a means to correct for absorption, enhancement, line interferences from other elements and background variations. Each equation has a specific application for one or a combination of effects. Once the slope, intercept and coefficient of determination has been established for each element from the appropriate calibration curve, the data are stored in tabular form in the Z-80 software. The actual samples are then run, ratioing all analyses to a reference sample or drift monitor as a check on instrument stability and precision for repeat analyses over extended periods of time. Information on the reproducibility and accuracy of the basic X-ray fluorescence method is given in Table V-2, which gives data on the ferromangese crust standard, MCC, a composite of samples from the Line-Islands Midpac area, recovered in the Midpac I cruise. Each of the analyses shown was separately prepared at various times over a period of a year. See also discussion in Chapter VII.

Table V-2. Detection limits and error distribution for elements determined by X-ray fluorescence. n refers to number of samples, S.D. is standard deviation, and CV refers to coefficient of variation.

Element	Reston x (n=2)	Woods Hole x (n=5)	SD	CV (%)
Si	4.75	4.58	0.055	1.2
Al	1.3	1.53	0.054	3.8
Mg	1.27	1.23	0.075	6.1
Cu	0.071	-	-	-
Ni	0.45	0.45	0.0045	1.0
Co	0.68	0.73	0.0217	3.0
Fe	13.9	14.42	0.063	0.44
Ti	1.07	1.02	0.0045	0.44
Mn	20.45	20.94	0.125	0.59
Ca	3.1	2.96	0.022	0.73
K	0.70	0.70	0.0084	1.2
P	0.63	0.68	0.0184	2.2

VI ANALYTICAL METHODS: THE DETERMINATION OF 27 ELEMENTS IN FERROMANGANESE MATERIALS

by P.J. Aruscavage, H. Kirschenbaum and F. Brown

Introduction

Assessment of the geochemistry and economic potential of marine ferromanganese oxides requires a large chemical data base. The challenge is to process large numbers of samples for many elements, from trace levels to major concentrations, with precision and accuracy in complex polymetallic deposits. Along with the manganese, iron, nickel and cobalt, less common elements like cerium, cadmium, vanadium, and molybdenum must be analyzed in complex polymetallic deposits, with concentrations and combinations unlike those in many land deposits and ores.

Comparative studies on the utility of ICP, atomic absorption, and other techniques for the elemental analysis of geological samples has been published (Thompson, 1985; Kane and Dorrzapf, 1987; Willis, 1986). Books and articles describing the theory and use of ICP and AA techniques are abundant (Fassel, V.A., 1978; Thompson and Walsh, 1983; Varma, A., 1984; Slavin, W., 1982; Koirtyohann, S.R., and Kaiser, M.L., 1982; Slavin, W., 1984). With the requirements in mind, we decided to pursue a scheme of analysis based primarily around the induction coupled plasma atomic emission spectrometry (ICPAES) technique because of its simultaneous multielement capability and its relatively large linear concentration range. Atomic absorption techniques are used only for those elements where the sensitivity, precision, or accuracy of the ICPAES technique are not sufficient for the determination.

Instrumentation

FAA Spectrometry

A Perkin-Elmer model 5000 atomic absorption spectrometer equipped with an automatic burner control, a deuterium background correction system, and a pre mix burner assembly consisting of an adjustable platinum/rhodium nebulizer, glass impact bead or plastic flow spoiler, and 10 cm single slot burner head was used for all determinations of Pb, Zn and K. The analytical conditions are given in Table VI-1.

GFAA Spectrometry

A Perkin-Elmer model 5000 Zeeman atomic absorption spectrometer equipped with a model HGA 500 graphite furnace controller, model AS-40 autosampler, dual lamp EDL power supply and a data system 10 computer with high speed graphics capability was used for the determination of As, Cd, Cr, Pt, Pd and Rh. The analytical conditions are given in Table VI-2.

ICP Spectrometry

A computer controlled simultaneous ICP spectrometer system was used for all determinations except Pt, Pd, Rh, Cd, Cr, As, Zn, K, and Pb. The system is composed of:

1. Two-Jarrell-Ash Mark III model 1160 direct-reader polychromators optically linked to an inductively coupled argon plasma source with 63 preset emission lines for determining 56 different elements with a computer controlled background correction capability.
2. Digital Equipment Corporation (DEC) Model PDP-11/34 minicomputer system with dual RL01 hard disk storage devices.
3. Jarrell-Ash RF generator with automatic impedance matching network.
4. VT 100 computer interface.
5. Fixed cross flow nebulizer.
6. Carter Fone 5130 printer system.
7. Gilson minipulse peristaltic pump.

Reagents

The chemicals mentioned in the procedures are all of reagent grade quality. National Bureau of Standards (NBS) Standard Reference Materials (SRM) were used to make working standards for ICP, FAA. and GFAA measurements. Doubly distilled water was used throughout the procedures.

Procedures

Digestion #1 (see figure 1)

1. Weigh 100mg sample (-100 mesh or finer) into a 30-mL Teflon container.
2. Add 3 mL HNO3, 1 mL HClO4, and 10 mL HF.
3. Cover and digest sample for 2 hr. at 150°C.
4. Cool; open container and evaporate to dryness.
5. Add 25 mL 3N HCl and 0.1 mL 30% H_2O_2. Heat gently on a hot plate at 120°C to dissolve MnO_2.
6. Transfer the solution to a tared 50-mL disposable polypropylene centrifuge tube.
7. Adjust the weight of solution to 52.5 grams (50 mL) with 3N HCl. The dilution factor of this solution is 500.
8. Pipet a 1.0 mL aliquot and transfer to a 15-mL disposable polypropylene centrifuge tube.
9. Add 9.0 ml H_2O. The dilution factor of this solution is 5000.

As shown in figure 1, the elements Cu, Ni, Mo, Sr, V, Y, Cr, Ba, Co, and P are determined by ICP spectrometry, K, Pb, and Zn by FAA spectrometry and Cr by Zeeman GFAA spectrometry on the concentrated solution. Mn, Ti, Al, Fe,mg and Ca is determined by ICP spectrometry and Cd by Zeeman GFAA spectrometry on the diluted solution. The instrumental conditions are shown in Tables VI-1 through VI-3.

Digestion #2 (see figure 1)

1. Weigh 100mg sample (-100 mesh or finer) into a 15-mL polypropylene centrifuge tube.
2. Pipet 5.0 mL (1+1) HCl into the tube and cap tightly. Mix sample with the acid.
3. Place in oven at 90°C for 2 hr.
4. Remove from oven, cool and pipet 5.0 mL water into the tube and mix.

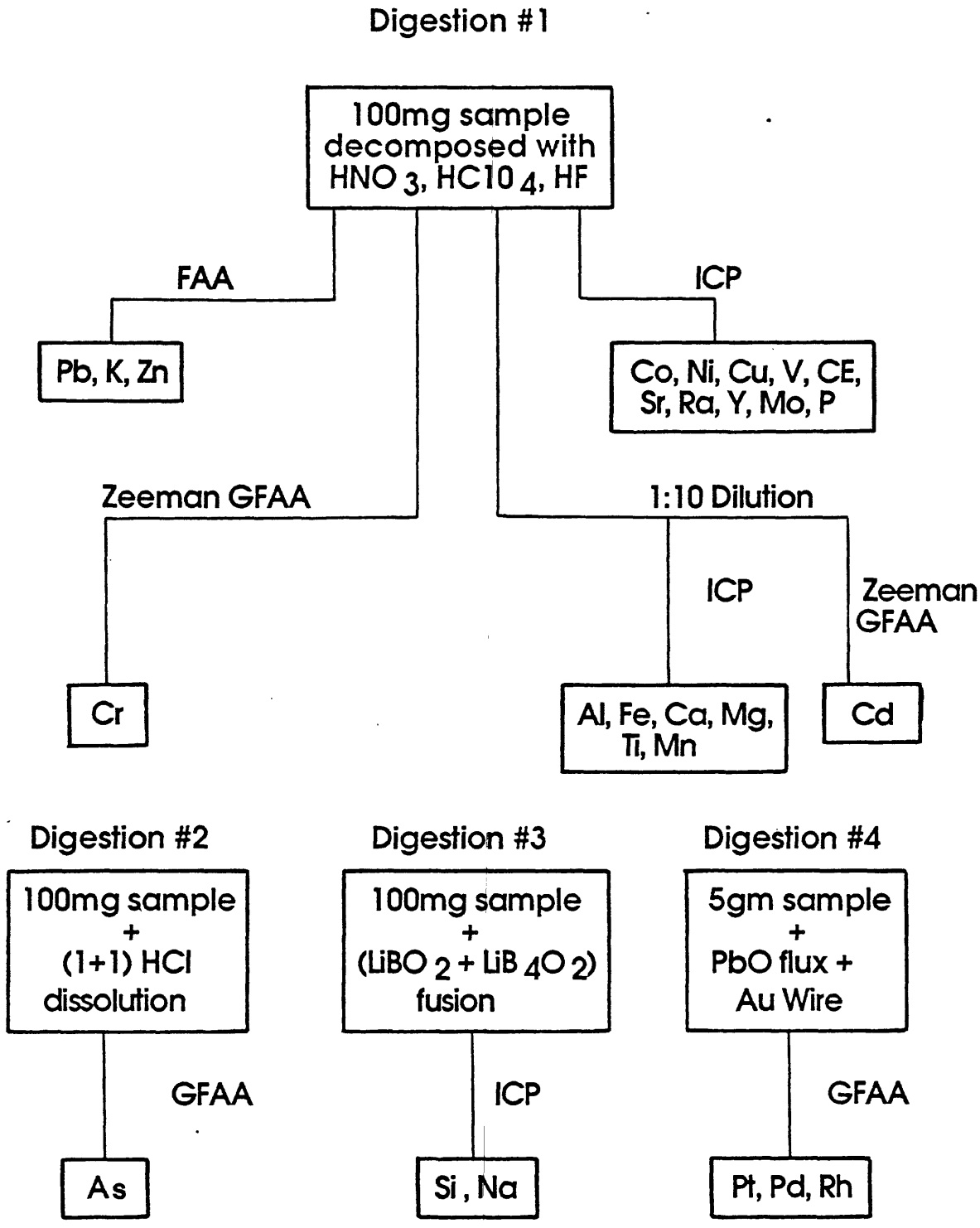


Figure IV-1 Analytical scheme for the determination of 27 elements in Ferromanganese materials.

5. Centrifuge for 5 min.
6. Pipet .05 mL of sample solution into a 5 mL disposal polystyrene microbeaker. Pipet .95 mL of 500 ppm Ni(NO3) into the beaker. Mix by swirling beaker. As shown in figure 1, arsenic is determined by Zeeman GFAA spectrometry. The dilution factor for the solution is equal to 2000.

Digestion #3 (see figure 1)

1. Prepare flux mixture of 1 part powdered lithium metaborate ($LiBO_2$) and 2 parts anhydrous lithium tetraborate (LiB_4O_7).
2. Weigh 100mg of sample (-100 mesh or finer) on a glassine powder paper.
3. Mix 0.9 gms of flux with the sample and carefully transfer the mixture to a graphite crucible. Lightly tamp down crucible several times.
4. Dry the mixture in oven at 105°C for 60 min.
5. Fuse the mixture in on electric furnace at 1000°C for 30 min.
6. Remove the crucibles from the furnace and allow to cool. When cool, the beads produed should be easily dislodged with the touch of a spatula.
7. To a 250-mL plastic bottle add a Teflon covered magnetic stir bar, the sample bead, 50 mL boiling water, and 5 mL (1+1) HNO_3.
8. Stir the mixture rapidly for 60 min. on magnetic stirrer.
9. Add about 100 mL water to bottle and transfer the solution to a 200-mL volumetric flask. Rinse the bottle with H_2O and add to contents in flask.
10. Pipet 5.0 mL of 1000g/mL indium solution, for internal standardization, into the volumetric flask. Fill to volume with H2O, mix, and pour the solution back into a dry plastic bottle.

Si and Na are determined by ICP spectrometry as shown in figure 1. The dilution factor of the solution is equal to 2000. The instrumental conditions are shown in Tables VI-3a, 3b.

The Determination of Pt, Pd and Rh

The elements Pt, Pd and Rh are determined by GFAA Spectrometry after separation by classical fire-assay methods and collection in a gold bead (Aruscavage and others., 1984). Briefly, the sample (typically 5 grams) is mixed in a clay crucible with a reducing flux consisting of 30g Na_2CO_3, 35g PbO, 10g SiO_2, 35g $Na_2B_4O_7$, 3.5g flour, 1g CaF_2 and 2mg gold wire. The sample is fused for approx. 1 hr at 1000°, poured into iron molds and the reduced lead metal containing Au, Pt, Pd, and Rh is then oxidized in a bone ash cupel at 850°C. The gold bead that remains is then dissolved in aqua-regia and subsequently the solution is analyzed for Pt, Pd and Rh by the GFAA technique. Table VI-2 shows the operating conditions for each of the elements.

Results and Discussion

Decomposition of the ferromanganese materials

After testing various procedures for decomposing these materials, we found that the best results were obtained using three separate and different methods for various elements. Because of the volatility of silicon tetrafluoride, a fusion of the sample with a lithium metaborate/tetraborate mixture similar to that used for the routine determination of rock forming major elements in silicates gave

the best data for silica and sodium. However because of the large blanks and high dilutions required to lower the salt content from the fusion, an acid decomposition was most useful for the trace and minor elements. The decomposition for arsenic presented a special problem in that its fluoride is also volatile and special precautions must be taken when using a hydrofluoric acid digestion. However we found that greater than 95% of the arsenic was leached from a test set of nodules with a hydrochloric acid digestion when compared with a total decomposition of the sample with hydrofluoric acid in a teflon lined bomb, thus making sample processing much easier.

ICP Determinations

Multielement capability is a main advantage of the ICP method, compared to atomic absorption methods. However, this advantage is often offset by spectral interferences common to optical emission techniques (A good guide to the selection of proper wavelengths and possible interferences in ICP atomic emission spectroscopy is the publication by Winge and others, 1985). Using standard procedures for investigating potential interferences in these high Mn-Fe matrices we found significant spectral interferences for the elements Mg, P, Co, Mo, V, Ce, Zn, Pb, As, and Cd. The extent of these interferences, shown in Table VI-5, is based on the background correction position given in Table VI-3b for the standard nodules A-1 and P-1. These interference corrections are applied automatically by computer algorithms (i.e. Pb (corr) = Pb (uncorr) + Co (corr) x K factor where K factor is the correction coefficient per concentration value Co in the sample. Because of the large corrections required or the poor sensitivity for the determination, the elements Zn, Pb, Cr, As, Cd, K, Pt, Pd and Rh are determined by atomic absorption techniques.

Atomic absorption determinations

Although atomic absorption techniques are largely free of spectral interferences, interferences caused by differing chemical matrices are common, especially in the graphite furnace technique. Possible interferences on Pt, Pd and Rh were tested previously (Aruscavage and others., 1984) by spiking 10 ng of the individual analyte elements (Pt, Pd, and Rh) with up to 1000 ng of interferent (Pt, Pd, Rh, and Ag). We found insignificant interferences (< 5% depression) in all cases except for the depressing effect of Rh on the Pd signal which amounted to 8% depression. The flame atomic absorption technique was found to be relatively free of interference except in the case of potassium. Because of its low ionization potential in the air-acetylene flame, potassium is ionized to a greater extent in pure solutions of the element than in digested samples which contain large amounts of easily ionizable elements such as sodium. This difference can cause an error in the results towards too high of values if calibration of sensitivity is made using these pure standard solutions. This interference can be corrected by adding a high concentration of ionizable salt such as NaCl to both samples and standards. We found, however that using a manganese nodule standard (P-1) for calibration eleminated the need for addition of salt and accurate results were obtained.

In the graphite furnace determination of Cd, Cr, and As we found significant signal supression caused by Fe and Mn. Fortunately, the suppression on Cd leveled off very quickly at about 25% supression for 10 ppm Fe or 25 ppm Mn. For Cr the supression (15%) leveled off at about 100 ppm Fe or Mn. By adding appropriate amounts of Fe to the calibration solutions for Cd and Cr, accurate results were obtained. For the determination of arsenic, nickel nitrate was

added to the solutions to allow higher charring temperatures and to provide a more stable matrix during atomization. Under these conditions no interference was observed.

Precision and Accuracy

The results for replicate analysis of the two USGS manganese nodule standards are shown in Table VI-4. The precision for most elements is better than 10% RSD except for Arsenic.

The accuracy of the procedure as shown by a comparison to literature values is also good and normally within 1 standard deviation from the published values. Exceptions are Ca, Ni, Mo, Ba, Sr, and Cr in nodule A-1 and Mo, V and Ba in nodule P-1. The determination limits are based on signals that are approximately 2 times that of the variation in the blanks or low standards are shown in Table VI-6.

Table VI-1. Operating conditions for FAAS determinations

Element	Pb	Zn	K
Wavelength (nm)	283.3	219.9	766.5
Band-pass (nm)	0.7	0.7	1.4
Flow Spoiler	Glass bead	plastic insert	plastic insert
Flame	Air/Acetylene	Air/Acetylene	Air/Acetylene
Flame conditions	oxidizing-blue	oxidizing-blue	oxidizing-blue
High standard	6 ppm	2 ppm	21 ppm (1)
Standard sensitivity (absorbance)	0.10	0.20	0.20
Linear range	0-12 ppm	0-2 ppm	0-21 ppm
Background correction	deuterium	deuterium	none

Notes: (1) - a 500 dilution of the USGS standard Nod-P-1 is used for calibration purposes. The sensitivity for this solution is achieved by rotation of the burner head to a 45° angle to the light path.

Table VI-2. Operating conditions for GFAAS determinations

Element	Cd	Cr	As	Pt	Pd	Rh
Wavelength (nm)	228.8	357.9	193.7	265.9	340.5	343.5
Bandpass (nm)	0.7	0.7	0.7	0.7	0.7	0.7
Light source	H.C.	H.C.	EDL	H.C.	H.C.	H.C.
Current/watts	6 ma	25 ma	8 w	30 ma	30 ma	30 ma
Bkg. correction	Zeeman	Zeeman	Zeeman	Zeeman	Zeeman	Zeeman
Mode	Peak Area	Peak Area	Peak Area	Peak Height	Peak Height	Peak Height
Integration time(sec)	4	6	5	4	4	4
High calibration standard (ppb)	2(1)	200(2)	100	200(3)	100(3)	20(3)
Standard absorbance	.12	.30	.38	.16	.38	.19
Dry temp. (°C)	120	120	120	130	130	130
Char Temp. (°C)	250	1000	500	1600	1100	1250
Atom. Temp. (°C)	2100	2700	2700	2700	2700	2700
Purge Gas	Argon	Argon	Argon	Argon	Argon	Argon
Gas flow at atom.	0	200	0	0	0	0
Ramp to atom. (sec.)	1	1	1	0	0	0
Graphite tube type	non-pyrolytic	non-pyrolytic	non-pyrolytic	pyrolytic	pyrolytic	pyrolyti
atomization	off-wall	off-wall	off-wall	off-wall	off-wall	off-wall
sample aliquot ()l)	20	10	20	20	20	20
modifier	none	$Mg(NO_3)_2$	$Ni(NO_3)_2$	none	none	none

Notes:

(1) solution contains 10 ppm Fe
(2) solution contains 100 ppm Fe
(3) solutions contain 2 Mg/ml Au
(4) H.C. = Hollow Cathode
(5) EDL = Electrodeless Discharge Lamp

Table VI-3a. Operating conditions for ICP determinations

Forward power	=	1.1 kw
Reflected power	=	<5 watts
Coolant gas flow	=	17 l/m Argon
Nebulizer gas flow	=	0.55 l/m Argon
Signal integration time	=	3 sec
Sample uptake	=	0.9 ml/minute
pump	=	peristaltic
Observation height above load coil	=	16 mm
Internal reference channels	=	low voltage card In channel (for Na, Si)
Nebulizer	=	fixed cross flow
Inductance coil	=	5 turn copper, water-cooled
Power frequency	=	27.12 mHz

Table VI-3b. Operating conditions for ICP determinations

	Wave-length (/)	Background position (/)	High conc-standards (ppm)	Inter-element corrections	Correction factor(ppm)
Al	3082	+ 0.48	10	-	-
Fe	2599	+ 0.48	25	-	-
Ca	3158	+ 0.48	100	-	-
Mg	2795	+ 0.48	10	Mn	-.00100
P	2149	+ 0.48	10	Mn; Cu	-.00020; +.00200
Ti	3349	+ 0.48	10	-	-
Mn	2576	+ 0.48	100	-	-
Co	2286	+ 0.48	10	Fe; Ti	+.00040; +.00180
Ni	2316	+ 0.48	10	-	-
Cu	3247	- 0.48	10	-	-
Mo	2020	- 0.48	10	Mn; Fe	+.00004; +.00010
V	2924	- 0.48	10	Fe	-.00030
Ba	4554	+ 0.48	10	-	-
Ce	4186	- 0.48	10	Ti	-.00800
Sr	4077	+ 0.48	5	-	-
Y	3710	+ 0.48	5	-	-
Si	2516	+ 0.48	10	-	-
Na	5890	+ 0.48	10	-	-
In	4511	+ 0.48	10	-	-

Table VI-4. Values found for standard samples[1]

Element	Nod A-1 Mean ± s (N)	Nod A-1 Lit.[2]	Nod P-1 Mean ± s (N)	Nod P-1 Lit.[2]	MCC-1 Mean ± s (N)	MNC-1 Mean ± (N)
SiO_2	3.92 ± .05(19)	3.70 ± .36(7)	14.55 ± .11(17)	14.18 ± .43(7)	-	-
Na_2O	1.07 ± .05(19)	1.09 ± .05(5)	2.19 ± .05(17)	2.24 ± .05(5)	-	-
Al	1.97 ± .040(32)	2.11 ± .50(8)	2.30 ± .035(32)	2.57 ± .62(8)	1.24 ± .02(32)	2.29 ± .04(32)
Fe	10.71 ± .19(32)	10.75 ± .45(13)	5.77 ± .10(22)	5.73 ± .50(13)	13.6 ± .23(32)	12.6 ± .24(32)
Ca	10.62 ± .18(28)	11.18 ± .16(8)	2.13 ± .05(28)	2.19 ± .066(8)	2.85 ± .04(28)	1.61 ± .04(28)
Mg	2.75 ± .045(32)	2.90 ± .14(8)	1.89 ± .025(32)	1.99 ± .087(8)	1.11 ± .014(32)	1.36 ± .02(32)
K	.48 ± .018(24)	.44 ± .11(9)	1.05 ± .006(24)	1.03 ± .061(8)	.71 ± .011(24)	.89 ± .011(24)
P	.50 ± .015(32)	.535 ± .064(6)	.20 ± .012(32)	.20 ± .015(6)	.62 ± .018(32)	.24 ± .006(32)
Ti	.28 ± .005(32)	.312 ± .038(6)	.27 ± .005(32)	.305 ± .034(6)	.99 ± .013(32)	.97 ± .017(32)
Mn	18.0 ± .35(32)	17.65 ± 1.43(11)	28.8 ± .57(32)	28.76 ± 1.38(11)	19.7 ± .33(32)	17.7 ± .33(32)
Co	.29 ± .008(32)	.315 ± .036(12)	.21 ± .007(32)	.226 ± .027(12)	.66 ± .019(32)	.29 ± .009(32)
Ni	.57 ± .012(32)	.628 ± .039(12)	1.23 ± .034(32)	1.34 ± .09(12)	.40 ± .013(32)	.50 ± .014(32)
Cu	.10 ± .002(31)	.113 ± .022(12)	1.10 ± .023(31)	1.16 ± .077(12)	.072 ± .003(31)	.34 ± .009(31)
Pb	841 ± 20(32)	998 ± 212(7)	466 ± 18(32)	552 ± 111(7)	1372 ± 39(32)	730 ± 24(32)
Mo	302 ± 9(32)	457 ± 68(7)	551 ± 17(32)	759 ± 122(7)	399 ± 14(32)	216 ± 9(32)
Zn	581 ± 23(32)	612 ± ~~110(9)~~	1575 ± ~~54(32)~~	~~1643 ± 161(8)~~	~~609 ± 15(32)~~	~~679 ± 15(32)~~
V	568 ± 14(32)	732 ± 161(4)	417 ± 12(32)	558 ± 82(4)	530 ± 17(32)	398 ± 13(32)
Ba	1334 ± 23(32)	1946 ± 462(6)	2331 ± 38(32)	3091 ± 498(5)	1922 ± 52(32)	1162 ± 23(32)
Ce	742 ± 21(32)	668 (1)	323 ± 9(32)	298 (1)	866 ± 28(32)	813 ± 24(32)
Sr	1479 ± 29(32)	1696 ± 107(6)	637 ± 16(32)	796 ± 167(6)	1294 ± 34(32)	875 ± 23(32)
Y	106 ± 2(32)	115 (1)	80 ± 2(32)	89 (1)	159 ± 4(32)	121 ± 3(32)
Cd	6.4 ± .3(32)	6.5 (1)	18 ± 1(32)	22.3 (1)	3.2 ± .3(32)	5.0 ± .3(32)
Cr	18. ± 1.6(30)	24.3 ± 1.5(3)	15 ± 1.2(30)	17.5 ± 2.5(3)	25.5 ± 1.3(30)	30 ± 3.6(30)
As	298. ± 25(30)	298 (1)	85 ± 9(30)	39 (1)	196 ± 21(30)	125 ± 14(30)

(1) Values from Al to Cu are in %. Values for Pb to As are in ppm. (N) = Number of determinations.
S = Standard deviation of the mean of N determinations.
(2) = "Best" values from Flanagan and Gottfried 1980, Tables 32 and 33.
Nod A-1 = USGS standard manganese nodule from the Atlantic Ocean.
Nod P-1 = USGS standard manganese nodule from the Pacific Ocean.
MNC-1 = Composite manganese nodule sample from Line Islands area of the Central Pacific Ocean.
MCC-1 = Composite ferromanganese crust from Line Islands area of the Central Pacific Ocean.

Table VI-5. ICP spectral interferences, see text for discussion

Wavelength (/)	Analyte Element	Interference	% Interference A-1	% Interference P-1
2203	Pb	Mn	3	6
2203	Pb	Co	15	15
2203	Pb	Al	4	7
2020	Mo	Mn	2	2
2020	Mo	Fe	3	1
2138	Zn	Mn	13	8
2286	Co	Fe	2	1
2286	Co	Ti	2	<1
2924	V	Fe	6	4
4186	Ce	Ti	4	9
2149	P	Mn	<1	3
2149	P	Cu	<1	7
2795	Mg	Mn	<1	2

Table VI-6. Determination Limits

Element	Instrument	ppm
Cu	ICP	5
Ni	ICP	5
Mo	ICP	5
Sr	ICP	2.5
V	ICP	5
Zn	FAA	15
Y	ICP	5
Ce	ICP	10
Ba	ICP	2.5
Co	ICP	5
Pb	FAA	10
Mn	ICP	25
Ti	ICP	10
Al	ICP	250
Fe	ICP	250
K	FAA	1250
mg	ICP	25
P	ICP	250
Ca	ICP	250
As	Zeeman GFAA	2
Cd	Zeeman GFAA	0.1
Cr	Zeeman GFAA	1
SiO_2	ICP	500
NaO_2	ICP	500

VII INTERLABORATORY CALIBRATIONS AND OTHER ANALYTICAL CHECKS

by F.T. Manheim and J.A. Commeau

with contributions by

B.J. Haynes, D. Root, V. Marchig, P. Halbach, and D. Puteanus

Several types of analytical problems were studied with the help of different laboratories and analytical methods: influence of grinding and sieving (homogeneity), water content, and systematic error in elemental analysis.

Influence of grinding and sieving on analytical values

Intercomparison of analytical determinations on ground, unsieved samples from the "Midpac I" cruise (Halbach and others, 1982) showed significant differences, depending on sample treatment. For example, analyses of cobalt and titanium by lithium borate flux X-ray fluorescence spectrometry and DC-plasma spectrometry, performed in the Woods Hole USGS laboratories yielded a pooled coefficient of variation for 10 pairs of cobalt determinations of 6.9 percent, expressed as percent of moisture-free weight. The corresponding value for titanium was still larger, at 19.1 percent. Inhomogeneities were suspected.

Further study showed that titanium tended to occur preferentially in more resistant coarser grains, along with iron and other detrital elements such as aluminum and silica, whereas cobalt was more homogeneously distributed in finer fractions along with manganese, nickel, copper, molybdenum, lead, and zinc. A second set of comparisons was performed on ground and sieved (100 mesh) samples from the R/V *S.P. Lee* cruise (Hein and others, 1985). In this case data of three different laboratories, including atomic-absorption analyses performed at the Technical University, Clausthal-Zellerfeld, agreed to within much closer limits: 4.3 percent and 5.8 percent pooled coefficient of variation for cobalt and titanium, respectively. As discussed in Chapter V, the basic grinding and sieving procedure was followed for all samples analyzed by us. It should be noted that the sieving through 200 mesh screen would have perhaps yielded even better sample homogeneity than sieving to 200 mesh (M. Fisk, United Nations, 1985, written communication). However, avoidance of biasing the results requires repeated regrinding of residual fractions until all fractions pass through the mesh. Time and availability of assistance to process the many samples did not permit this additional precaution.

Interlaboratory calibration of R/V S.P. Lee cruise data

The cooperative cruise of the R/V S.P. Lee in 1983 provided an excellent opportunity for a wide-range interlaboratory study on samples of crusts ground and sieved aboard the vessel. Analytical data on splits of approximately 56 samples were performed by the U.S. Geological Survey laboratories in Reston Virginia and Woods Hole Massachusetts, (see Chapter V), the Bureau of Mines laboratory in Avondale, Maryland, and the laboratory of the German Geological Survey in Hannover, Federal Republic of Germany. In addition, shipboard analyses were performed on a small, portable X-ray fluorescence unit (Portaspec, made

by the Hankinson Corp.) for six fixed elements (Mn, Fe, Ni, Co, Cu, plus semi-quantitative estimations on Zn and Pb). All the analyses except the shipboard and those of the German Geological Survey had accompanying hygroscopic moisture determinations, permitting recalculation to a moisture-free basis. Because hygroscopic moisture was significant in the "air-dry" powder (to 20 percent) the German data were recalculated to a moisture-free basis based on water values from the USGS-Reston data set. This correction was justified by comparison between water content for the Woods Hole and the Reston splits (Table VII-1). With two exceptions, the samples show remarkably good agreement, considering the expected changes due to sample equilibration with different laboratory environments. The data in Table VII-1 show that the pooled error for sample pairs (coefficient of variation) was only 1.66 percent of the analytical values, considerably less than deviations for elemental determinations, reported above and in Table VII-3.

Table VII-1. Hygroscopic water determinations for S.P. Lee Cruise L5-83-HW, USGS Reston VA(R) and Woods Hole MA (W), data. K = mean correction factor, given by $100/(100-H_2O^-)$. CV = difference between correction factors for the two sets of data, as a percentage of the corrected sample value.

SEQNO	H_2O^-(R)	H_2O^-(W)	K	CV	SEQNO	H_2O^-(R)	H_2O^-(W)	K	CV
17006	17.0	18.4	1.215	1.41	53029	13.0	14.4	1.158	1.34
17008	10.4	11.3	1.121	0.78	53030	8.7	6.8	1.084	1.56
17010	5.9	5.3	1.059	0.49	53032	10.3	10.2	1.115	0.07
17012	4.0	12.0	1.089	6.64	89013	7.5	5.5	1.069	1.61
17014	9.7	10.3	1.113	0.28	89017	17.6	19.8	1.231	2.33
17016	9.3	13.9	1.132	4.14	89020	5.6	5.6	1.059	0.00
17018	8.8	9.4	1.100	0.56	89022	7.2	9.3	1.090	1.77
53020	16.4	16.7	1.198	0.28	89025	6.2	5.7	1.088	0.39
53026	15.3	14.3	1.184	2.33	89026	4.9	10.0	1.081	4.21
53027	11.0	13.8	1.142	2.62	89031	14.7	15.0	1.176	0.28

Grand mean, K (correction factor) = 1.125.

Pooled CV (grand mean of CV values) = 1.66 (percent)

H_2O^+ values

H_2O+ is obtained by subtracting H_2O^- from total water obtained by the Penfield method (Shapiro, 1975). H_2O^- is determined on a split of powder taken at the same time as splits taken for many other elements (Ch. VI). Unfortunately, time delay between the H_2O^+ and H_2O^- determination permitted change in total water content, owing to gain or loss from atmospheric moisture, thus affecting the H_2O^+ values. This problem was recognized early in examining summation values, but because of the large number of samples to be run and frequent shortage of material, it was impractical to perform additional separate H_2O^- measurements for the H_2O determinations. Errors from this source are believed to account for most of the deviation of the summation value from the expected value.

A two-way analysis of variance was performed on the three to five sets of elemental data by the different laboratories to determine possible presence of systematic bias in the analyses. An example of one data set is given in Table VII-2. A summary of all elements studied is provided in Table VII-3. The simplest description of systematic bias of data by the different laboratories is given by the lab effect, or differences of the column means, representing data by a given laboratory for a given element, from the grand mean for all laboratories. Total of all lab effects were equal to zero.

One may observe that the largest (+) lab effect for iron is obtained from the shipboard analyses, as might be expected. These average about 5 percent higher than the mean of data from all laboratories. The F statistic is 14.4, much greater than the value of 2.9, expected for 4 degrees of freedom for the columns and 18 degrees of freedom for the rows (95 percent confidence level). This means that we reject the null hypothesis that the differences between the laboratories' data are not statistically significant.

In nearly every case except for cobalt Table VII-3 suggests that there are statistically significant differences in data from the participating laboratories. However, with some exceptions, these are probably not large enough to be of practical significance. We have included the shipboard measurements in the set to permit comparative evaluations, but a more judicious approach toward estimating true values would exclude these data, which are subject to fewer analytical controls than the laboratory determinations. A more subjective effort to arrive at "true" values might choose the mean of three out of the four, or two of three sets of data for each element on the basis of pairwise comparisons among the sets. There seems to be no concensus on this important problem, as a recent debate on the merits of various approaches to "best values" estimation suggests (Abbey and Rousseau, 1985).

Table VII-2. Comparison among five data sets for Fe analyses on ground and sieved crust samples from S.P.Lee Cruise L5-HW-83. RES = Reston USGS laboratories, WH = Woods Hole USGS laboratories, GERM = German Geological Survey, SH = shipboard analyses, and BURM = Bureau of Mines (Avondale) analyses. LE = lab effect, DF = degrees of freedom, SS = mean square due to regression, and MS mean square due to residual variation (error). F or "F statistic" = SS/MS.

SEQNO	RES	WH	GERM	SHIP	BURM	Row mean	Row SD
17006	16.86	16.28	16.02	19.03	18.42	17.32	1.334
17008	19.41	18.89	18.74	20.98	19.35	19.47	0.890
17010	18.80	17.61	18.38	21.25	18.67	18.94	1.370
17012	8.85	9.13	8.46	8.64	9.97	9.01	0.592
17014	13.28	13.38	13.84	13.95	14.96	13.88	0.668
17016	12.45	12.69	12.05	13.23	13.84	12.85	0.699
53018	17.54	17.01	16.72	18.64	18.43	17.67	0.848
53020	19.61	19.09	18.60	20.81	18.91	19.40	0.867
53026	19.95	19.05	19.18	22.07	18.36	19.72	1.421
53027	19.32	18.94	18.96	19.99	19.21	19.28	0.427
53029	16.32	15.82	15.28	16.55	17.08	16.21	0.689
53030	14.89	14.03	14.84	15.11	16.33	15.04	0.829
53032	13.60	13.22	13.48	13.71	14.43	13.69	0.453
89013	18.91	18.32	18.70	19.45	20.82	19.24	0.973
89017	17.47	16.89	16.54	18.44	18.98	17.66	1.029
89022	22.41	21.70	21.62	24.89	22.01	22.53	1.358
89025	22.17	20.85	22.79	21.74	20.86	21.68	0.842
89026	19.03	18.89	18.87	19.55	18.21	18.91	0.479
89031	19.34	18.74	17.62	19.69	19.87	19.05	0.909
Column mean	17.38	16.87	16.88	18.30	17.83	17.45	
LE	-0.07	-0.58	-0.57	+0.85	+0.38		

	DF	SS	MS
Columns	4	29.15	7.29
Rows	18	984.79	74.71
Residual error	72	36.48	0.507
Total	94	1050.42	

F = 14.38

Table VII-3. Analysis of variance among sets of laboratory data for elements analyzed on S.P. LEE crust samples. RES = Reston USGS laboratories, WH = Woods Hole USGS laboratories, GERM = German Geological Survey, SHIP = shipboard analyses, BURM = Bureau of Mines laboratories (Avondale, MD), LF = "lab effect" described in text, DF = degrees of freedom, SS = mean square for regression, MS = mean square due to residual variation, F = SS/MS, SD = standard deviation, CM = column mean.

MAJOR AND MINOR

Element	RES	WH	GERM	SHIP	BURM	Row Mean	DF	F
Fe	17.88	16.87	16.89	18.3	17.83	17.45	18	14.4
LE	-0.0717	-0.5812	-0.5727	0.8499	0.3757	0.		
Mn	24.14	23.33	23.28	24.22	25.76	24.15	17	19.476
LE	-0.0065	-0.8138	-0.8688	-0.0718	+1.6173	0.		
Co	0.844	0.9013	0.8601	1.0054	0.8474	.8916	.8	2.60
LE	-0.0476	+0.0097	-0.0315	+0.1138	0.0442	0.		
Ni	0.4145	0.5999	0.4619	0.3267	0.4773	0.4161	18	65.078
LE	-0.0016	-0.0162	+0.0458	-0.0894	0.0612	(-.0002)		
Cu	0.0988	--	0.1053	0.0891	0.1309	0.1060	33	38.696
LE	-0.0073	--	-0.0007	-0.0169	+0.0249	0.		
SiO_2	9.753	9.648	9.284	--	--	9.562	18	4.235
LE	+0.191	+0.087	-0.278	--	--	0.		
Al	1.159	1.605	1.255	--	1.285	1.326	18	19.35
LE	-0.167	+0.279	-0.71	--	-0.041	0.		
Mg	1.141	1.078	1.168	--	1.245	1.158	18	14.10
LE	-0.017	-0.080	+0.010	--	+0.087	0.		
K	0.603	0.545	--	--	--	0.574	23	14.74
LE	+0.0292	-0.292	--	--	--	0.		
Ca	3.18	2.88	3.00	--	2.94	2.9975	18	23.46
LE	+0.181	-0.122	+0.009	--	-0.06	0.		
Ti	1.299	1.313	--	--	1.539	1.3839	22	40.47
LE	-0.085	-0.070	--	--	+0.155	0.		
P	0.492	0.523	--	--	0.592	0.53556	23	2.66

Element	RES	GERM	SHIP	BURM	Row Mean	DF	F
Pb	0.1802	0.1605	0.1210	0.2298	0.1729	40	144.48
LE	0.0074	-0.0123	-0.0518	0.0569	.0002		
Ba	0.1768	--	--	0.2416	0.2092	48	315.93
LE	-0.0324	--	--	0.0324	0.		
Sr	0.1570	0.1824	--	0.1788	0.17277	40	80.24
LE	-0.0157	+0.0097	--	+0.006	0.		
V	0.0623	--	--	0.0765	0.06939	47	77.086
LE	-0.00707	--	--	+0.00707	0.		
Mo	0.04859	--	--	0.05918	0.05389	48	62.47
LE	-0.00529	--	--	0.00529	0.		
Zn	0.0879	0.0812	0.0654	0.1100	0.08612	38	4.33
LE	0.0018	0.0049	-0.0208	0.0239	0.		

VIII DATA By C.M. Lane and F.T. Manheim

Geological and Station Data

The geological and station data for ferromanganese crust samples collected by the USGS summarized in this report consist of the geographic location in decimal degrees, water depth, cruise identification, average crust thickness within dredge recoveries, sampling device, institution of origin, and brief description of the nature of the dredge or other sampler recovery. An example of the station data, as it is reported in Appendix A, is given in Table VIII-1. We have reported some stations where chemical analyses are not available. These fall into the following categories: 1) crusts were observed at a particular station but there was not enough sample for analysis, 2) absence of crusts at a particular site was regarded as significant or 3) sites were camera stations TV grab stations or hydrographic stations. Key attributes such as depth may be missing for a few samples. Further research (e.g., for missing cruise reports) may fill in these gaps in the station data. Locations of principal sites are shown in Fig. VIII-1.

The geological and station data for ferromanganese crusts acquired from SNDB is reported in Appendix B. Similar attributes are represented, however crust thicknesses and description of dredge content were not reported by SNDB. When available length of core, surface lithology and estimated coverage with source of estimate are reported. To facilitate further research original SNDB reference numbers to data sources are given in Appendix B.

Both Appendix A and Appendix B are indexed by geographic area as indicated below. Data in Appendix A have been sorted by latitude because there were often many samples per station and samples were not always consecutively assigned sequence numbers whereas Appendix B is sorted on sequence number. In the tables latitudes are negative south of the Equator, and longitudes are negative west of Greenwich, England. Map insets are shown in Fig. VIII-I.

A1 Marshall Islands area (0-35°N; 135°E - 175°E)
A2 Central North Pacific (N. Line Islands and Hawaiian Archipelago) 5°S - 35°N; 145°W-175°E)
A3 South Pacific (S. Line Islands - French Polynesia) (30°S - 0°; 140°W - 175°E)
A4 United States West Coast offshore EEZ (30°N - 50°N); 115°W - 135°W)
A5 Blake Plateau (27°N - 35°N; 70°W - 81°W)
A6 Southeast Atlantic (20°N -35°N; 119°W - 117.5°W)
A7 New England Seamounts (30°N -48°N; 45°W - 72°W)
A8 Other areas not included above
A9 NGDC data
A10 Reference data

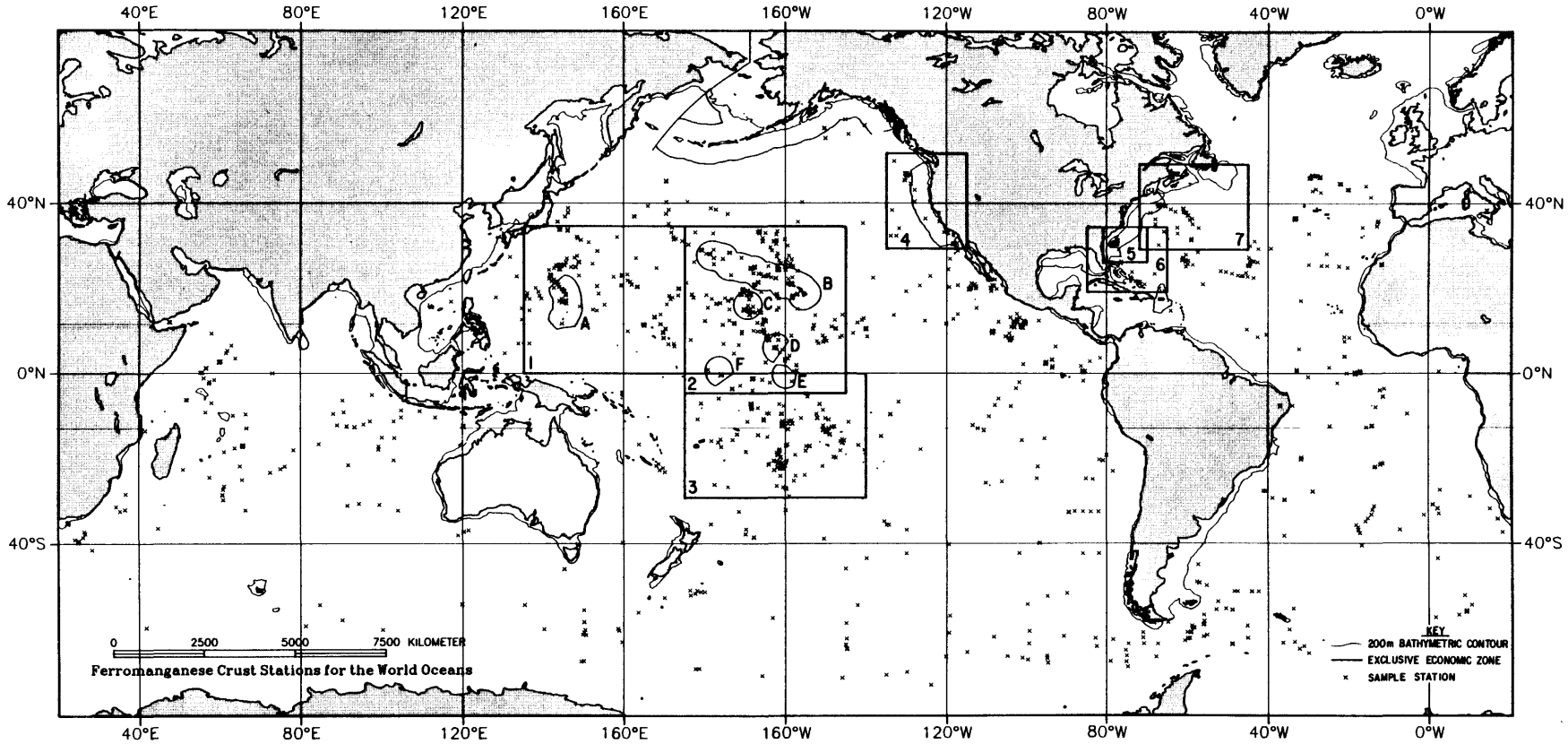


Figure VIII-1 Location plot of ferromanganese crust sampling stations in world oceans.

Explanation of column headings

In the following section each of the column headings for Appendix A will be briefly commented on and qualified. Latitudes and longitudes are given in decimal degrees. "Depth interval" is given in meters. Where available both the start and end positions and corresponding depth for a dredge are reported, however only the position and depth for the beginning of a dredge is used for graphic output.

"Sample" refers to a concatenated designation which includes the original cruise identification, followed by a slash and a sample designation, for example "/D4 - 4" for Dredge No 4, sample 4. There is no uniform procedure amongst organizations for labeling dredge material or subsamples of these dredges. In some cases the only feature that differentiates between subsamples may be different thickness entries for the crust. These differences are also reflected in the assignment of a new sequence number (SEQNO). The sequence number has been described in Chapter IV and is a unique sample identifier.

"Thickness" refers to thickness in millimeters of the sample or subsample. Thickness ranges for the dredge or other gross sampling are given under "Description". Following "sample device", "Inst" refers to institution of origin. The coding for abbreviations is as follows: TUCLZ Technical University, Clausthal-Zellerfeld, Federal Republic of Germany; SIO, Scripps Institution of Oceanography; HIG Hawaii Institute of Geophysics; OSU Oregon State University; FSU Florida State University; LDGO Lamont Doherty Geological Observatory; UWASH University of Washington; SMIT Smithsonian Institution; NOAA National Oceanic and Atmospheric Administration; WHOI Woods Hole Oceanographic Institute, USGS-WH U.S. Geological Survey Woods Hole MA, and USGS-MEN U.S. Geological Survey Menlo Park CA.

Explanations of variables in the USGS file of station data are listed below. The number following the variable name refers to the type of variable (1 = integer, 2 = real number, 3 = dictionary, 4 = code, and 6 = character string).

SEQNO	1	Sequence number
LAT1	1	Latitude on bottom (decimal degrees)
LAT2	2	Latitude off bottom (decimal degrees)
LON1	1	Longitude on bottom (decimal degrees)
LON2	2	Longitude off bottom (decimal degrees)
DEPTH1	2	Depth on bottom (meters)
DEPTH2	2	Depth off bottom (meters)
CRUISE	6	Cruise identification
STATIO	6	Station number
SAMP#	6	Sample number
MONCOL	1	Month collected
DAYCOL	1	Day collected
YRCOL	1	Year collected (2 digits)
HOUR	1	Time collected
SEC	1	Time collected
PHASE1	6	Phases collected
SMPDEV	3	Sampling device
AMTCOL	2	Amount collected

Table VIII -1 Example of the USGS station data tables as found in Appendix A.

SOUTHEASTERN ATLANTIC AREA A-6

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
20.267	-65.683	7002	CHAIN 34/D-3	079002	-	-	WHOI	Fragment thick orange stained black smooth Mn crust homogeneous but light assume high Mn content may be hydrothermal in origin.
20.817	-66.917	4878	RC-8/D-8	079004	1.5	Dredge	LDGO	Nodules and micronodules, caryn seamount.
21.833	-70.573	5416	GS/7103/10	080008	-	-	UMIAMI	Botroidal Mn slabs 15mm thick.
22.317	-72.080	3363	GS/7308/D-10	080008	-	-	UMIAMI	Partly encrusted calcareous "sediment" with Mn encrusted up to 5mm where present.
22.333	-72.085	2250	GS/7308/D-11	080002	-	-	UMIAMI	Thick botryoidal crust over calcareous "sediment".
22.570	-72.375	3420	GS/7308/D-12	080003	-	-	UMIAMI	Calc "sediment" with thick Mn crust up to 20mm.
22.642	-72.850	2390	GS/7308/D-13	080004	-	-	UMIAMI	Thick Mn crust with calcareous material.
23.157	-73.752	3126	GS/7308/D-14	080005	-	-	UMIAMI	Mn encrusted upon coral and calcareous "sediment". Mn crust is 0-10mm thick.
23.183	-73.973	1315	GS/7308/D-15	080006	-	-	UMIAMI	Massive botryoidal Mn crust slabs up to 50mm thick.
23.487	-74.200	2910-2062	GS/7308/D-16	080007	-	-	UMIAMI	Massive slabs (50mm thick) of botryoidal Mn crust (inside somewhat more Fe stained).
24.277	-68.107	5668	BIOLOGICAL/NEW	079001	-	-	UMIAMI	Heavily encrusted Mn (up to 15mm) on calcareous "sediment"; substrate is dark brown botryoidal slab of Mn crust.
30.798	-78.160	840	NONE/111493/6	116008	-	-	NOAA	80mm diam hard nodule.
30.798	-78.160	840	NONE/111499/5	116009	-	-	NOAA	Classic nodule 70mm diam.
30.798	-78.495	860	NONE/111498/17	116010	-	-	NOAA	Flattened disc shaped nodule 35mm diam.
30.798	-78.495	860	NONE/111411/139	116021	-	-	NOAA	Slab hard Mn shaped and cracked in some places, unique two layer shape.
30.798	-78.495	860	NONE/111411/146	116022	-	-	NOAA	Mn nodule.
30.798	-78.495	860	NONE/111411/81	116024	-	-	NOAA	Classic small nodule 50mm.
30.798	-78.495		NONE/111411/14	116023	-	-	NOAA	Classic small nodule 50mm.
30.800	-78.767	805	PROSPECTOR 6A/6A-1	116038	-	Chainbag Dredge		Round and flat nodules.

UNITSC	6	Units of amount collected
INST	3	Institution affiliated with the sample
PHOTO	4	Photo available (Y or N)
PHASE2	6	Phase analyzed
THICK	2	Thickness of crust (mm)
MORPH	3	Morphology of crust
REFID	6	Reference number to link with reference file
NAVCDE	4	Navigation quality code
COMMNT	6	Comments

Chemical data

Chemical data are provided in two basic modes; oxides and elements. Examples of these are given in Tables VIII-2 and VIII-3. First, where sufficient data are available to permit a chemical summation, i.e. the U.S. Geological Survey (Reston) data, concentrations are presented in oxide form corresponding to the oxidation state nominally assumed for the crusts. The second mode reports elemental concentrations, which include a basic assay of at least five elements: Mn, Fe, Co, Ni, Cu. The SNDB falls into this category (Appendix C, Table 9). A third mode, normalized data, is not given in tabular form, but is utilized in the chemical maps and selected diagrams. Normalizations procedures are discussed later.

Complete data sets are reported in Appendix C, as itemized below. All Tables (C01-C11) represent hygroscopic water-free data.

C01	USGS (Reston)
C02	USGS (Woods Hole)
C03	Bureau of Mines (Avondale) (B. Haynes)
C04	German Geological Survey (V. Marchig) and TUCLZ (Halbach and others.)
C05	Shipbard data by Portaspec X-ray fluorescence, Midpac area and Marshall Islands areas (F. Manheim and T. Ling)
C05a	Shipboard data by XRF on board R/V Sonne, Midpac cruises 2a and 2b (P. Halbach and D. Puteanus)
C06	Analytical Services Co., Oregon, HIG KK84 samples.
C07	Geological Survey of Japan (A. Usui)
C08	Aplin thesis -major and minor elements
C08a	Aplin thesis -rare earth elements
C09	SNDB crust samples -major and minor elements
C10	SNDB crust samples -trace elements
C11	NGDC crust samples
C12-C18	Recent crust data from references

Some special remarks are appropriate regarding the unmodified, water-corrected data and derivation of the oxide sum. All data are presented on a hygroscopic moisture-free basis. Therefore, the H_2O^- value is not included in the summation. The summation does not include Cl and SO_4 values (mainly due to dried sea water in pore fluid) nor trace metals. We have found the sum of the majors to have a normal distribution with a mean value 98.6, rather than 100.0. This is in reasonable agreement with the estimated contributions from

the above sources. As has been discussed under analytical chemistry, Chapter VII, scatter about the expected sum is believed to be mainly due to unavoidable inaccuracy in determination of H_2O^+. This is reflected in Tables VI-1 to VI-3 under discussion of the interlaboratory calibrations. τ(gamma) refers to the correction factor that would be needed to bring the observed sum to the theoretical sum of 98.6. Table VIII-2 is an example of summed data as reported in Table 01 of Appendix C. Laboratory number refers to the sample number assigned by the performing laboratory, enabling recheck of data by analysts. Sample interval refers to the portion of the crust taken for analysis. Where no description is given one can generally assume that a bulk sample was used. However, one should recognize that many, especially older SNDB materials may represent indeterminate samplings of crusts, and even for newer material, surfaces of crusts may be ground off by unprotected chain dredge bags during recovery.

Other data sets are reported in terms of elements. Where H_2O-data are available they are reported, although the data are already corrected for hygroscopic moisture. For the SNDB data shown in Table VIII-3 the reference number refers to the cross-reference list provided in Chapter XIII (Frazer and Fisk, 1980).

Crust sample and analytical material are highly heterogeneous. They present some problems common to the study of abyssal manganese nodules, and additional sources of error or complicating factors. These can render data interpretation difficult or misleading. The main sources of uncertainty include high hygroscopic water content of crusts, as discussed in Chapter V, contamination with substrate, poor selection of samples (i.e. not crusts at all), and analytical and other factors.

Total water (hygroscopic and bound) may exceed 40 percent, and the way analyses are presented is therefore critical. For example, some of the early data of both J. Mero and D.S. Cronan (see Table XIII-1) referred to an ignited (about 800°C) basis, thus maximizing reported metal content. On the other end of the spectrum, some workers have reported data on an air-dry basis, and some even on a partly sea-water-wet basis (!). Still other literature data report acid-soluble or reducible metal concentrations. We have chosen a 105-110°C, oven-dried basis both on grounds of established use (SNDB and most Russian data) as well as on the basis of convenience and reproducibility (see Table V-1). For other data culled from the literature or unpublished sources the leaders of the Scripps study frequently applied discretionary corrections (Frazer and others., 1978). Spot checks revealed inconsistencies in some of the revised data. Similar problems were reported to us by J.R. Hein and L. Morgenson (oral communication, 1986).

Normalized data

An even more serious problem than water content is that of contamination. Unlike abyssal nodules, most crusts form layers on tabular substrates or envelope large talus fragments. In removing crust for analysis many older samplings incorporated large amounts of substrate material into the analyzed sample, so that "crusts" at the far end of this spectrum can have a nearly pure basaltic, hyaloclastite, volcanic ash, phosphorite or carbonate composition. These

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	020006	020007	020007	020007	020007	020008	020009	020009	020009	020010	020010	020010
Latitude	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755
Longitude	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792
Depth	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
Lab#	D6-1-C	D6-2-A	D6-2-B	D6-2-C	D6-2-D	D6-4-A	D6-6-A	D6-6-B	D6-6-C	D6-13-A	D6-13-B	D6-13-C
SiO_2(wt.%)	2.17	8.29	12.0	6.39	3.41	6.43	4.48	8.73	5.49	5.73	10.0	6.66
TiO_2	1.01	1.87	2.36	2.30	1.49	1.52	1.47	2.23	2.30	1.71	2.22	2.25
MnO_2	27.3	41.7	34.2	42.0	38.2	41.2	47.9	41.2	42.5	44.1	38.2	39.6
Fe_2O_3	12.7	27.0	29.0	26.8	18.8	28.8	24.7	26.8	28.3	26.2	27.7	28.2
Al_2O_3	.90	1.31	2.89	1.40	.66	.86	.49	1.87	1.19	.77	2.00	1.47
Co_3O_4	.350	1.07	.718	1.06	.644	.969	1.22	.909	.785	1.15	.867	.926
NiO	.683	.612	.556	.666	.696	.512	.692	.621	.617	.626	.673	.623
CuO	.161	.069	.113	.152	.126	.071	.053	.135	.197	.091	.148	.221
CaO	26.4	3.61	3.81	3.77	13.9	3.81	4.14	3.81	4.16	3.80	3.37	3.64
MgO	1.61	1.84	1.79	1.91	1.59	1.96	1.87	1.77	1.76	1.88	1.80	1.80
Na_2O	1.93	2.45	2.39	2.20	2.30	3.09	2.47	2.41	2.08	2.50	2.39	2.31
K_2O	.42	.56	.79	.57	.45	.52	.59	.73	.55	.51	.72	.57
CO_2	4.32	.67	.66	.60	1.64	.58	.67	.55	.63	.66	.56	.56
P_2O_5	13.64	1.01	1.27	.97	7.24	1.14	1.06	.85	1.02	1.00	.78	.81
H_2O+	5.8	7.5	8.4	8.4	7.2	7.5	7.5	8.2	8.0	7.4	7.5	7.6
H_2O-	14.3	25.2	22.2	21.7	19.6	25.5	26.4	22.1	23.7	26.8	26.2	26.5
Sum	99.5	99.5	100.9	99.3	98.4	99.0	99.3	100.9	99.6	98.1	98.9	97.3
As(ppm)	249	199	219	270	300	350	250	290	340	244	290	330
Ba	1900	1900	1800	2300	1600	1200	1900	2800	1300	1800	2400	1500
Cd	5.7	3.3	3.0	4.3	4.0	3.6	3.5	3.1	4.4	3.7	3.1	3.8
Co	1500	1400	950	1200	840	890	940	1300	750	1000	1200	830
Cr	9	6	17	9	33	3	22	5	3	22	9	11
Mo	480	570	300	540	510	500	460	600	720	370	500	590
Pb	1800	1400	1400	1700	1700	1600	1400	1400	1900	1300	1400	1800
Sr	1500	1900	1500	1800	1700	1600	1700	2000	1800	1500	1600	1600
V	570	620	570	750	760	770	650	830	840	580	790	750
Y	180	270	193	153	187	201	167	157	217	149	117	205
Zn	950	770	780	970	740	660	850	1100	680	720	880	720
γ	.991	.991	.978	.993	1.002	.996	.993	.978	.990	1.005	.997	1.014
Sampled	Mn-P_2O_5	Botryoids	7-15mm	20-40mm	40-60mm	Bulk	0-10mm	10-25mm	25-35mm	Porous	5-25mm	25-45mm
Interval	cement	0-7mm	-	-	-	0-5mm	-	-	-	0-5mm	-	-

Sequence#	036001	039001	041001	043001	046001	047001	047003	047004	047005	047006	047007	047008
Latitude	.542	15.340	10.895	15.483	13.042	10.367	10.400	10.600	11.458	11.483	11.458	12.550
Longitude	2.483	-21.850	-45.297	-64.083	-97.067	-108.383	-108.433	-108.800	-103.300	-103.217	-103.233	-103.267
Depth	2652	-	4640	1086	3888	3140	3843	4592	1498	1235	1408	1240
Lab#	W-222718	W-231374	W-222720	W-228415	W-231351	W-222681	W-222682	W-222579	W-222541	W-222542	W-222543	W-222544
SiO_2(wt.%)	24.3	4.31	16.3	9.27	29.0	18.0	30.4	25.5	25.4	18.3	20.5	19.5
TiO_2	.83	1.65	.88	.85	.78	1.36	.09	1.39	.65	.75	.47	.79
MnO_2	19.0	20.3	19.9	27.1	23.6	27.1	27.1	28.5	18.8	22.6	19.0	21.1
Fe_2O_3	27.5	34.6	35.0	30.2	19.5	29.7	24.8	16.5	29.0	34.1	34.5	32.0
Al_2O_3	6.24	3.04	5.54	4.38	7.15	3.90	.82	7.19	6.23	4.43	4.75	4.39
Co_3O_4	.225	.793	.250	.379	.048	.187	.023	.157	.045	.103	.054	.097
NiO	.450	.193	.218	.546	.540	.334	.382	.602	.242	.255	.173	.254
CuO	.354	.036	.089	.078	.172	.153	.153	.823	.117	.110	.104	.072
CaO	1.24	10.6	2.05	4.38	3.56	3.80	.78	1.94	4.22	3.63	3.15	5.07
MgO	3.32	2.55	2.23	3.46	2.49	2.11	2.88	2.87	2.60	2.08	1.72	1.99
Na_2O	2.59	1.26	1.59	1.62	3.08	2.84	2.83	2.77	2.69	2.57	2.90	2.30
K_2O	1.14	.38	.60	.68	1.09	.60	2.72	1.53	.84	.74	.81	.81
CO_2	.11	4.42	.45	2.20	.18	.48	.06	.14	.31	.44	.47	1.62
P_2O_5	.49	2.61	1.09	1.12	.60	.89	.16	.45	.82	1.04	1.05	1.03
H_2O+	9.1	6.6	9.8	11.1	7.2	7.4	7.0	8.9	6.3	7.7	7.8	7.6
H_2O-	15.2	14.1	18.2	13.7	12.8	20.0	10.1	13.3	15.7	20.3	19.2	19.9
Sum	96.9	93.3	95.9	97.4	99.1	98.8	100.2	99.2	98.2	98.9	97.5	98.6
As(ppm)	142	480	430	570	161	238	32	81	178	260	235	225
Ba	1400	1500	930	1700	1300	1400	580	3000	1200	1300	1400	1200
Cd	1.7	4.0	2.4	4.5	3.7	2.9	8.3	2.3	2.7	2.5	3.1	2.6
Co	1300	2900	1600	780	310	550	47	280	154	290	210	260
Cr	67	57	28	60	44	14	3	22	57	34	27	42
Mo	<5	310	280	380	300	280	200	108	100	188	90	150
Pb	1000	1900	980	930	172	380	<55	196	190	290	136	250
Sr	840	1400	1000	1300	890	1300	211	620	1000	1200	1100	1200
V	440	1200	940	1000	500	610	75	420	450	580	540	540
Y	64	151	171	174	115	188	20	57	116	163	136	150
Zn	710	550	550	790	570	590	870	670	650	650	660	640
γ	1.018	1.056	1.028	1.013	.995	.998	.984	.994	1.004	.997	1.011	1.000
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-14mm	0-15mm	0-24mm	0-5mm	0-35mm	-	-	0-12mm	-	-	-	-

Table VIII -2.Example of the Analytical lab's chemical data tables, in oxide form, as in Appendix C1.

admixtures can seriously bias both regional elemental variability as well as statistical studies involving histograms, correlation coefficients, and factor analysis.

Contamination was present even in newer samples from dedicated crust cruises. It is recognized that for mining engineering, processing and other purposes variable amounts of crust admixture may be taken into consideration, but it is clearly necessary from the point of view of establishing the nature and regional variability of the crust phases to limit the arbitrary admixture of extraneous material.

We therefore created a normalized data set from the total data population. Crusts consist basically of two major phases, a metal oxide phase, itself often composed of several potential subphases, and a detrital phase, also potentially containing subphases. At the simplest level, most of the heavy metal and transition metals that are of both economic and special geochemical interest are associated with the former phase. After careful consideration of alternatives and cross-plotting of chemical information, we concluded that the most stable and workable normalization technique would utilize the sum of iron and manganese as the normalizing factor. This choice also reflects past observations that when influence of diluting (non-crust) substances is minimized, Fe and Mn ferromanganese phases show an inversely correlated behavior, with a relatively constant sum.

As noted in Fig. IX-7, for the well-controlled USGS data set, the bulk of the data asympototically approach a maximum Fe+Mn value representing a hypothetical "pure crust" material when Mn is plotted against Mn+Fe. A similar relationship is obtained when Fe is plotted against Fe+Mn. Based on the histogram in Fig. VIII-2 and other studies we chose a value of 50.00 to represent the "pure crust" end member. The end member composition retains about 22 percent of other constituents including H_2O^+, Si, Al, Mg, K, etc. Some of these are incorporated in the manganese mineral structure.

A set of data wherein the normalized value of each of the "metalliferous" components assumed to be associated with the Mn-Fe oxide phase, M*, is obtained by the relationship:

$$M^* = 50.00 \times M/(Fe+Mn)$$

where M is the concentration of a given element in the group, Mn, Fe, Co, Ni, Cu, Zn, Cd, Pb, Mo, V, As, and Ce. Thus, values for most samples with (Fe+Mn) < 50.00 will be increased in concentration. An exclusion before normalization is applied for samples meeting the test, Mn/Fe >5. This exclusion eliminates some hydrothermal oxide samples which typically have very high Mn/Fe ratios (Toth, 1980).

Where Fe+Mn values are very low, the normalization process may sometimes create unreasonably high (apparent) minor metal concentration, e.g. in SEQNO 127006, values of 5000 ppm Zn and 497 ppm Cd were obtained for original Fe+Mn of only 0.21 percent in a nearly pure carbonate rock. However, such outliers are few and are excluded for mapping.

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	0800024-01	0870004-00	0890009-00	0910002-00	0910005-01	0910005-02	1120022-00	1130048-00	1130061-00	1130062-01	1130063-01
Latitude	-62.850	-64.517	-64.183	-63.067	-63.100	-63.100	-56.617	-55.933	-53.042	-59.142	-53.058
Longitude	-74.758	-145.967	-165.933	178.483	177.617	177.617	-34.800	-45.202	-48.883	-48.883	-48.950
Depth	4005	3775	2932	3583	3383	3383	3696	3740	3118	3850	3255
Si(wt.%)	-	-	11.3	15.5	-	-	-	-	-	-	-
Ti	-	.91	.63	.46	.78	1.16	-	-	.53	-	-
Mn	10.3	18.1	14.8	8.80	13.5	12.1	22.0	26.6	7.40	12.3	27.7
Fe	25.7	17.3	11.0	12.4	22.4	23.0	19.2	13.0	19.9	23.6	14.5
Al	-	-	2.40	3.90	-	-	-	-	-	-	-
Co	.140	.570	.170	.140	.330	.350	.480	.120	.340	.150	.210
Ni	.100	.290	.700	.270	.200	.130	.260	.990	.060	.220	.770
Cu	.100	.090	.290	.130	.080	.080	.050	.410	.090	.100	.160
Ca	2.28	-	1.52	1.79	-	-	2.24	2.00	-	2.14	1.65
Mg	2.99	-	-	-	-	-	.96	1.90	-	1.82	1.63
Na	2.16	-	-	-	-	-	1.57	3.57	-	2.97	2.78
K	.98	-	-	-	-	-	.34	1.07	-	.99	1.07
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	17.1	17.4	12.2	19.1	20.4	-	-	15.0	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	1200	3900	2500	1700	2800	-	-	1100	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	1300	110	50	1100	620	-	-	510	-	-
Pb	2000	-	1500	1400	-	-	3100	900	-	2600	800
Sr	-	1300	1000	1100	1300	1300	-	-	860	-	-
V	-	560	-	-	1200	920	-	-	490	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	640	400	1000	580	600	500	1800	2700	300	870	1600
Sample type	Mn-coated rock	Nodule -	Crust -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Several crusts	Crust -	Crust -
Portion sampled	unknown -	without nucleus	cross section	cross section	outer crust	outer crust	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	Clay	-	-	-	-	-	-	-	-	-
Reference	A368	A227	A197	A197	A227	A227	A368	A368	A227	A368	A368

Sequence#	1130065-00	1140011-01	1140029-01	1140040-05	1140051-00	1140081-01	1140081-02	1140088-01	1140119-00	1140127-00	1140127-01
Latitude	-59.033	-53.000	-57.538	-55.100	-55.733	-56.267	-56.267	-56.233	-55.642	-52.833	-52.833
Longitude	-48.978	-52.900	-55.138	-55.833	-56.050	-58.275	-58.275	-58.700	-55.912	-50.500	-50.500
Depth	3862	3101	4075	2871	3914	4087	4087	4133	4085	2842	2842
Si(wt.%)	-	13.8	-	-	-	-	-	-	-	-	-
Ti	-	.25	-	-	.37	.40	.47	-	-	-	-
Mn	18.4	10.8	11.3	14.0	3.90	1.00	1.00	1.56	6.20	9.50	9.20
Fe	21.1	15.8	17.9	28.2	19.2	14.5	16.8	40.3	20.8	14.7	18.9
Al	-	2.70	-	-	-	-	-	-	-	3.57	3.00
Co	.160	.150	.160	.280	.120	.130	.150	.020	.100	.100	.140
Ni	.500	.390	.240	.230	.120	.290	.130	.030	.110	.240	.070
Cu	.250	.080	.080	.070	.090	.160	.160	.060	.040	.100	.090
Ca	1.65	1.19	1.66	1.35	-	-	-	1.51	-	-	-
Mg	1.70	-	2.52	1.54	-	-	-	1.75	-	-	-
Na	3.08	-	4.07	2.09	-	-	-	2.19	-	-	-
K	.96	-	2.59	.77	-	-	-	.91	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	13.0	-	-	7.8	10.1	7.7	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	3000	-	-	580	400	510	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	52	14
Mo	-	140	-	-	510	260	290	-	-	160	230
Pb	2100	1200	1100	3200	-	-	-	2400	-	600	1100
Sr	-	800	-	-	760	480	520	-	-	-	-
V	-	-	-	-	710	230	660	-	-	350	570
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1100	670	520	900	300	460	450	660	-	720	1700
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Crust -	Crust -	Crust -
Portion sampled	unknown -	cross section	unknown -	unknown -	outer crust	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A197	A368	A368	A227	A227	A227	A368	A333	A333	A333

Table VIII -3.Example of the SNDB chemical data tables as in Appendix C9

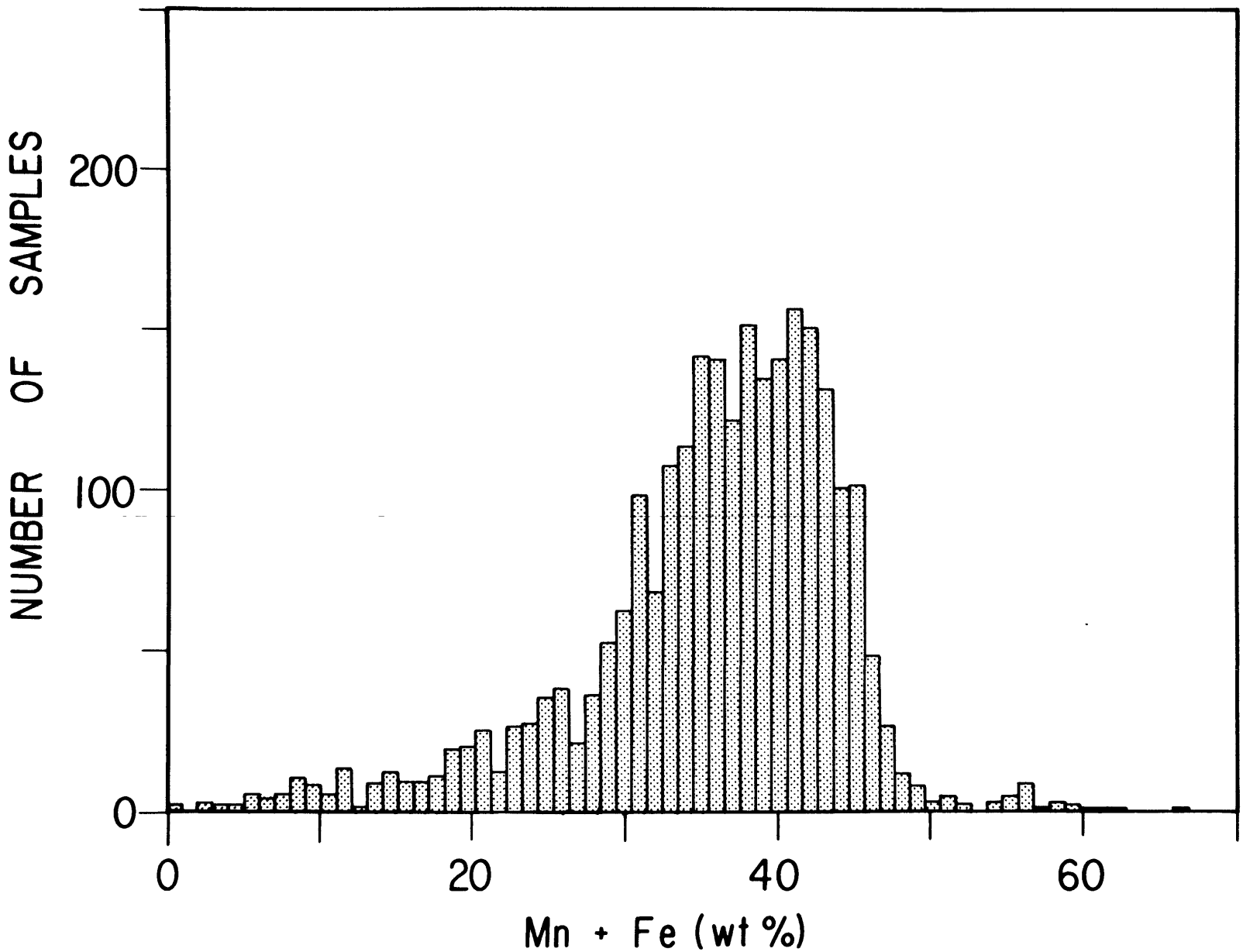
A slightly different normalization factor (51.3) was used in Figs. IX-1c and IX-2c, from a prior report (Manheim and Lane-Bostwick, 1987). Use of the new normalization factor does not change the principal features.

Exclusion data set

This data set removes samples with large amounts of dilutants like silicates and phosphorite, which can yield spurious correlation coefficients. Dilutants also create a spurious low-end tail in frequency plots of elements in the main ferromanganese oxide group (Fe, Mn, Cu, Ni, Co, Zn, etc.) (e.g. Fig. VIII-3).

The special "exclusion" data set is not given in tabular form, but was utilized in descriptive output (Tables IX-1 thru IX-4) and Co histograms (Figs. IX-1B, IX-2B). This set was employed in Manheim (1986) to assess regional means for the world oceans and parts of the Pacific Ocean. The qualifying values are those passing all of the following tests (in percent, on a hygroscopic water water - free basis):

$Mn > 15$ $Fe < 23$ $P < 3$
$Mn/Fe < 5$ $Al < 2.5$
$Si < 7$ $Ca < 6$


NUMBER OF SAMPLES
200
100
0
0
20
40
60
Mn + Fe (wt %)

IX Data Interpetation and Mapping by F.T. Manheim and C.M. Lane

Frequency descriptions and regional means

The various data sets incorporated in the database presented herein offer a large variety of material for display of frequency distributions. These demonstrate both the distribution of chemical values and some of the complicating factors like contamination, mentioned earlier. Figs. IX-1A through IX-1C show histograms for cobalt in the SNDB. The number of class intervals in the histogram was chosen to display maximum coherent detail on modes and submodes. The SNDB data set has complex and irregular features. The new USGS data set (Figure IX-2A) has a smoother lognormal character and suggests a trimodal distribution: a lognormal population with a cobalt mode just under 1.0 percent, a secondary mode at approximately 0.1 percent Co, and a weak scattering of data with a mode less than 0.01 percent. The main mode is attributable to hydrogenetic, high-cobalt crusts (see Chapter II), the secondary mode to phases partly influenced by hydrothermal manganese deposits, and the last mode to a combination of highly substrate-contaminated samples, and hydrothermal phases. Use of the exclusion data set (Fig. IX-2B) goes farthest toward delimiting the hydrogenetic mode, which is the critical population for economic interest. The exclusion data set has a scattering of low-cobalt values, which have not yet been investigated in detail. Data normalized to the sum, Fe+Mn, is less effective in removing the tail of low values (Figs. IX-1c and IX-2c) but retains more samples that would be eliminated in the exclusion set.

If means are calculated using the raw (water-corrected) or normalized data, the central value will be shifted toward lower concentrations because of the low-Co tail. This reflects "dirty samples" (contaminants and extraneous phases, including hydrothermally influenced compositions). Medians are a better measure of central tendency, but are likewise influenced by the tail. The most consistent population measures involve the "exclusion data set" discussed in Chapter VIII. It carries the disadvantage that some analyses are sacrificed. However, it has been chosen as the most consistent basis for regional means. Means for the total Pacific Ocean, Marshall Islands area, Atlantic and Indian oceans are presented in Tables IX-1 to IX-4.

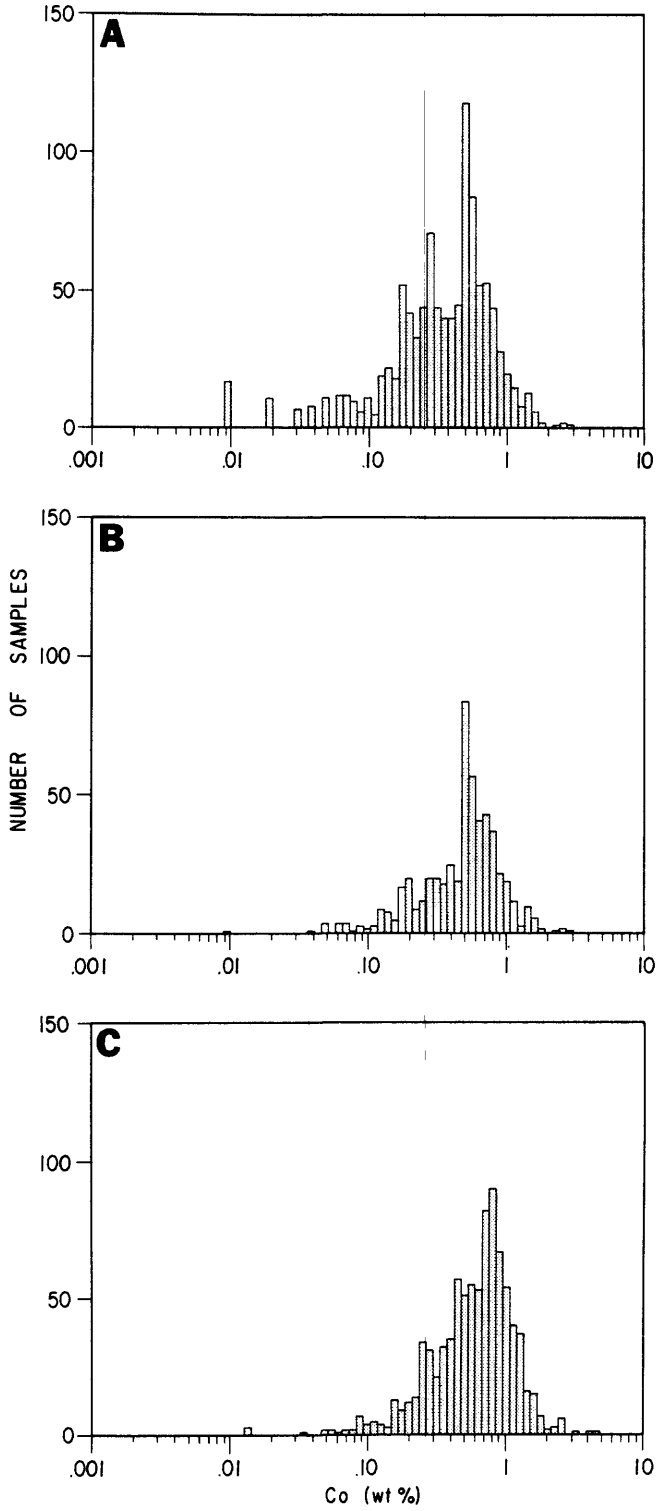


Figure IX-1 Histogram of Co values for USGS data set: a) raw data b) exclusion data set, and c) normalized data set.

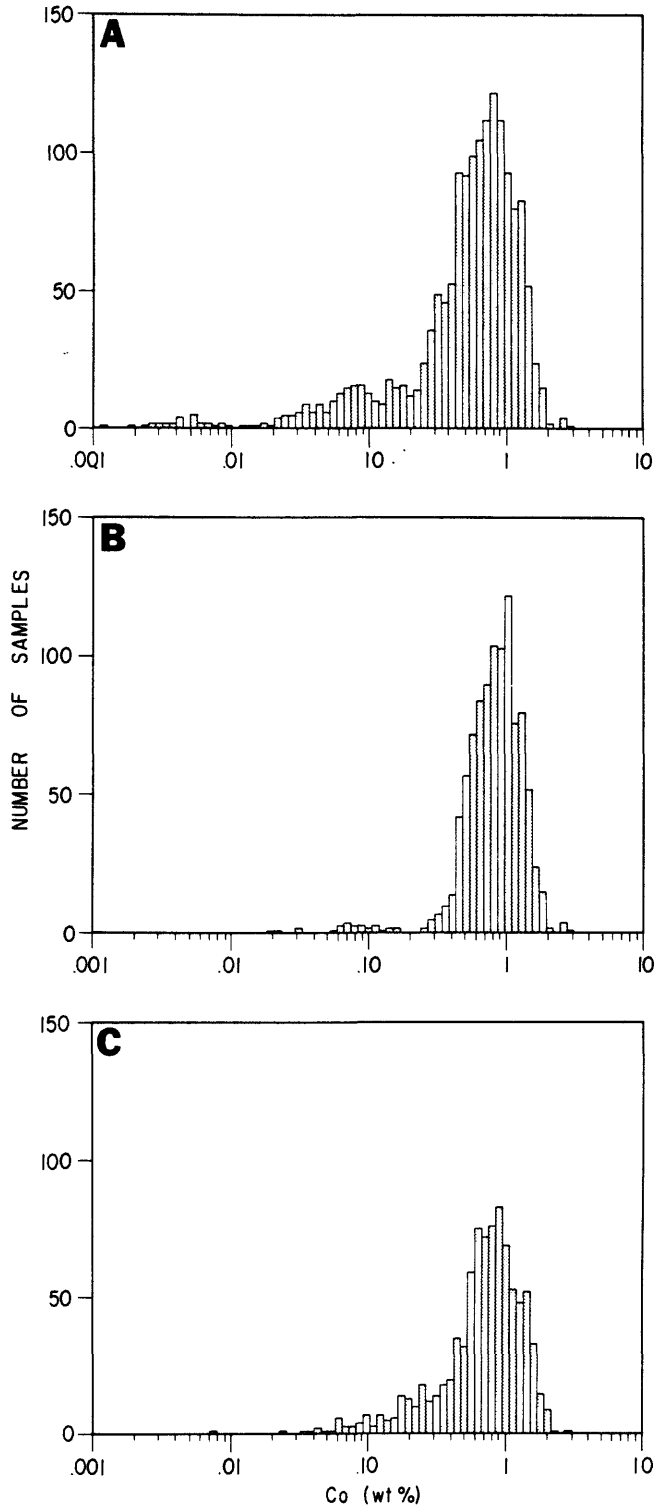


Figure IX-2 Histogram of Co values for SNDB data set: a) raw data b) exclusion data set, and c) normalized data set.

Table IX-1. Descriptive statistics for the Total Pacific Ocean (exclusion data set: see Chapter VIII discussion). Values for minimum, maximum, mean and SD in percent moisture-free material, except Pt(ppm). Note, however, that the Pacific mean is biased by a large data population in the central, cobalt-rich seamount areas.

Variable	Number samples	Minimum	Maximum	Mean	SD	CV
Lat	834	-43.000	55.127	19.0769	10.3106	54.0
Lon	834	-179.745	179.288	-102.8786	130.4872	-126.8
Depth	819	598.	6890.	2011.80	721.	35.9
Mn	773	15.100	38.79	25.02	4.14	16.6
Fe	802	5.980	22.95	16.89	2.93	17.4
Ni	773	0.120	1.536	0.46	0.17	36.6
Co	805	0.029	3.02	0.87	0.37	42.5
Cu	603	0.013	0.55	0.08	0.05	69.4
mg	632	0.710	2.39	1.16	0.20	17.6
Ca	655	1.410	5.97	2.83	0.78	27.8
Al	746	0.064	2.50	0.95	0.51	54.1
Ti	675	0.102	2.46	1.12	0.28	25.4
K	443	0.064	1.01	0.54	0.10	20.1
P	653	0.026	1.88	0.51	0.25	49.3
Si	542	0.610	6.99	3.42	1.64	48.1
Na	293	0.207	3.32	1.74	0.48	27.8
CO_2	63	0.086	2.21	0.54	0.21	40.0
Ba	401	0.0842	0.4300	0.1850	0.0598	32.3
Mo	399	0.0171	0.1493	0.0569	0.0207	36.3
Pb	476	0.0154	0.3700	0.1921	0.0559	29.1
Sr	444	0.0827	0.2453	0.1671	0.0226	13.5
V	399	0.0249	0.1600	0.0695	0.0129	18.6
Zn	460	0.0100	0.6712	0.0734	0.0393	53.6
Y	264	0.0083	0.0501	0.0188	0.0044	23.6
Ce	264	0.0061	0.2849	0.1232	0.0369	29.9
As	265	0.0140	0.3430	0.0292	0.0216	74.1
Cd	271	<0.0007	0.0014	0.0004	0.0002	62.4
H_2O^-	563	4.00	37.93	16.45	6.67	40.6
H_2O^+	281	3.78	17.59	8.73	1.67	19.2
Pt(ppm)	8	0.1639	1.2935	0.4840	0.3934	81.3

*Decimals are a function of software output and do not reflect level of accuracy.

Table IX-2. Descriptive statistics for the Marshall Islands area. Values for minimum, maximum, mean and SD in percent moisture-free material, except Pt(ppm).

Variable	Number samples	Minimum	Maximum	Mean	SD	CV
Lat	100	6.667	33.666	16.961	7.442	43.9
Lon	100	138.968	174.325	162.523	10.709	6.6
Depth	100	905.	3835.	1944.	680.	35.0
Mn	100	15.87	32.51	25.95	3.48	13.4
Fe	100	5.98	21.02	16.31	2.68	16.4
Ni	100	0.26	1.05	0.52	0.14	28.4
Co	100	0.07	1.96	0.85	0.33	39.1
Cu	86	0.022	0.264	0.08	0.047	56.3
mg	82	0.84	1.72	1.16	0.16	14.5
Ca	82	1.72	5.70	2.88	0.62	21.6
Al	100	0.12	2.37	0.80	0.48	59.8
Ti	80	0.56	1.57	1.09	0.21	19.2
K	80	0.32	1.00	0.54	0.11	22.1
P	80	0.27	1.74	0.51	0.24	47.1
Si	98	0.61	6.91	3.16	1.54	48.8
Na	66	1.19	2.49	1.90	0.21	11.4
CO_2	66	0.44	1.20	0.62	0.16	26.2
Ba	68	0.1091	0.3609	0.1705	0.0504	29.5
Mo	66	0.0195	0.1117	0.0541	0.0159	29.4
Pb	84	0.1340	0.3000	0.1924	0.0395	20.5
Sr	68	0.1152	0.2453	0.1622	0.0174	10.7
V	66	0.0442	0.0842	0.0679	0.0082	12.1
Zn	86	0.0400	0.6712	0.0813	0.0661	81.4
Y	66	0.0099	0.0501	0.0194	0.0058	29.9
Ce	66	0.0747	0.2143	0.1156	0.0286	24.8
As	66	0.0140	0.0383	0.0282	0.0044	15.7
Cd	66	0.0002	0.0006	0.0004	0.0001	22.5
H_2O^-	80	11.16	31.40	23.70	4.37	18.5
H_2O^+	83	3.78	11.95	8.10	1.54	19.0
Pt(ppm)	8	0.1639	1.2935	0.4840	0.3934	81.3

Table IX-3. Descriptive statistics for the Atlantic Ocean. Values for minimum, maximum, mean and SD in percent moisture-free material, except Pt(ppm).

Variable	Number samples	Minimum	Maximum	Mean	SD	CV
Lat	89	-59.033	45.800	4.556	36.094	792.2
Lon	89	-86.548	22.383	-31.637	28.624	-90.5
Depth	89	649.	5842.	2594.	1250.	48.2
Mn	82	15.02	42.50	20.27	4.98	24.6
Fe	83	7.51	22.90	18.63	3.37	18.1
Ni	83	0.02	1.56	0.39	0.24	61.2
Co	83	0.01	3.00	0.54	0.40	73.2
Cu	83	.010	0.800	0.107	0.113	105.3
mg	57	0.93	4.17	1.64	0.61	37.2
Ca	61	0.16	5.30	2.54	0.96	37.9
Al	16	0.40	2.31	1.32	0.55	41.8
Ti	15	0.02	1.37	0.70	0.38	54.9
K	58	0.18	1.69	0.45	0.28	62.7
P	12	0.16	1.80	0.62	0.48	77.4
Si	19	0.50	6.96	3.22	1.84	57.3
Na	59	0.21	3.96	1.66	0.70	42.2
Ba	13	0.0703	0.7100	0.2071	0.17	83.6
Mo	17	0.0160	0.0680	0.0385	0.0132	34.2
Pb	63	0.0106	0.3500	0.1647	0.0803	48.8
Sr	15	0.0615	0.2043	0.1394	0.0390	28.0
V	13	0.0108	0.1500	0.0934	0.0367	39.3
Zn	62	0.0040	0.2730	0.0809	0.0472	58.4
Y	13	0.0057	0.0250	0.0170	0.0066	39.0
Ce	9	0.0127	0.2519	0.1687	0.0820	48.6
As	13	0.0095	0.0602	0.0362	0.0148	40.9
Cd	9	0.0003	0.0014	0.0005	0.0004	75.1
H_2O^-	13	5.30	21.70	16.32	5.7502	35.2

Table IX-4. Descriptive statistics for the Indian Ocean. Values for minimum, maximum, mean and SD in percent moisture-free matieral, except Pt(ppm).

Variable	Number samples	Minimum	Maximum	Mean	SD	CV
Lat	129	-52.083	12.728	-4.286	12.571	-293.3
Lon	129	25.050	118.675	64.478	17.058	26.5
Depth	129	1170.	5579.	3402.	1044.	30.7
Mn	128	15.00	38.30	18.15	3.17	17.5
Fe	128	7.20	23.00	16.68	3.44	20.6
Ni	128	0.08	1.17	0.39	0.20	51.4
Co	129	0.06	1.22	0.37	0.23	61.5
Cu	129	0.020	0.830	0.129	0.12	95.0
mg	59	0.94	2.04	1.22	0.30	24.4
Ca	80	0.99	5.98	2.03	0.87	43.2
Al	72	0.37	2.35	1.32	0.50	38.1
Ti	84	0.27	1.76	0.70	0.26	37.3
K	3	0.51	0.62	0.56	0.05	9.5
P	7	0.23	1.65	0.59	0.53	90.1
Si	23	1.60	6.90	5.35	1.27	23.8
Na	3	1.60	2.31	1.92	0.36	18.8
Ba	10	0.1102	0.3990	0.1652	0.0847	51.3
Mo	32	0.0280	0.0717	0.0440	0.0110	25.0
Pb	107	0.0200	1.3700	0.1494	0.1741	116.5
Sr	7	0.0810	0.1675	0.1271	0.0278	21.9
V	27	0.0430	0.1166	0.0767	0.0168	21.9
Zn	102	0.0110	0.1100	0.0564	0.0171	30.4
Y	7	0.0112	0.0510	0.0207	0.0137	66.0
Ce	3	0.1284	0.2036	0.1769	0.0421	23.8
As	6	0.0236	0.0359	0.0283	0.0047	16.8
Cd	6	0.0003	0.0011	0.0006	0.0002	29.6
H_2O^-	6	19.50	32.30	25.70	5.32	20.7

Elemental concentrations vs. water depth

The data in all depth figures represent area 2 in Fig. VIII-1 (Mid Pacific area) without duplicate analyses. The inverse relationship between cobalt and water depth of crust occurrence is demonstrated in the Mid-Pacific data set, Figure IX-3. This diagram shows much scatter and much more diffuse trends than studies limited to smaller geographic areas (e.g. Halbach and others, 1983; Halbach and Manheim, 1984). Mn and Ni likewise show highest values in the shallowest occurrences. A plot of depth vs. Co/Mn (Fig. IX-4) reveals that removing the effect of the Mn relationship still leaves a marginal inverse Co-depth function. In contrast, Cu is well known to have direct correlation with depth (Fig. IX-5). Consequently, the ratio of Co to Cu (Co/Cu) would be expected to be a sensitive discriminator for water depth of origin for crusts. As we see in Fig. IX-3, a trend is found, but much scatter remains. Some of this scatter can be explained by uncertainty in establishing the depth of crust occurence, because sample sites comprised dredge hauls that covered significant vertical ranges; other factors contributing scatter include crusts on talus that has slumped to a present position deeper than where they formed, and changing depth with time for some seamounts.

Fe is illustrated in Fig. IX-5, which shows a rapid increase in Fe concentration from 1000 to 2000 m, followed by a much more gentle increase concentration with depth. Halbach and Puteanus(1984) suggest that the increase in iron concentrations with depth may be associated with debris from foraminifera that decompose in and beneath the oxygen-minimum zone in the North-Central Pacific equatorial area. The aluminosilicate group of elements tend to increase in concentration with depth in a linear fashion.

Interelement plots

The varied nature of interelement relationships calls for many types of plots. Fig. IX-7 displays interelement plots using the full USGS data set, whereas remaining plots display the smaller Mid Pacific set utilized for element/depth plots discussed earlier. Several of the sample populations included in the USGS data set can be seen in figure IX-7 (Mn/Fe vs. Mn + Fe). The main hydrogenetic crust population is represented by the dense clustering from 30 to 50 percent Mn+Fe, and from .5 to 5 Mn/Fe. Samples with greater Mn/Fe are often hydrothermally influenced, whereas samples with Mn+Fe < 30 percent are appreciably admixed with substrate material. Substrates having >8% iron content, like basalt and altered basalt tend toward lower Mn/Fe values.

A large increase in the number of analyses for non-oxide elements is provided by the new data. This is illustrated by comparing Figs. IX-8 (new data) and IX-8b (SNDB) (Al vs. Si). At low Si values in the main hydrogenetic crust a Si/Al ratio of about 5.0 is found. A population of samples with very low Si/Al ratios implies mineral phases richer in Al than Si and include recently discovered lithiophorite-like manganese minerals (Manheim and others, 1988; Olson and others, 1988).

A plot of Si against Mn+Fe (Fig. IX-8c) shows the expected inverse relationship for samples in the main crust mode. A smaller low-Si population is associated with phosphatic substrate as displayed when we plot detrital Al against Mn (Fig. IX-8d). The portion of Al that forms part of the Mn mineral structure,

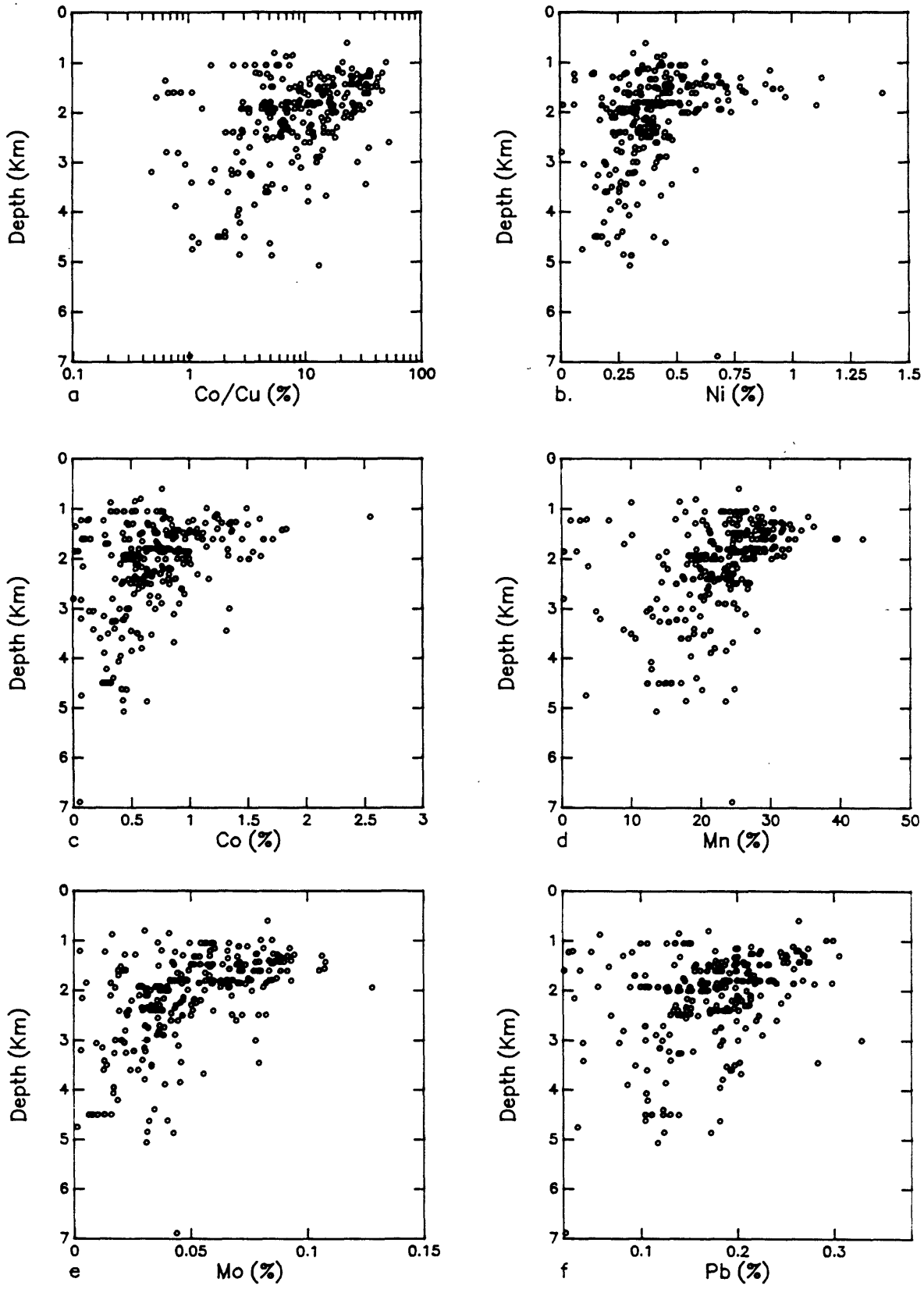


Figure IX-3 Plots of water depth vs. Co/Cu, Ni, Co, Mn, Mo, Pb for Mid-PacificOcean.

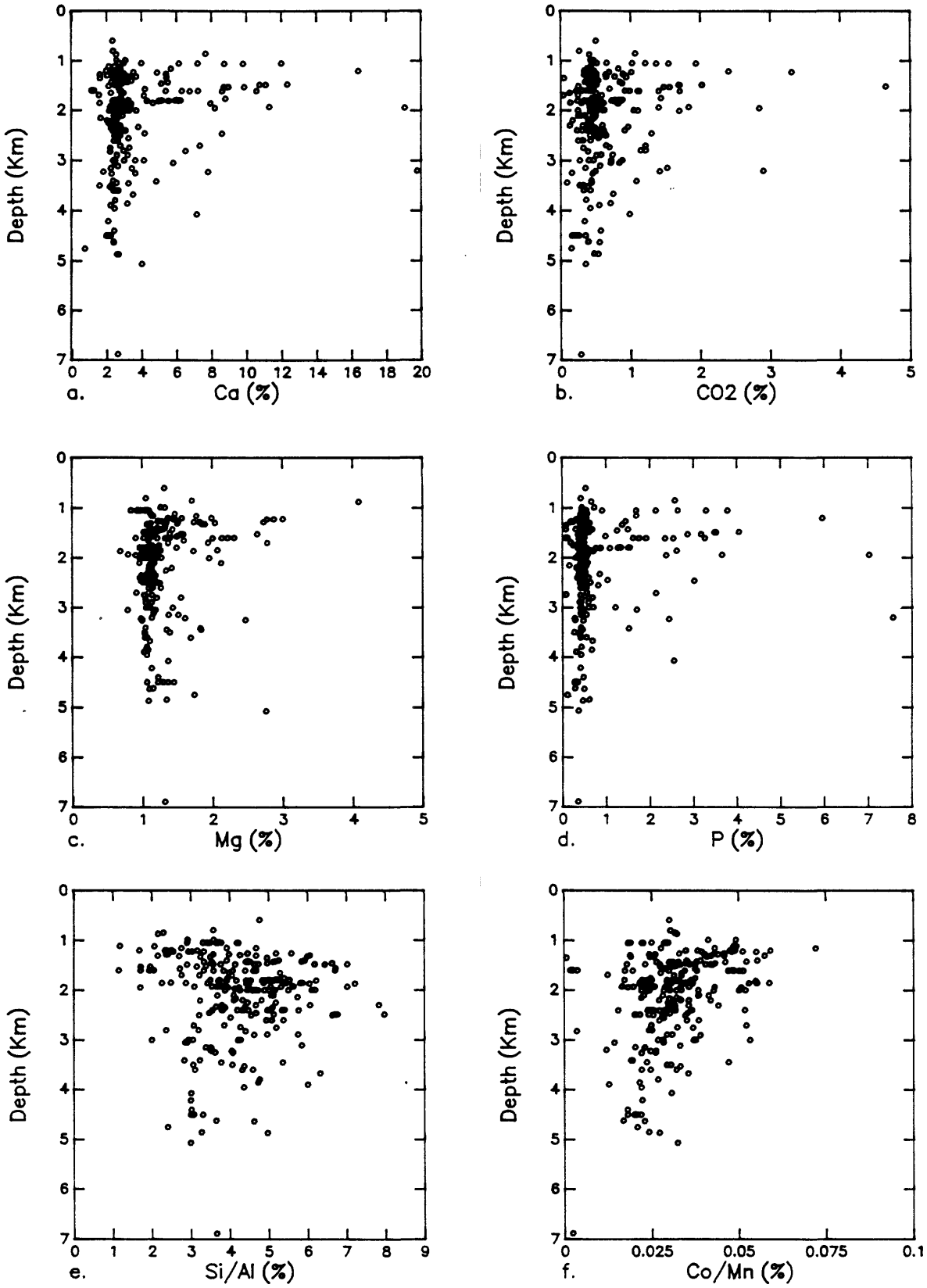


Figure IX-4 Plots of water depth vs. Ca, CO_2, Mg, P, Si/Al, Co/Mn for Mid-PacificOcean.

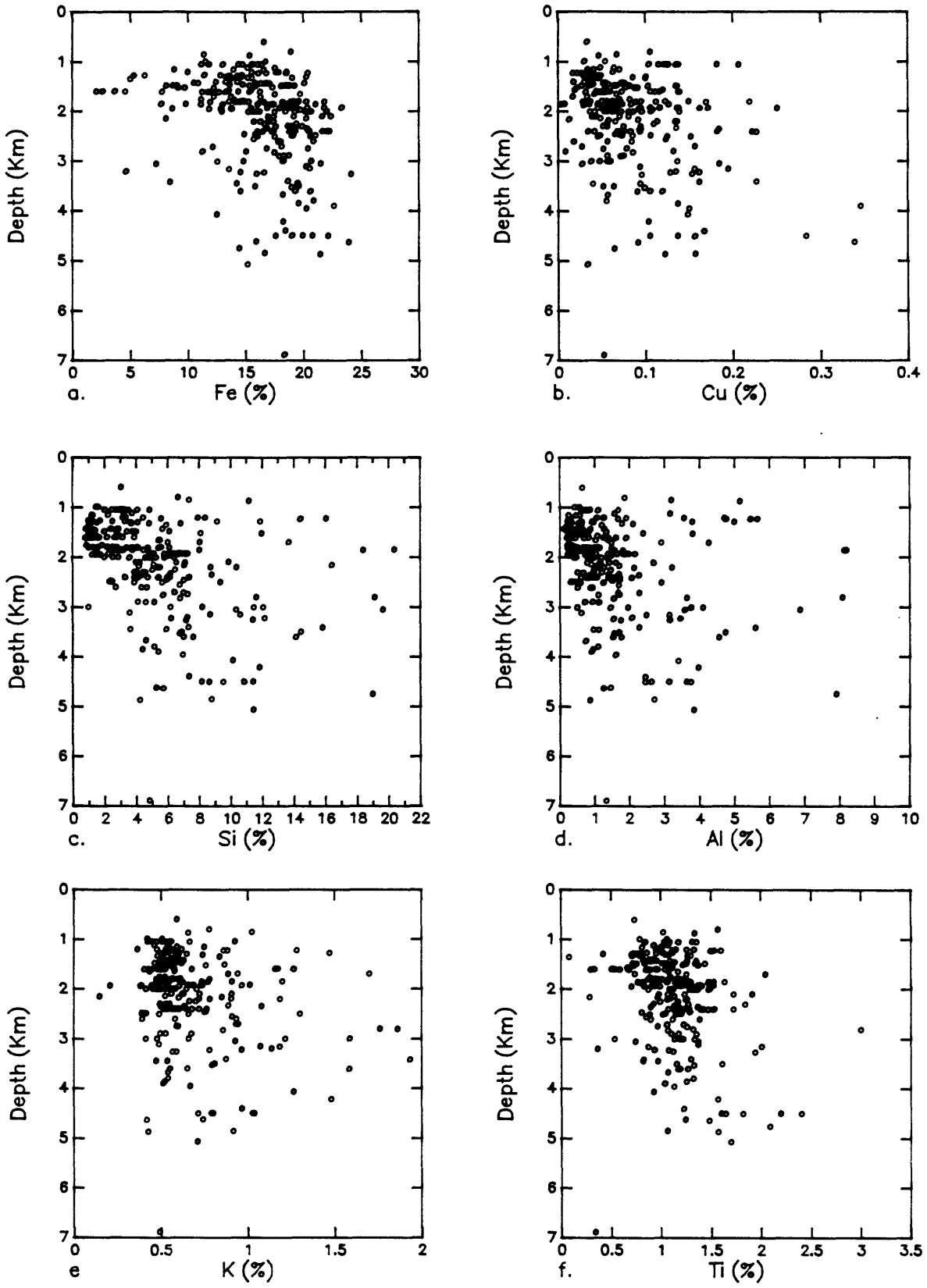


Figure IX-5 Plots of water depth vs. Fe, Cu, Si, Al, K, Ti for Mid-PacificOcean.

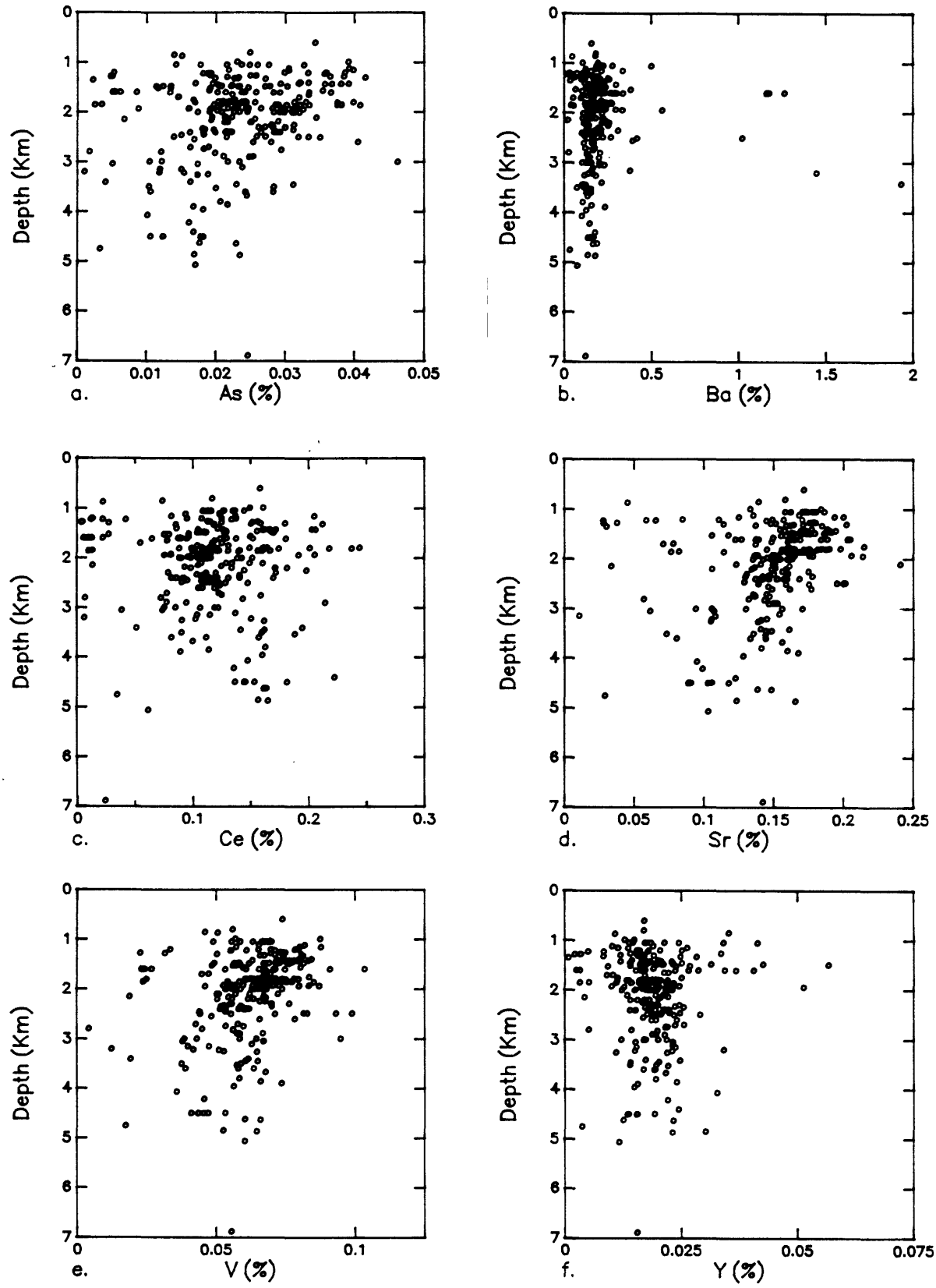


Figure IX-6 Plots of water depth vs. As, Ba, Ce, Sr, V, Y for Mid-PacificOcean.

delineated as Al*, is given by Al*=0.016xMn on the basis of additional data. The plot of Al corrected for this fraction intersects 0.0 percent Al at about 32 percent Mn (Fig. IX-8d). An attempt to relate the corrected Al/H_2O^+ ratio and Si (Fig. IX-8f) gives a strong divergence for increasingly impure crusts (see Figs. IX-7 and IX-8f). The nearly vertical trend, best shown in the larger population (Fig. IX-7) is related to unweathered basalt admixtures at about 46 percent SiO_2, whereas the upcurving trend to the highest Si values is thought to represent altered basaltic materials.

Various elemental plots against Mn are depicted in Figs. IX-9 and IX-10. The larger data set for Co and Mn data is also shown in the earlier IX-7 plot. For all elements except Fe and Cu a positive correlation is obtained. However, outliers are often found at Mn values of about 40 percent or higher, which usually represent hydrothermal oxides. For Pb, Co, Ce, As, and Mo the outliers tend to be on the low side, whereas for Cd, Zn and Ba the outliers tend toward higher values. This is consistent with the finding of these elements in polymetallic sulfides deposits. Ni concentrations for high-Mn outliers are well below the envelope of more normal Mn values, but are subsequentially higher than in the case of Co.

The behavior of elements such asmg and Ti in crusts is still poorly understood (Fig. IX-11), much of the scatter being due to admixture in substrate. Note the very small spread ofmg values between 1.0 and 1.5 percent for the main envelope of purer crust data, in contrast to much wider dispersion in contaminated samples (IX-11e).

In Fig. IX-12 Co and Ni show linear correlation within the main body of purer crusts, whereas an arcuate envelope for the Fe and Si plot (Fig. IX-12d). The large scatter is due to dilution with a variety of phases including basalt and smectite formed from weathering of basalt. As expected, redox-active Ce, which is precipitated with the Mn element group, is poorly correlated with Y, whose behavior is generally linked with the rare earth element group (Fig. IX-12c). A distinctive envelope of Sr values between .1 and .2 percent is obtained for the pure crusts (Fig. IX-12e).

Histograms

Figs. IX-13 through IX-16 depict normal histograms for 20 constituents in the USGS data set, whereas Figs. IX-17 through IX-19 show paired normal and lognormal histograms for nin additional constituents. The distribution may be grouped roughly as follows:

Normal	Broad, irregular	Lognormal
Fe, Ti	Ce, Mo	Al, P
Na, H_2O^-	Pb, Y	Si, Cu
(H_2O^+), Zn*		Mn/Fe, (Ca)
Cd*, Ba*		Ni**, Mn**

where parenthesis refers to slightly skewed distributions, * refers to small tail toward higher values, attributed to hydrothermal samples, and ** refers to small tail toward lower values, probably linked to hydrothermal samples, especially those with higher iron content in the case of Mn. Co remains skewed toward lower

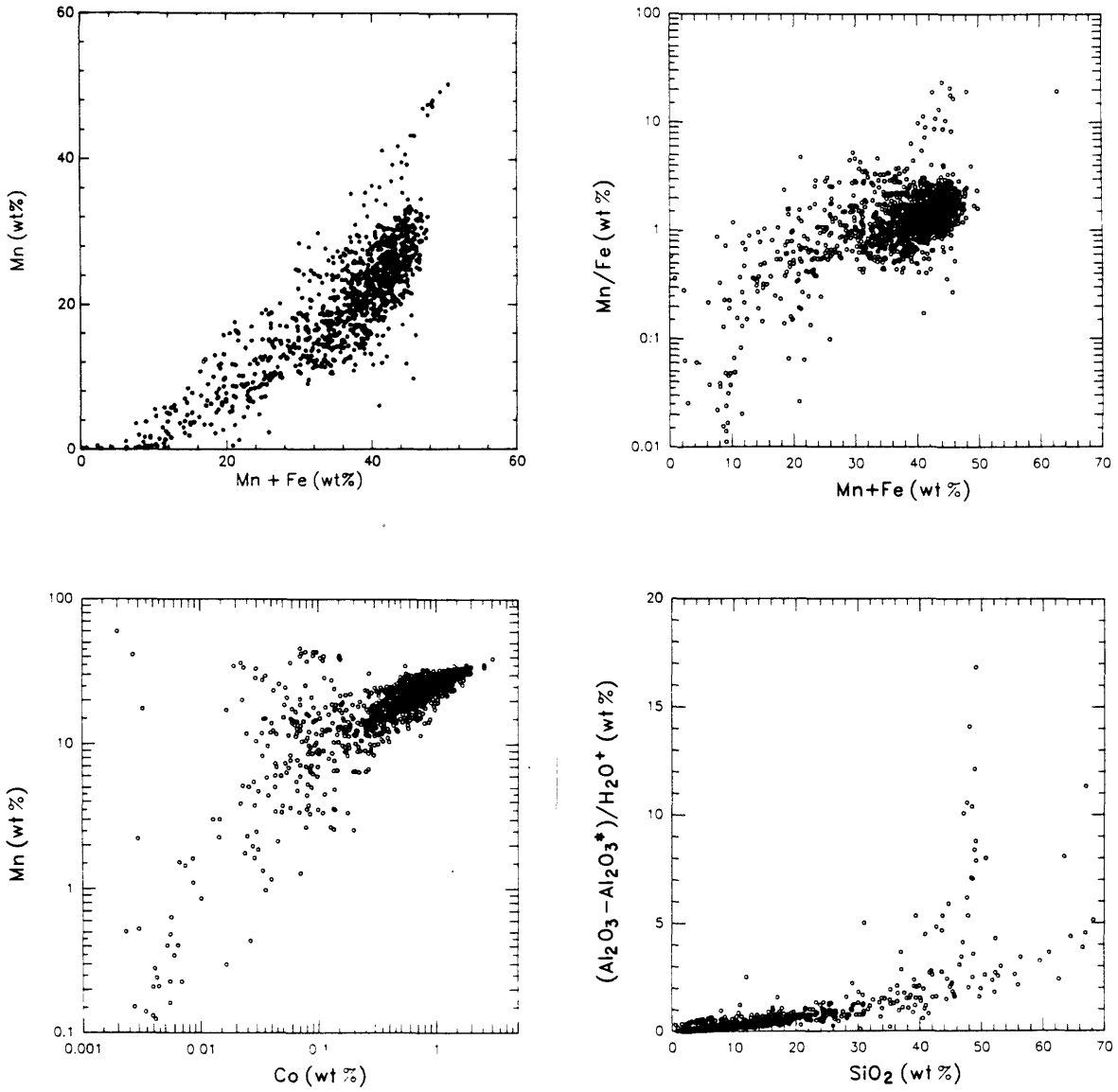


Figure IX-7 Plots of Mn vs. , Mn + Fe, Mn/Fe vs. Mn +Fe, Mn vs. Co , (Al_2O_3 - Al_2O_3*)/H_2O+ vs. SiO_2 for complete USGS data set.

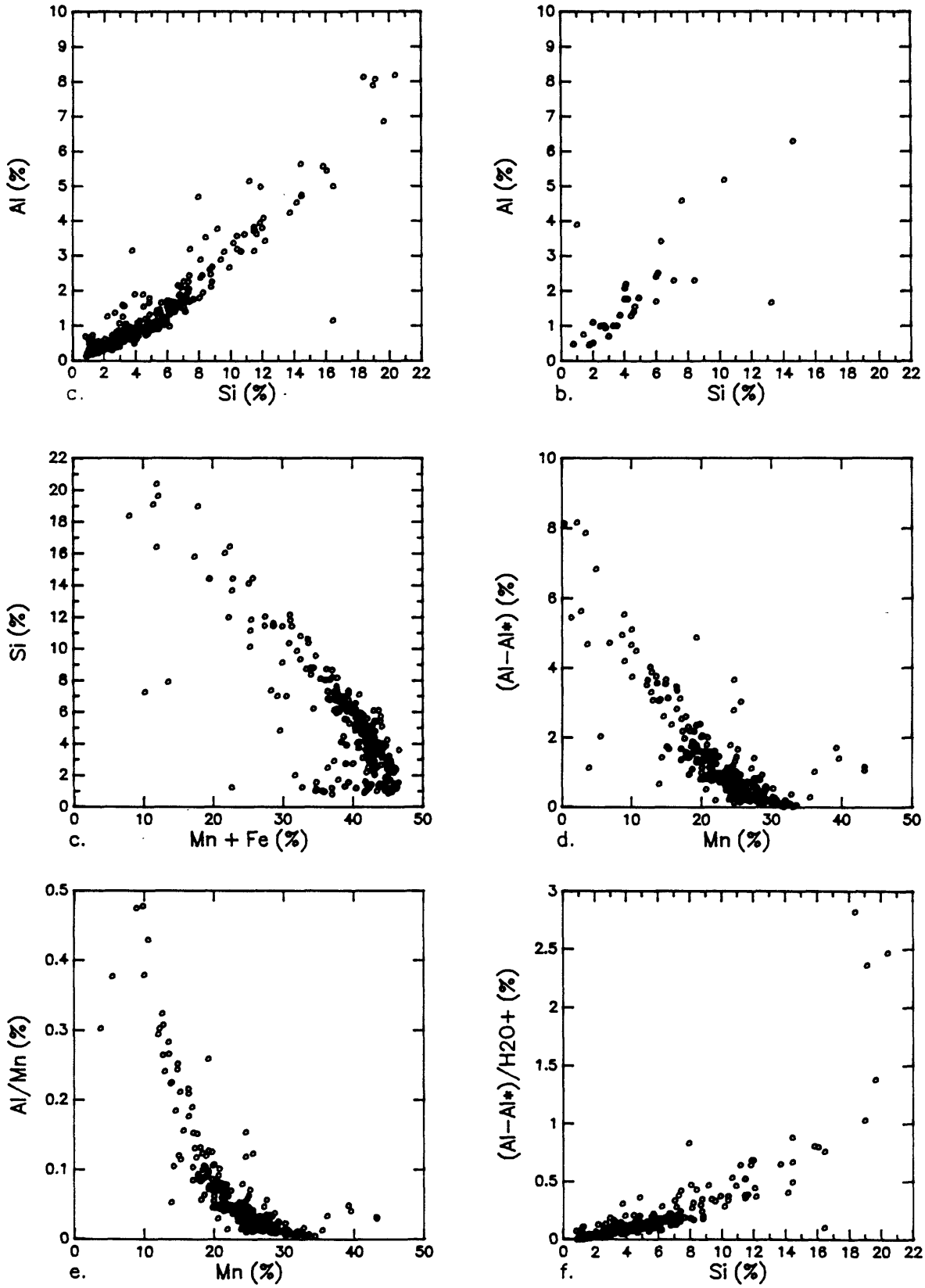


Figure IX-8 Plot of Al vs. Si (USGS), Al vs. Si (SNDB), Si vs. Mn/Fe, (Al-Al*) vs. Mn, Al/Mn vs. Mn, (Al-Al*)/H_2O+ vs. Si.

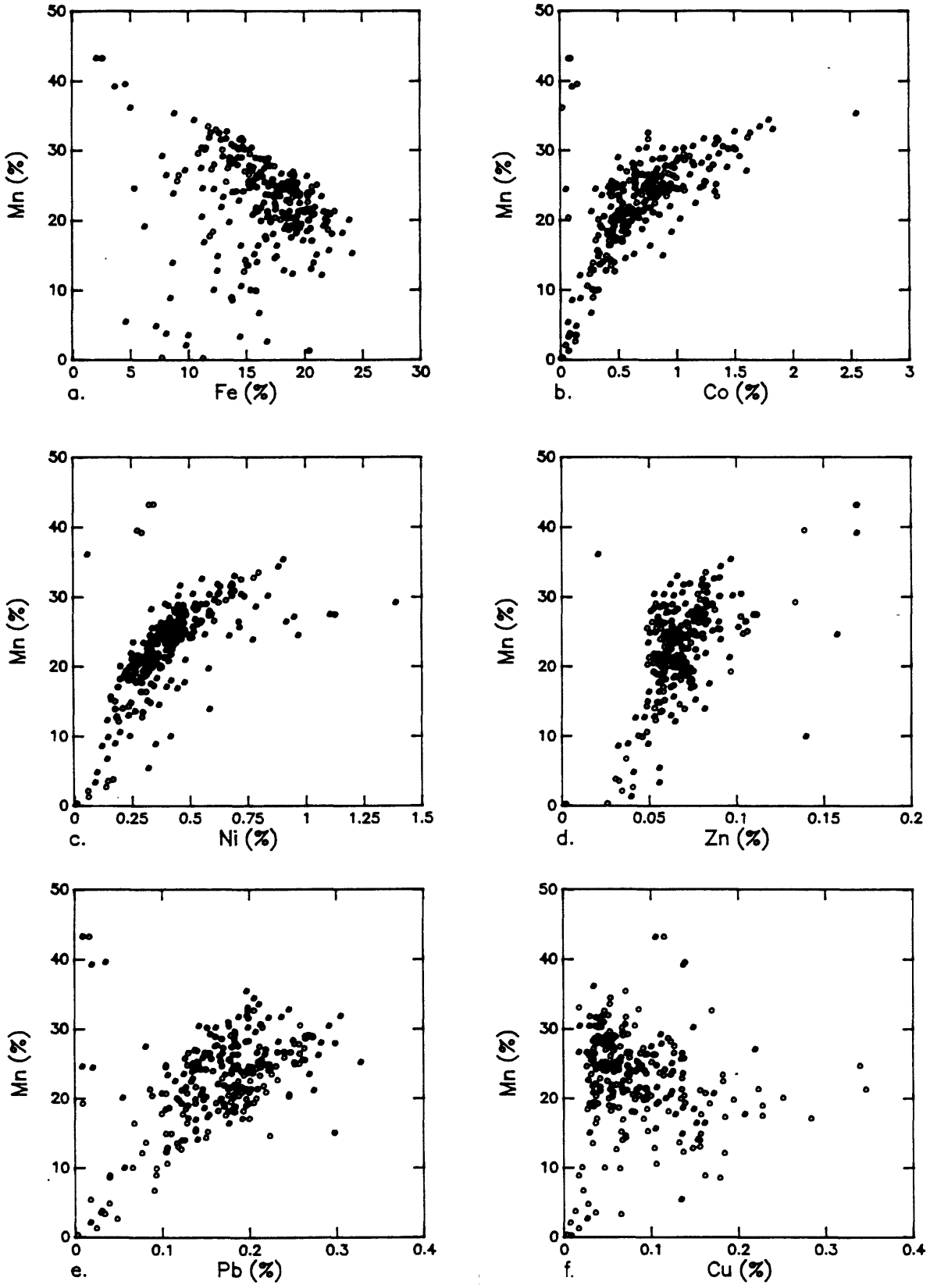
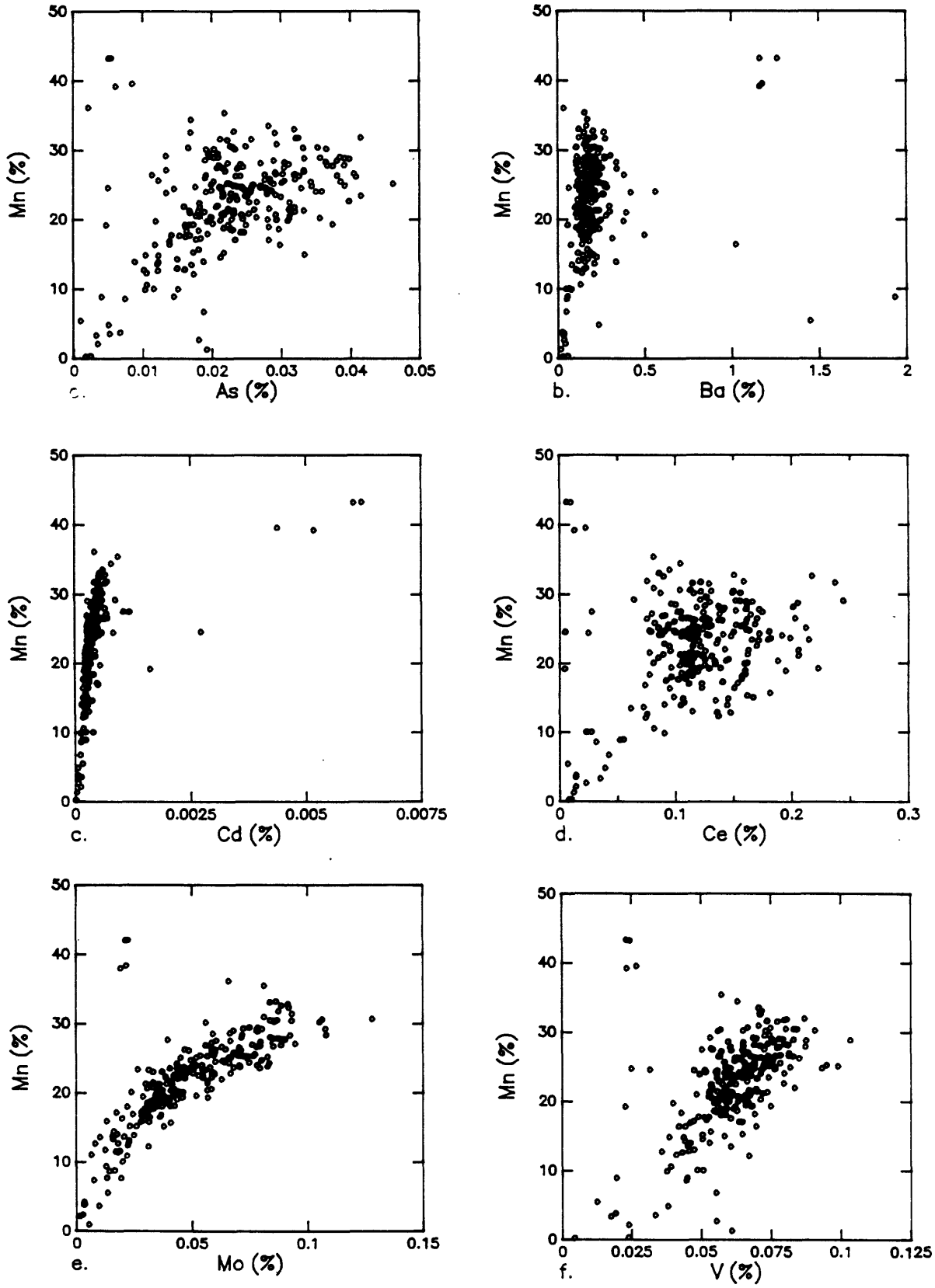


Figure IX-9 Plot of Mn vs. Fe, Co, Ni, Zn, Pb, Cu for Mid-Pacific Ocean.



FigureIX-10 Plot of Mn vs. As, Ba, Cd, Ce, Mo, V, for Mid-Pacific Ocean.

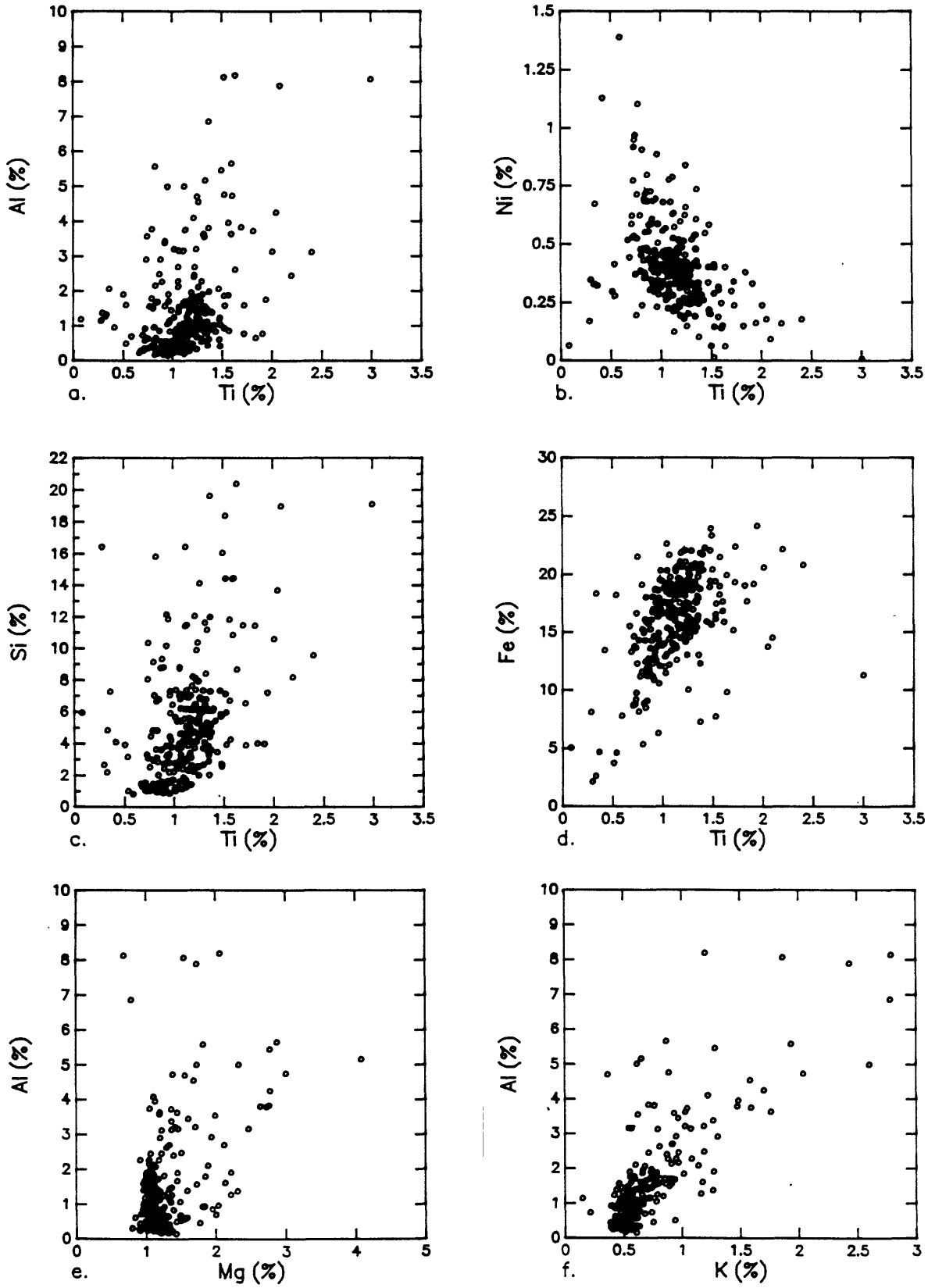


Figure IX-11 Plot Al, Ni, Si, Fe vs. Ti, Al vs. Mg, Al vs. K for Mid-Pacific Ocean.

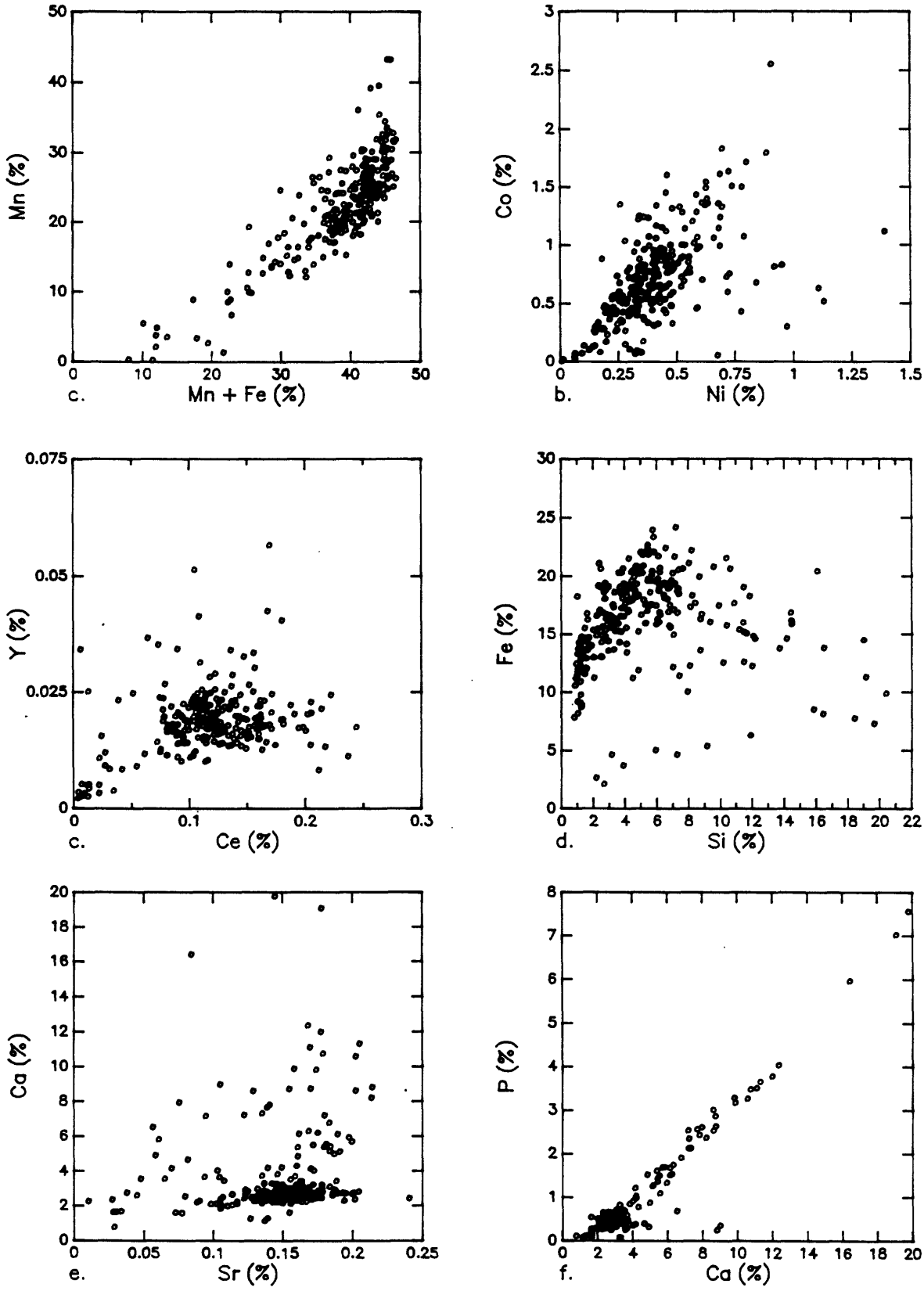


Figure IX-12 Plot of Mn vs. Mn +Fe, Co vs. Ni, Y vs. Ce, Fe vs. Si, Ca vs. Sr, P vs. Ca for Mid-Pacific Ocean.

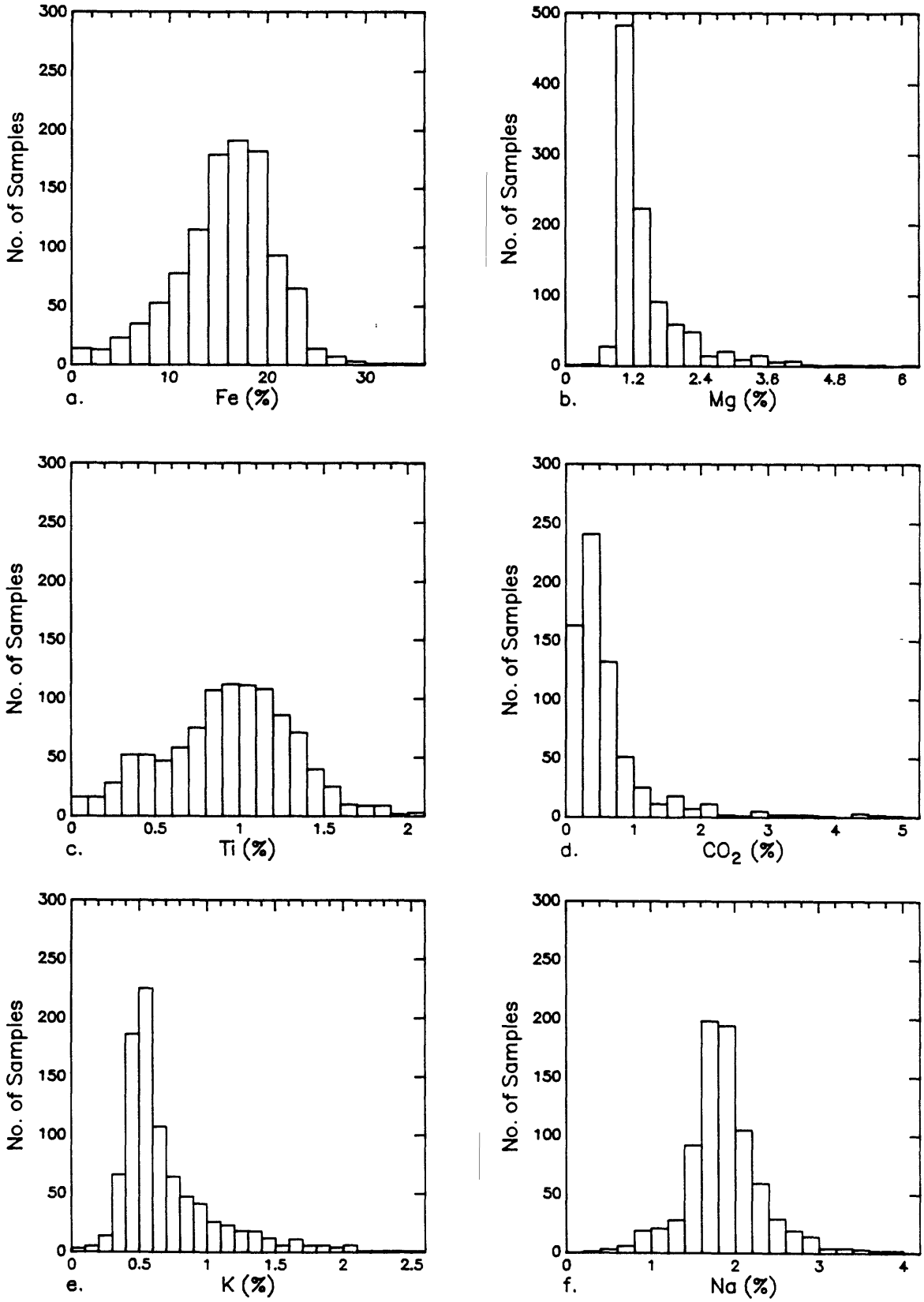


Figure IX-13 Histograms of Fe, Mg, Ti, CO_2, K, Na.

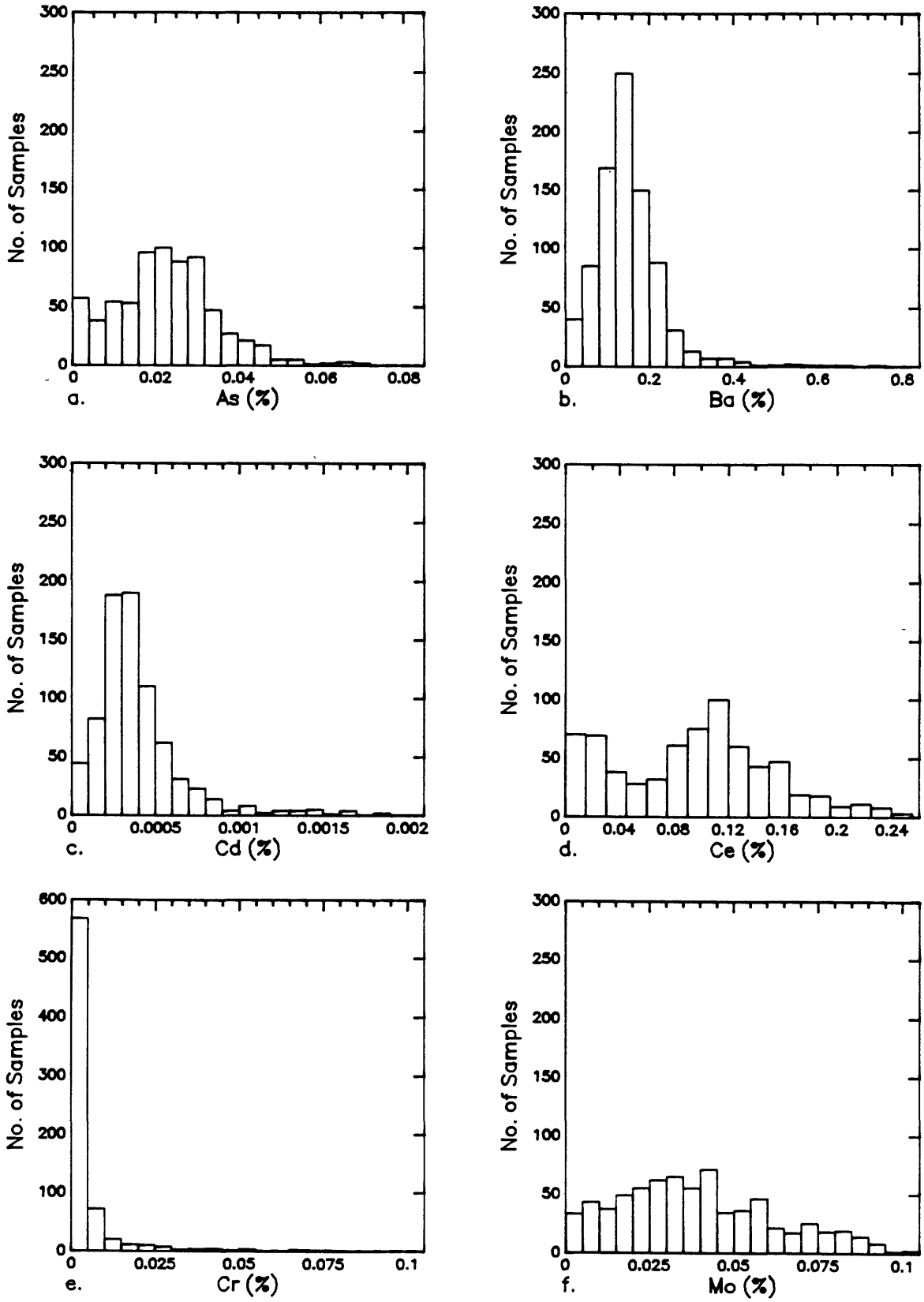


Figure IX-14 Histograms of As, Ba, Cd, Ce, Cr, Mo.

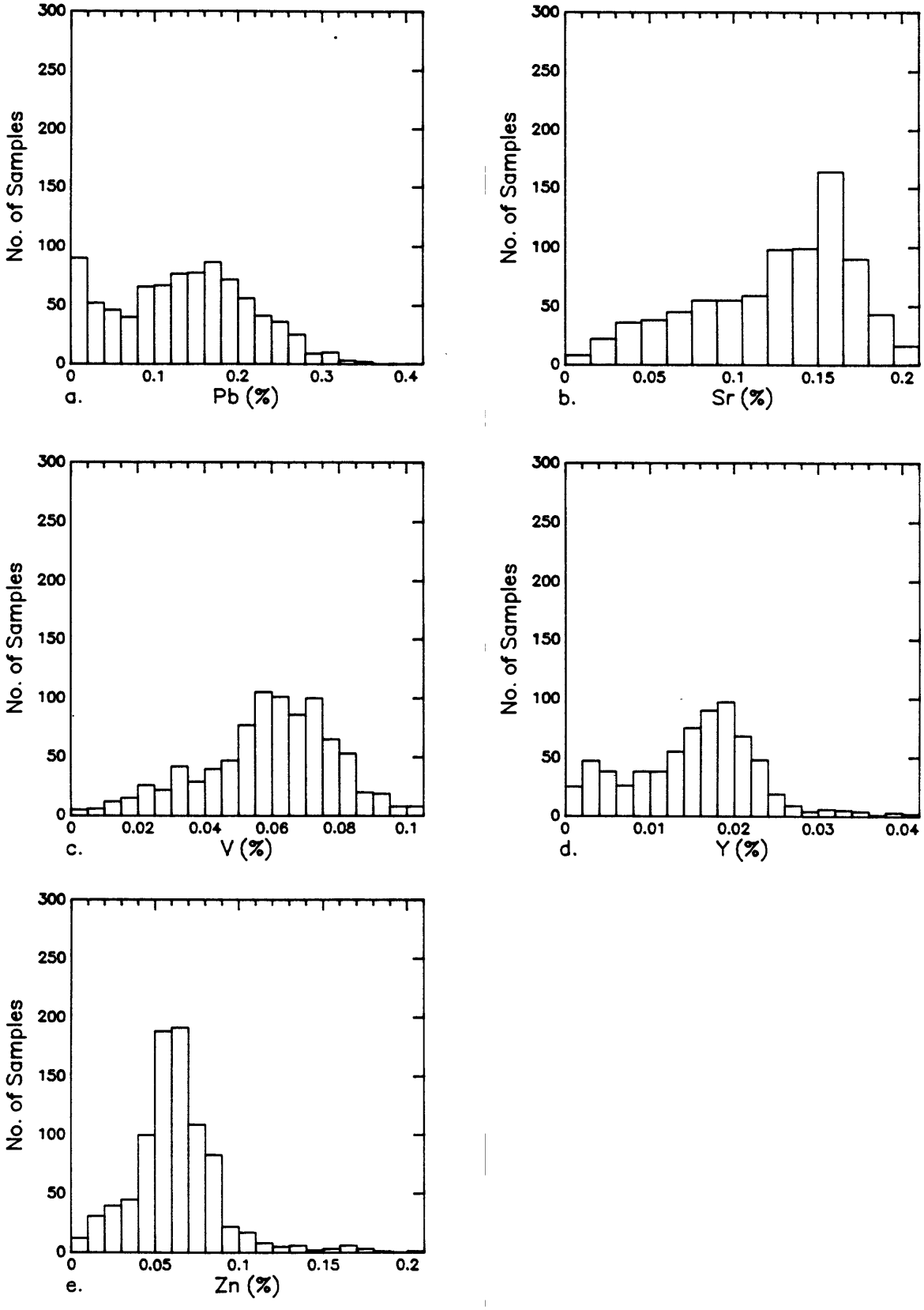


Figure IX-15 Histograms of Pb, Sr, V, Y, Zn.

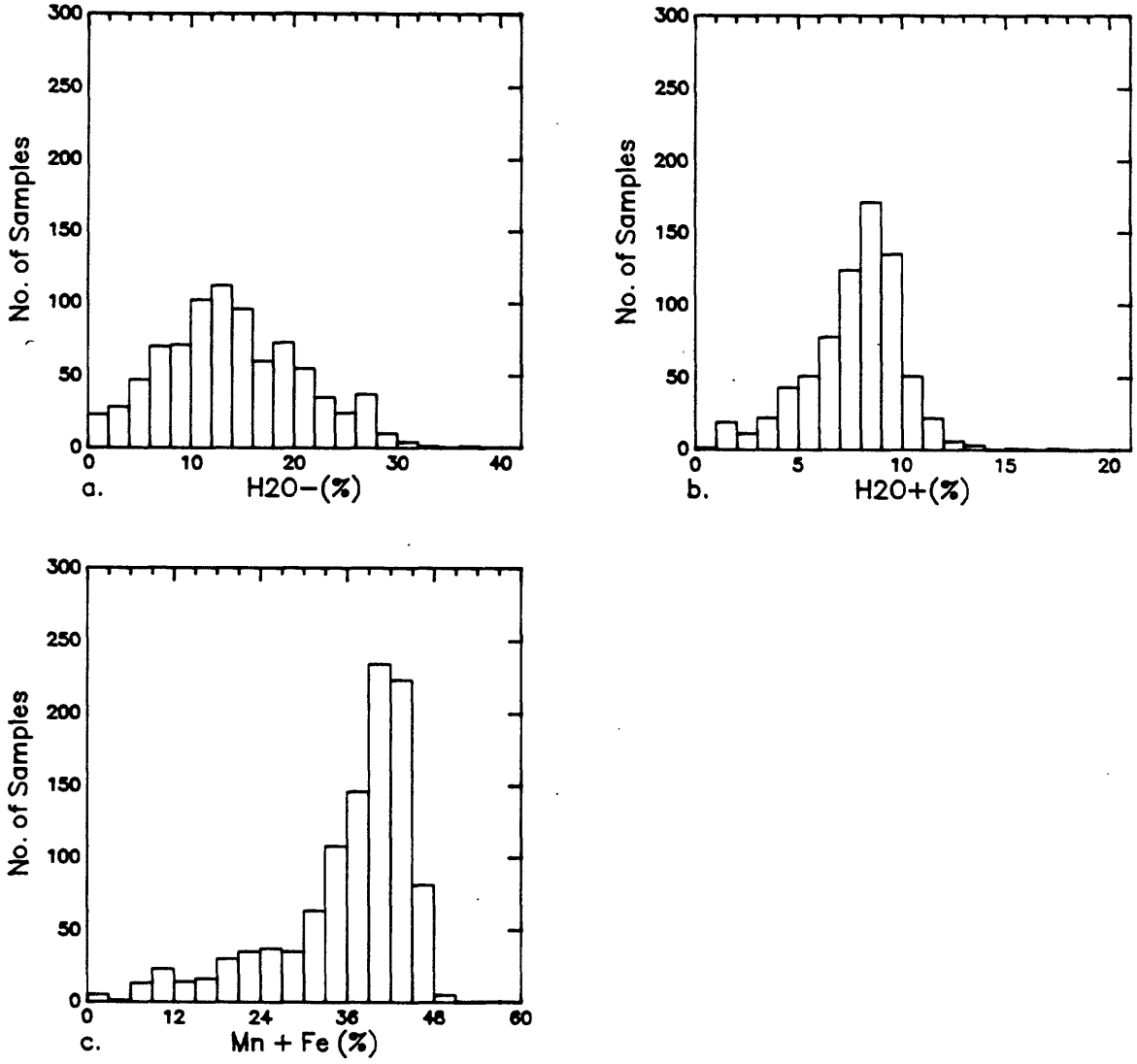


Figure IX-16 Histograms of H_2O^-, H_2O^+, Mn + Fe.

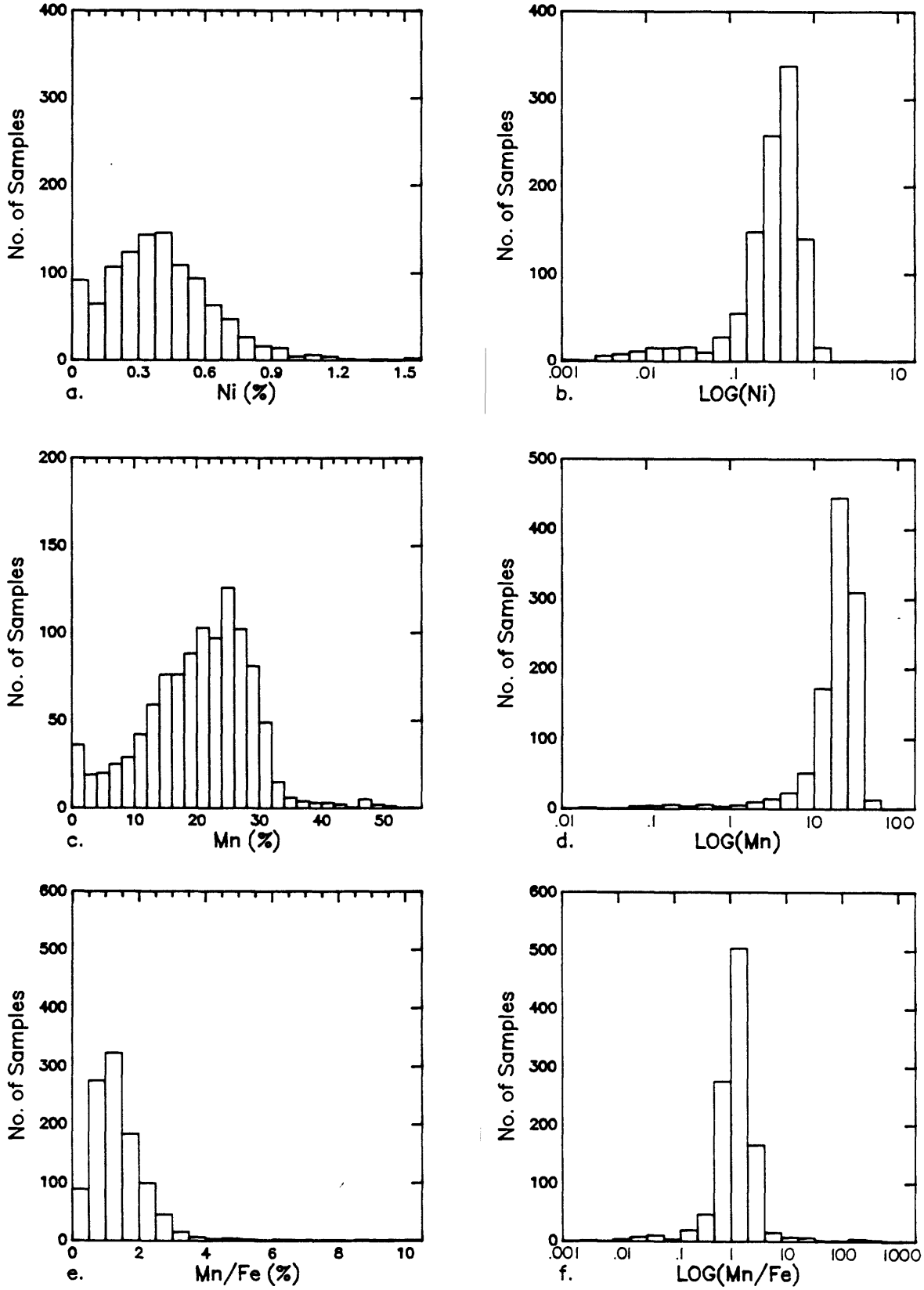


Figure IX-17 Histograms of Ni, log (Ni), Mn, log (Mn), Mn/ Fe, log (Mn/Fe).

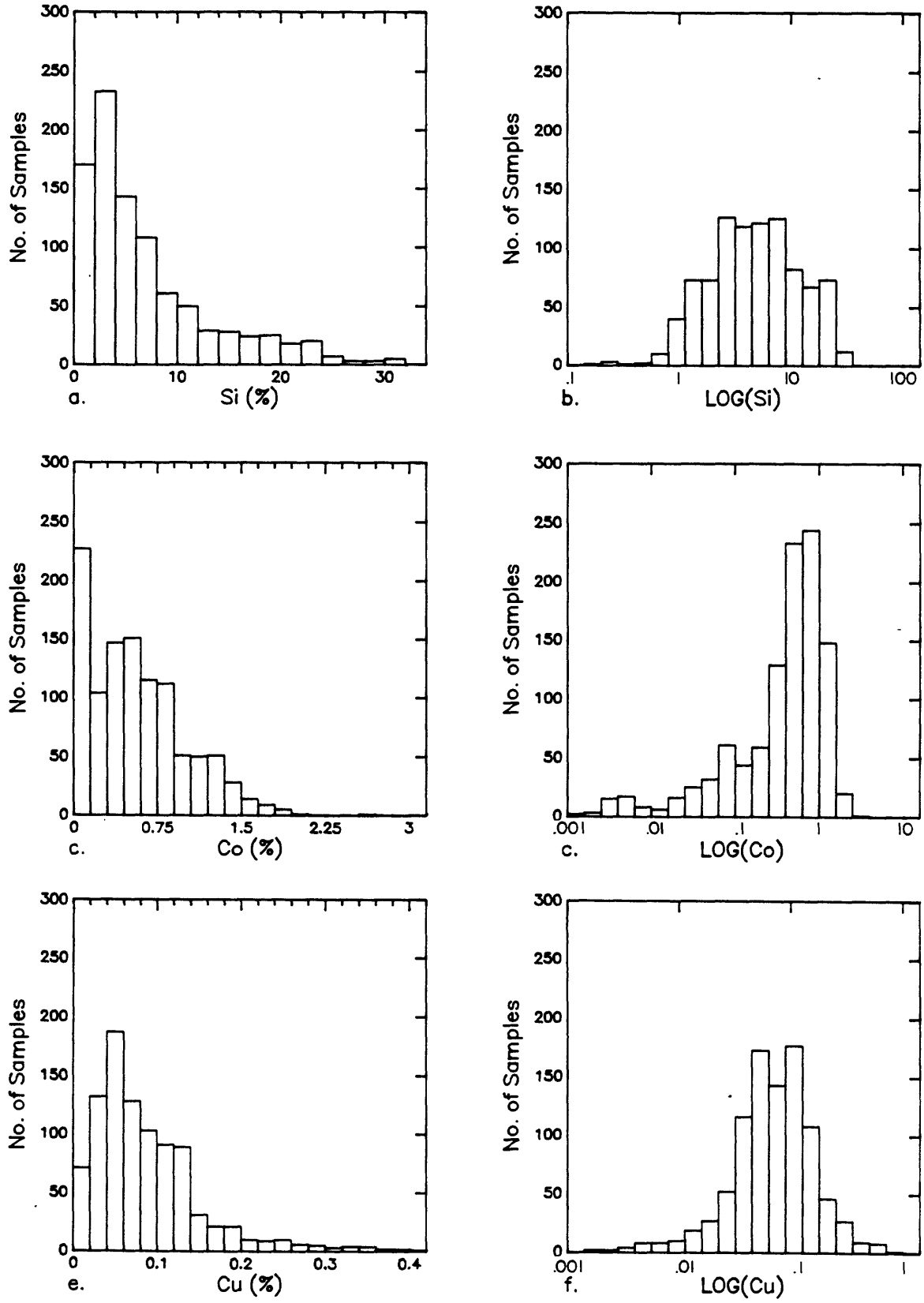


Figure IX-18 Histograms of Si, log (Si), Co, log (Co), Cu, log (Cu).

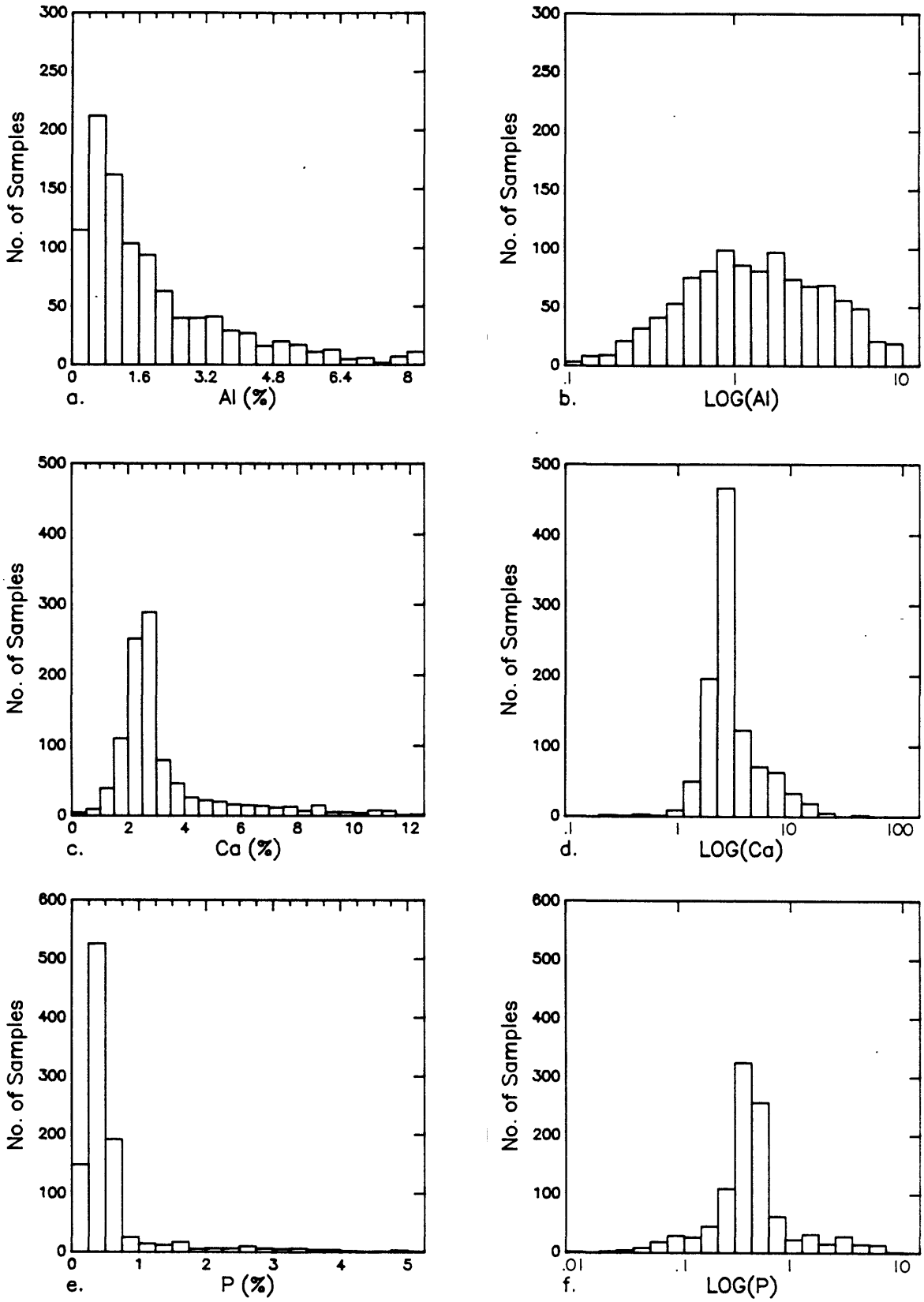


Figure IX-19 Histograms of Al, log (Al), Ca, log (Ca), P, log (P).

values even in a lognormal plot, which is attributed largely to hydrothermally affected samples.

Correlation coefficients

Correlation matrices for the Mid-Pacific, southern Line Islands, Marshall Islands, Indian Ocean, Atlantic Ocean and Pacific Ocean areas are presented in Tables IX-5 to IX-9, using the Pearson-Product-Moment statistic. In general, the principal correlation groups include the Mn oxides, silicates, phosphates, and Fe- depth-latitude. We recognize that dilution by silicates, phosphates, or other substrate materials will tend to create false correlations among elements within the oxide group.

One method of clarifying the influence of dilutants on correlation matrices is to compare correlation coefficients for the raw data sets and exclusion sets for major oceans and ocean areas. A summary table of some of the principal associations for the Mid-Pacific area is given in Table IX-10, including a small, homogeneous data set from the top 5 mm of crusts from Necker Ridge, Horizon Guyot, and S.P. Lee Guyot (data reported in Hein and others, 1985).

Four principal geochemical associations are examined in Table IX-10: Depth, Mn oxides, silicates (divided into two subcategories Si and Al), and Ca. Table IX-10 shows that in most cases the exclusion data set has stronger statistical affinities than the unmodified sets. The correlation levels increase with decreasing sample size and reduction of contaminants and extraneous phases. Exceptions occur for hygroscopic moisture H_2O^-: Mn, CO_2:Ca and K:Al. The manganese phases have great surface area, and therefore greater tendency toward higher hygroscopic moisture. This relationship, though at a low level, is more pronounced in the most heterogeneous data set. Likewise, correlation between elements associated with carbonates and aluminosilicates is greater in this set. Dilution by silicates, phosphates, or other substrate materials that create outliers not only tend to create false correlations among elements within the oxide group. False correlations may also be induced among constituents making up dilutants; i.e. a group of crust samples contaminated with phosphates and silicates may tend to show false correlations between elements in phosphates and silicates, because both phases may change in concentration in reverse proportion to the amount of "dilution" by Mn-Fe oxide phase that may be present. One means of minimizing these problems is referred to below.

The Pearson-Product-Moment (P-P) correlation coefficient presumes a normally distributed population even though it has been and remains widely used in geochemical studies on which non-normally distributed populations are present. A correlation method that does not depend on frequency distribution is rank correlation (S-R). A new program was developed in house to perform both the P-P and the S-R correlations. The results are in Table IX-11 and IX-12 and used the smaller data set in the Mid Pacific area to be consistent with majority of the interelement plots. The numbers for the bottom matrix refer to number of sample points used for each correlation. The S-R data set displays much lower correlations for elements where a tail or a few outliers affect the Pearson Product Moment matrices. For example, the P-P correlation for Ca:P is .95, whereas the S-R correlation yields only .59. The P-P index is strongly influenced by a few samples which have high apatite content. On the other hand, the correlations Mn:Co, Mn:Ni, Co:Ni, Pb:Co, Mo:Co, and As:Co are all higher for the SR procedure.

Table IX-5a. Correlation matrix for mid-Pacific area using unmodified USGS data points, Total data points = 956. Note: shipboard data have been excluded.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	CO2	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	H2O-	H2O+
Lat	1.00	.31	.01	-.29	.22	-.39	-.29	-.01	.03	-.23	.28	.13	.29	-.16	.39	-.18	-.21	.08	-.26	.20	-.21	-.09	-.28	.03	.18	.08	.08	-.02	.11
Lon		1.00	-.03	-.05	.09	-.08	-.01	-.14	.02	-.09	-.02	-.04	.03	-.08	.03	-.04	-.08	-.07	.08	.16	.04	.04	-.17	-.03	.14	.28	-.01	.12	-.06
Depth			1.00	-.37	.34	-.38	-.37	.40	-.05	-.19	.28	.38	.22	-.17	.44	.04	-.17	-.05	-.45	-.25	-.29	-.17	-.16	.04	.02	-.22	-.16	.05	-.01
Mn				1.00	-.37	.65	.80	-.05	-.17	-.11	-.76	-.48	-.45	-.14	-.81	-.01	-.20	.32	.70	.35	.59	.38	.44	-.06	.28	.20	.42	.27	.18
Fe					1.00	-.50	-.13	.06	-.29	-.53	.04	.57	-.19	-.46	.27	-.23	-.38	-.42	-.13	.29	.19	.38	-.34	.11	.38	.19	-.49	.22	.24
Ni						1.00	.58	.03	.03	.25	-.53	-.47	-.28	.21	-.65	-.04	.10	.03	.63	.22	.35	.24	.42	.08	.11	.05	.13	.16	-.01
Co							1.00	-.34	-.12	-.17	-.54	-.22	-.34	-.20	-.58	.06	-.15	-.21	.69	.45	.41	.39	.17	-.04	.24	.24	-.04	.19	.10
Cu								1.00	-.09	-.08	.10	.14	.10	-.02	.17	-.17	-.05	.23	-.25	-.17	-.09	-.10	.17	.09	.11	-.17	.00	-.02	.04
Mg									1.00	.07	.19	-.12	.04	.05	.23	-.16	.00	.03	-.20	-.19	-.41	-.27	.00	-.20	-.33	-.09	.11	-.12	-.02
Ca										1.00	-.12	-.35	-.10	.96	-.23	-.17	.81	.06	.05	-.14	.10	-.10	.10	.36	-.03	-.14	-.11	-.13	-.30
Al											1.00	.48	.78	-.10	.93	.27	.04	-.08	-.68	-.45	-.78	-.54	-.19	-.17	-.49	-.26	-.07	-.28	-.28
Ti												1.00	.21	-.32	.51	.00	-.15	-.30	-.41	-.02	-.25	-.12	-.16	-.14	.08	-.10	-.40	-.02	-.10
K													1.00	-.09	.73	.36	-.03	.19	-.51	-.56	-.63	-.57	-.15	-.18	-.41	-.24	.17	-.21	-.20
P														1.00	-.21	-.21	.69	.14	.01	-.08	.11	-.11	.08	.40	-.01	-.13	-.09	-.12	-.26
Si															1.00	.08	-.05	-.07	-.80	-.51	-.79	-.58	-.49	-.17	-.43	-.24	-.19	-.21	-.19
Na																1.00	-.19	-.21	.02	-.03	-.26	-.20	-.23	-.19	-.14	.20	-.02	-.07	-.16
CO2																	1.00	.14	-.04	-.22	.06	-.11	.03	.27	-.11	-.14	-.09	-.20	-.27
Ba																		1.00	-.11	-.15	.15	-.18	.26	.04	-.14	-.10	.51	-.15	-.07
Mo																			1.00	.51	.65	.59	.19	.06	.37	.32	-.02	.37	.12
Pb																				1.00	.50	.51	.07	.06	.66	.39	-.27	.42	.20
Sr																					1.00	.65	.16	.25	.55	.29	-.08	.22	.20
V																						1.00	.07	.16	.53	.32	-.27	.33	.22
Zn																							1.00	.00	-.07	-.05	.55	-.01	.04
Y																								1.00	.18	.00	-.22	-.01	.06
Ce																									1.00	.21	-.29	.32	.19
As																										1.00	-.12	.26	.11
Cd																											1.00	-.12	-.03
H2O-																												1.00	-.11
H2O+																													1.00

Table IX-5b. Correlation matrix for mid-Pacific area using "exclusion" data Total number of samples = 702. Note: shipboard data are also excluded.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	CO2	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	H2O-	H2O+
Lat	1.00	.34	-.04	-.42	.29	-.39	-.32	-.07	.11	-.28	.32	.09	.23	-.07	.44	-.24	-.25	-.08	-.20	.38	-.17	-.08	-.39	.05	.47	.15	-.08	.07	.06
Lon		1.00	-.01	-.08	.06	-.10	-.05	-.14	.03	-.12	-.04	-.13	.08	-.08	.04	-.07	.00	-.14	.09	.15	.02	-.01	-.19	.01	.21	.28	.07	.13	-.10
Depth			1.00	-.43	.40	-.37	-.43	.40	-.17	-.19	.24	.25	.02	-.18	.40	-.02	-.08	-.02	-.47	-.35	-.23	-.21	-.10	.12	-.08	-.22	-.11	.12	-.02
Mn				1.00	-.73	.80	.76	-.23	.35	.34	-.74	-.44	-.16	.12	-.89	.17	.12	.07	.84	.21	.34	.30	.38	-.39	.08	.07	.31	.19	-.16
Fe					1.00	-.77	-.63	.16	-.36	-.43	.48	.51	-.11	-.21	.72	-.23	-.20	-.01	-.67	-.02	-.05	-.01	-.26	.45	-.01	-.01	-.44	.05	.05
Ni						1.00	.84	-.04	.51	.24	-.45	-.41	.05	.07	-.69	.24	.08	.06	.58	.05	.01	.05	.38	-.46	-.21	-.07	.48	.11	-.15
Co							1.00	-.40	.40	.11	-.54	-.33	-.09	-.03	-.69	.20	.04	-.17	.60	.28	.05	.14	.21	-.26	-.08	.06	.33	.05	-.17
Cu								1.00	-.14	.00	.36	.28	.27	.04	.38	-.18	.02	.44	-.36	-.24	-.07	-.16	.21	-.13	.00	-.18	-.28	-.02	.04
Mg									1.00	.03	-.07	-.22	.18	.04	-.22	.53	-.09	-.12	.32	.21	-.29	-.05	.05	-.39	-.13	.07	.49	.17	-.19
Ca										1.00	-.34	-.24	-.05	.82	-.39	-.07	.65	.28	.38	.03	.41	.20	.28	.19	.19	-.01	-.08	.00	.01
Al											1.00	.48	.38	-.14	.63	.06	-.14	.04	-.69	-.09	-.48	-.37	-.14	.05	-.08	-.12	-.14	-.19	.09
Ti												1.00	.00	-.12	.50	-.31	.01	.25	-.57	-.02	-.06	-.21	.03	.23	.17	-.19	-.40	-.06	.06
K													1.00	-.05	.40	.12	-.03	.05	-.28	-.23	-.41	-.44	-.18	-.13	.07	-.09	.17	-.04	.08
P														1.00	-.23	-.12	.48	.31	.25	.21	.38	.23	.23	.40	.15	.02	-.13	-.03	.05
Si															1.00	-.08	-.18	-.10	-.65	-.18	-.50	-.58	-.39	.19	-.08	-.10	-.56	-.04	.09
Na																1.00	-.06	-.16	.21	.25	-.18	-.07	-.15	-.28	.05	.44	.30	-.01	-.15
CO2																	1.00	.18	.06	-.13	.09	-.03	.19	.18	.03	-.07	.04	-.06	-.02
Ba																		1.00	.10	.01	.43	.17	.25	-.10	.27	.06	-.32	-.07	-.04
Mo																			1.00	.37	.46	.47	.23	-.27	.10	.23	.20	.18	-.09
Pb																				1.00	.19	.28	.09	-.06	.48	.25	-.08	.22	-.11
Sr																					1.00	.59	.22	.12	.28	.21	-.37	-.12	-.01
V																						1.00	.17	.01	.11	.21	-.24	.02	-.02
Zn																							1.00	-.31	-.19	-.09	-.12	-.08	-.04
Y																								1.00	-.05	.00	-.48	-.12	.08
Ce																									1.00	.08	-.11	.08	-.10
As																										1.00	-.15	.13	-.01
Cd																											1.00	.16	-.13
H2O-																												1.00	-.36
H2O+																													1.00

Table IX-6a. Correlation matrix for mid-Pacific area using unmodified SIO data points, Total sample points = 218. NA represents where no data pairs were available, .00 represents not enough data pairs to correlate.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	Ba	Mo	Pb	Sr	V	Zn	Y	H2O-
Lat	1.00	.01	-.36	.01	.28	-.31	.18	-.39	.34	.01	-.35	.12	-.86	-.32	-.13	-.76	.11	-.02	.30	.77	.59	-.35	.58	-.02
Lon		1.00	-.06	-.03	-.03	.07	-.09	.05	-.15	-.08	.58	-.05	.60	.13	.27	.55	-.04	-.02	.10	-.76	-.65	.10	.58	.19
Depth			1.00	-.18	-.19	.13	-.43	.57	-.24	-.34	.05	-.18	.62	-.30	.41	-.20	-.12	-.53	-.65	-.15	-.65	.02	-.34	-.52
Mn				1.00	.22	.31	.53	-.05	.25	.01	-.65	-.18	-.48	.02	-.23	-.44	-.23	.72	.47	.39	.37	.21	1.00	.08
Fe					1.00	-.44	.31	-.32	.18	-.03	-.41	.39	-.73	-.45	-.13	-.62	-.14	.32	.45	.61	.63	-.56	NA	.08
Ni						1.00	.11	.64	.24	-.04	.17	-.28	.61	.27	.33	.68	-.11	.09	-.31	-.43	-.44	.69	.47	-.38
Co							1.00	-.23	.64	.43	-.72	.12	-.56	.18	-.44	-.47	-.37	.40	.51	.65	.77	-.22	.23	.18
Cu								1.00	-.05	-.25	.18	-.13	.77	-.14	.64	.65	.06	-.39	-.52	-.56	-.50	.55	-.17	-.70
Mg									1.00	.14	-.07	.33	-.32	.27	.01	-.34	-.74	.15	.77	.64	.70	.39	.00	-.44
Ca										1.00	-.35	-.16	-.28	.66	-.29	-.26	-.15	.27	.56	.79	.64	.03	-.51	-.18
Al											1.00	.12	.85	-.27	.70	.80	.35	-.21	-.87	-.63	-.96	-.32	.04	-.58
Ti												1.00	-.35	-.50	-.04	-.40	-.11	.31	.06	.71	.69	-.55	.09	.04
K													1.00	.62	.61	.87	.23	-.26	-.75	-.63	-.97	.22	-.73	-.77
P														1.00	-.24	-.66	-.61	-.90	-.95	.64	NA	.58	NA	-.62
Si															1.00	.57	.15	-.24	-.47	-.51	-.59	.12	-.21	-.79
Na																1.00	.94	.27	-.64	-.79	-.95	-.31	.21	.10
Ba																	1.00	.06	.15	-.47	-.45	.16	-.17	.53
Mo																		1.00	.43	.21	.47	.49	.54	.30
Pb																			1.00	.94	.46	-.26	-.35	-.23
Sr																				1.00	.80	-.16	-.51	.14
V																					1.00	-.06	NA	NA
Zn																						1.00	NA	.65
Y																							1.00	.NA
H2O-																								1.00

Table IX-6b. Correlation matrix for mid-Pacific area using "exclusion" SIO data points, Total sample points = 153.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	Ba	Mo	Pb	Sr	V	Zn	H2O-
Lat	1.00	.00	-.43	-.05	.25	-.26	.27	-.36	-.13	.15	-.10	.08	-.83	.06	.24	-.08	.42	.50	.34	.77	.73	-.28	.14
Lon		1.00	-.07	-.10	-.05	.06	-.13	.05	-.09	-.01	-.05	-.07	-.26	-.33	-.41	-.65	-.05	.15	.18	-.77	.65	.12	.53
Depth			1.00	-.30	-.28	.12	-.52	.59	-.15	-.24	.44	-.20	.55	-.02	.46	.17	-.46	-.37	-.69	-.72	-.49	-.02	-.52
Mn				1.00	.03	.22	.41	-.19	.62	.11	-.51	-.11	-.29	.02	-.62	.82	.11	.89	.62	.40	.45	.36	-.11
Fe					1.00	-.56	.23	-.43	.04	.13	-.03	.55	-.62	-.04	.11	.35	-.07	.56	.36	-.63	.60	-.74	-.12
Ni						1.00	.04	.65	.82	-.03	-.19	-.36	-.13	.13	-.29	.82	-.18	-.08	-.26	.35	-.59	.67	-.02
Co							1.00	-.34	.52	.28	-.63	.04	-.84	-.26	-.52	.77	.21	.29	.40	.10	.68	-.39	.09
Cu								1.00	.38	-.28	.07	-.20	-.67	.67	.35	.92	-.30	-.35	-.58	.69	-.91	.43	-.41
Mg									1.00	.42	.00	-.03	-.27	.09	-.09	.84	1.00	1.00	1.00	NA	NA	.47	-.09
Ca										1.00	-.07	.17	-.28	-.22	-.01	.53	.08	.66	.28	-.20	NA	-.10	-.49
Al											1.00	.30	.53	-.29	.69	-.53	-.37	-.75	-.73	-.94	NA	-.55	-.55
Ti												1.00	-.09	-.67	.02	-.24	.28	.48	-.05	.34	.81	-.51	-.09
K													1.00	.93	.35	-.41	-.47	-.98	1.00	.94	NA	NA	-.93
P														1.00	.19	NA	-.92	-.94	-.97	NA	NA	.29	NA
Si															1.00	-.41	.15	-.39	-.53	-.81	NA	-.76	-.72
Na																1.00	.90	.95	NA	NA	NA	NA	.35
Ba																	1.00	.46	.57	.39	.10	.79	.31
Mo																		1.00	.63	.63	.79	.97	.37
Pb																			1.00	.93	.50	-.23	-.11
Sr																				1.00	NA	.94	.96
V																					1.00	NA	NA
Zn																						1.00	.40
H2O-																							1.00

Table IX-7a. Correlation matrix for the Southern Line Islands using both USGS +SIO "exclusion" data. Total number of samples = 112.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	H2O-
Lat	1.00	-.11	.18	.13	-.08	-.03	-.13	.02	-.34	.09	-.14	-.18	.50	.20	.08	.09	-.49	-.13	-.31	.27	-.18	-.05	-.36	-.28	.00	.55	-.50
Lon		1.00	-.29	.29	-.05	.16	.10	-.06	.33	.11	.02	.08	-.39	-.08	-.01	.11	.35	.52	.28	.18	.20	.09	.42	.58	-.28	-.15	.46
Depth			1.00	-.56	.30	-.40	-.72	.16	-.12	-.43	.54	-.20	.21	-.15	.77	-.05	-.35	-.48	-.70	-.52	-.48	-.22	-.41	-.72	-.20	.43	.47
Mn				1.00	-.17	.51	.52	-.15	.52	.45	-.41	.07	.16	-.09	-.60	.58	-.17	.54	.51	.55	.47	-.03	.46	-.46	.59	.29	-.61
Fe					1.00	-.39	-.27	-.31	.29	.07	.31	.21	.10	-.07	.49	.06	-.58	-.22	-.23	.26	-.01	-.09	.07	-.40	.62	.04	.22
Ni						1.00	.30	.27	.27	.25	.04	-.19	.15	.12	-.01	.28	-.08	.33	.25	.26	.08	.11	.29	-.44	.24	.23	-.47
Co							1.00	-.18	.63	.39	-.51	.37	-.14	-.38	-.80	.44	.61	.53	.85	.18	.32	.06	.78	.54	.37	-.55	-.20
Cu								1.00	-.04	.00	-.25	-.30	-.21	-.25	-.29	.02	.04	-.05	-.27	-.08	-.30	.12	-.07	.69	-.61	-.44	.16
Mg									1.00	.39	.05	.35	-.41	-.77	-.34	.73	-.53	.57	.89	-.35	.50	-.34	.95	-.94	.42	.70	.40
Ca										1.00	-.23	-.08	.37	.12	-.15	.16	-.38	.49	.47	.30	-.11	.14	.24	.75	-.14	-.27	-.10
Al											1.00	-.13	-.28	.41	.54	.58	-.27	-.60	-.38	-.67	-.40	.07	.31	-.57	-.66	.64	.03
Ti												1.00	-.13	.02	-.32	.16	.19	.55	.56	.18	.30	-.04	.69	.78	.20	-.95	-.12
K													1.00	.76	.81	-.47	-.43	-.26	-.66	-.21	-.77	-.60	-.65	.47	-.91	-.08	-.64
P														1.00	.36	.13	-.50	.08	-.18	-.08	-.29	.24	.67	.80	-.22	-.51	-.42
Si															1.00	-.65	-.17	-.67	-.79	-.46	-.88	-.40	-.82	-.39	-.85	.46	-.12
Na																1.00	-.46	.72	.70	-.60	.59	.30	.80	-.31	-.13	.78	.36
Ba																	1.00	.32	.57	-.41	.10	.18	-.37	.92	.20	-.28	.36
Mo																		1.00	.46	.37	.16	.00	.49	.64	.28	-.43	.47
Pb																			1.00	.11	.18	-.08	.92	.87	.28	-.60	.24
Sr																				1.00	-.04	.24	-.02	-.13	.88	-.28	.39
V																					1.00	.77	.62	.32	.78	-.29	.27
Zn																						1.00	-.52	.13	.72	-.05	-.30
Y																							1.00	.61	.14	-.92	-.81
Ce																								1.00	-.10	-.74	-.79
As																									1.00	-.26	.57
Cd																										1.00	.69
H2O-																											1.00

Table IX-7b. Correlation matrix for the Marshall Islands using USGS "exclusion" data. Total number of samples = 100.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	CO2	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	Pt	H2O-	H2O+
Lat	1.00	-.68	-.31	-.38	-.29	-.14	-.49	-.02	.32	-.06	.30	-.64	.09	.21	.30	.07	-.02	.19	.19	.35	-.32	-.12	-.13	-.16	.18	-.08	-.03	-.24	-.15	.36
Lon		1.00	.17	.49	.22	.08	.49	-.09	-.14	.04	-.32	.27	-.12	-.09	-.27	.20	.20	-.13	.03	-.12	.11	.10	.11	.10	-.12	-.05	-.02	.48	.18	-.51
Depth			1.00	-.03	.32	-.10	-.07	.08	-.10	-.10	.02	.24	.07	-.17	.11	-.20	-.09	.07	-.17	-.33	-.02	-.02	-.02	-.04	.04	-.15	-.04	.04	-.10	-.18
Mn				1.00	-.19	.65	.59	.17	.21	.08	-.72	-.03	-.39	-.25	-.69	.30	-.07	.10	.57	.30	.13	.29	.16	-.13	.28	.23	.60	-.13	.47	-.37
Fe					1.00	-.61	-.08	-.21	-.30	-.28	.03	.10	-.21	-.19	.38	-.17	-.18	-.24	-.10	-.08	.19	.41	-.04	.06	-.32	.50	-.51	-.22	.28	-.16
Ni						1.00	.20	.52	.43	.25	-.33	.09	.03	-.01	-.50	-.01	.05	.40	.19	.01	-.07	-.15	.17	-.12	.32	-.35	.69	.49	.14	-.13
Co							1.00	-.36	-.05	-.04	-.46	.33	-.18	-.19	-.46	.32	-.03	-.48	.15	.26	-.04	-.05	.07	-.02	.01	.17	.45	-.50	.31	-.30
Cu								1.00	.12	.20	-.01	.13	.14	.06	-.18	-.37	-.08	.73	.04	-.24	.10	-.04	.10	-.06	.27	-.39	.03	.74	-.27	.08
Mg									1.00	.30	.28	-.28	.32	.28	.31	.22	.14	.31	-.09	.14	-.20	-.32	-.02	-.31	.01	-.37	.23	-.67	.09	.18
Ca										1.00	.03	.03	.15	.88	.00	-.12	.50	.34	-.01	-.15	.18	-.11	-.04	.61	.19	-.36	-.01	.82	.06	-.04
Al											1.00	.06	.77	.21	.78	-.32	.03	.12	-.53	-.34	-.18	-.51	-.11	-.13	-.21	-.53	-.42	-.13	-.56	.39
Ti												1.00	.18	-.22	-.07	-.17	.02	-.07	-.31	-.40	.20	-.33	-.04	.08	.21	-.30	.04	.25	.06	.05
K													1.00	.16	.61	-.34	-.13	.11	-.37	-.47	-.18	-.60	-.07	-.15	-.05	-.57	-.12	-.29	-.32	.26
P														1.00	.21	-.15	.38	.22	-.07	-.05	.03	-.10	-.06	.57	.00	-.30	-.14	.78	-.09	-.67
Si															1.00	-.32	-.04	-.08	-.55	-.33	-.26	-.43	-.07	-.13	-.31	-.32	-.51	-.57	-.21	.19
Na																1.00	.02	-.33	.22	.47	-.07	.13	-.03	-.06	-.03	.27	.19	-.68	.35	-.23
CO2																	1.00	.22	-.26	-.11	-.11	-.17	-.06	.24	.12	-.29	-.04	.71	-.12	.02
Ba																		1.00	-.04	-.28	.02	-.16	.07	-.10	.52	-.50	.02	.93	-.34	.37
Mo																			1.00	.45	.33	.66	.03	-.06	.03	.45	.27	.08	.31	-.21
Pb																				1.00	.01	.24	.01	.03	.20	.45	.26	-.34	.39	-.12
Sr																					1.00	.47	.05	.28	-.02	.19	-.10	.62	.03	.04
V																						1.00	.02	.09	-.30	.74	-.05	.26	.34	-.11
Zn																							1.00	-.05	-.06	.08	.06	-.18	.08	-.10
Y																								1.00	.16	.00	-.11	.87	.15	-.12
Ce																									1.00	-.35	.30	.90	.06	.05
As																										1.00	-.06	-.66	.50	-.18
Cd																											1.00	-.33	.18	.05
Pt																												1.00	.10	.38
H2O-																													1.00	-.55
H2O+																														1.00

Table IX-8a. Correlation matrix for the Indian Ocean using USGS + SIO "exclusion" data. Total number of samples = 129. Note: For both tables shipboard data are not included and H2O+ is not listed due to too few data pairs.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	H2O-
Lat	1.00	-.24	-.05	-.10	.27	-.38	-.11	-.33	.31	-.22	-.02	-.37	-.07	-.09	.58	-1.00	.18	-.03	-.11	-.43	.62	-.36	-.41	-.71	-.35	.15	.56
Lon		1.00	.54	-.02	-.34	.24	-.39	.44	.05	-.02	.29	-.20	-.52	-.37	.49	-.31	-.37	-.33	-.13	-.23	-.53	.21	-.28	-.68	-.29	-.33	-.67
Depth			1.00	-.18	-.19	.01	-.47	.31	.02	-.39	.62	.11	.33	-.52	.71	.53	-.48	-.49	-.01	-.61	-.40	-.19	-.50	-.19	-.68	-.31	-.70
Mn				1.00	-.20	.47	.19	.21	.60	-.05	.00	-.27	.69	-.39	-.17	.64	-.54	.00	.08	.15	-.15	.37	-.50	.24	-.25	-.02	.09
Fe					1.00	-.67	.12	-.59	-.71	.02	-.41	.02	-1.00	-.40	.15	-.95	-.22	.06	.10	.06	.22	-.22	-.67	-.91	-.26	-.06	-.34
Ni						1.00	-.09	.64	.66	-.07	.38	-.08	.95	.66	-.09	.99	-.21	-.08	-.04	-.43	-.15	.71	.78	.66	-.06	.35	.59
Co							1.00	-.32	-.18	.55	-.42	.70	.29	.25	-.46	.06	.64	-.04	.25	.06	.04	-.27	-.16	.73	.29	.17	.62
Cu								1.00	.71	-.26	.49	-.27	.68	.01	-.02	.97	-.14	-.27	-.08	-.06	-.49	.61	.25	.53	-.70	.01	.06
Mg									1.00	-.46	.51	-.43	.89	-.08	.40	.97	-.55	.35	-.17	-.70	.04	.49	.05	.55	-.81	.15	-.99
Ca										1.00	-.51	.48	.02	.99	-.25	-.21	.88	-.38	.05	.07	.47	-.21	.77	.51	.12	-.11	.30
Al											1.00	-.06	.76	-.74	.90	.88	-.81	.15	-.05	-.86	-.96	.22	.29	.33	-.64	.02	-.92
Ti												1.00	.23	.95	-.09	.01	.40	-.42	.33	-.55	-.08	-.33	-.86	.69	-.38	-.02	.08
K													1.00	-.04	.57	.97	-.32	-.20	-.97	-.31	-.95	-.82	-.40	.87	-.99	.84	-.95
P														1.00	-.30	-.26	.87	-.33	-.56	.02	.55	.62	.82	.47	.13	-.58	.35
Si															1.00	.74	-.89	-.19	-.65	-.79	.33	-.39	-.25	.08	-.85	.93	-.80
Na																1.00	-.52	.03	-.88	-.52	-.99	-.78	-.19	.73	-.93	.94	-1.00
Ba																	1.00	.41	.55	.31	.25	-.38	-.73	.20	.16	-.79	.60
Mo																		1.00	.32	.70	.58	.05	.03	-.66	.74	.37	-.12
Pb																			1.00	.88	.08	-.01	-.06	-.97	.87	-.06	.84
Sr																				1.00	-.50	.52	.05	.21	.65	-.78	.59
V																					1.00	-.02	-.40	-.66	.88	-.97	1.00
Zn																						1.00	.34	-.15	-.20	.30	.84
Y																							1.00	-.61	.38	.17	.10
Ce																								1.00	-.93	.45	-.67
As																									1.00	-.74	.89
Cd																										1.00	-.97
H2O-																											1.00

Table IX-8b. Correlation matrix for Atlantic Ocean using USGS + SIO "exclusion" data. Total number of samples = 89.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	H2O-
Lat	1.00	-.43	-.01	-.19	.07	-.19	-.07	.01	.33	-.09	.15	-.56	-.26	-.35	-.27	-.32	.18	.12	-.26	-.22	.04	-.43	.31	-.32	.05	.10	-.98
Lon		1.00	.08	-.13	.10	-.18	.01	-.24	-.41	.37	-.32	.37	-.12	.57	.24	.03	-.50	-.19	.25	-.07	-.08	-.05	-.02	.68	.05	-.67	.70
Depth			1.00	-.03	-.13	.18	-.17	.56	-.07	-.26	.04	.12	.30	-.42	.49	.38	-.18	-.49	-.18	-.45	-.38	.05	-.13	.01	-.53	.12	.10
Mn				1.00	-.48	.51	.47	.44	.01	.03	-.34	-.10	.49	-.49	.27	.16	-.07	.28	.22	-.28	-.71	.48	-.58	-.05	-.28	.66	-.37
Fe					1.00	-.62	.08	-.47	-.32	-.04	.29	.61	-.63	.22	-.41	-.33	-.16	.06	.23	.74	.74	-.41	.51	.53	.73	-.94	.74
Ni						1.00	.16	.62	.43	-.23	.45	-.01	.57	-.08	.52	.36	.34	.16	-.21	-.26	-.13	.66	-.82	-.62	-.27	.90	-.82
Co							1.00	.23	-.22	.23	-.09	.73	-.43	.06	-.56	-.18	.08	.34	.57	.57	.24	-.31	.33	.81	.37	-.41	.67
Cu								1.00	.42	-.37	.43	-.17	.74	-.46	.63	.46	.31	-.22	-.37	-.32	-.27	.62	-.65	-.68	-.56	.92	-.91
Mg									1.00	-.23	.50	-.39	.31	-.61	-.03	.21	.56	.52	-.47	-.54	-.17	.14	-.44	-.63	-.17	.73	-.60
Ca										1.00	-.40	-.19	-.10	.88	.03	.04	-.46	-.29	.16	-.24	-.45	-.27	.16	.21	.47	-.51	.40
Al											1.00	.15	.13	-.55	.51	.28	.10	-.10	-.43	-.18	.04	.36	-.25	-.50	.31	.12	-.49
Ti												1.00	-.40	-.21	-.25	.53	-.22	.25	.66	.69	.37	-.24	.27	.88	.24	-.59	.60
K													1.00	-.57	.57	.51	.56	.04	-.32	-.54	-.44	.52	-.29	-.53	-.64	.79	-.65
P														1.00	-.05	-.73	-.69	-.16	.04	.03	.61	-.19	.15	.64	.21	-.88	.87
Si															1.00	.09	-.12	-.36	-.56	-.68	-.65	.54	-.64	-.72	-.26	.62	-.54
Na																1.00	.09	.37	-.08	.41	.23	.34	.35	.17	-.42	.13	.49
Ba																	1.00	.00	.08	-.13	-.10	.34	-.75	-.63	-.54	.91	-.17
Mo																		1.00	.47	.58	.07	-.27	-.08	.56	.31	-.32	.44
Pb																			1.00	.68	.12	-.18	.15	.86	.45	-.54	.75
Sr																				1.00	.81	-.20	.51	.72	.35	-.59	.74
V																					1.00	-.06	.48	.58	.22	-.79	.81
Zn																						1.00	-.66	-.76	-.60	.97	-.89
Y																							1.00	.51	.12	-.64	.58
Ce																								1.00	.30	-.73	.65
As																									1.00	-.74	.63
Cd																										1.00	-.89
H2O-																											1.00

Table IX-9. Correlation matrix for total Pacific ocean using USGS "exclusion" data, total data points = 834.

	Lat	Lon	Depth	Mn	Fe	Ni	Co	Cu	Mg	Ca	Al	Ti	K	P	Si	Na	CO2	Ba	Mo	Pb	Sr	V	Zn	Y	Ce	As	Cd	Pt	H2O-	H2O+
Lat	1.00	.08	-.15	-.24	.15	-.37	-.19	-.25	-.10	-.19	.13	.04	.07	-.03	.21	-.18	-.31	.10	.09	.32	.04	.00	-.24	.03	.43	.11	-.14	-.24	-.01	.15
Lon		1.00	-.04	.04	-.02	.05	-.05	-.07	.04	-.05	-.12	-.12	.00	-.03	-.08	.11	.21	-.17	.03	.09	-.08	-.02	.02	.07	-.01	.12	.12	.48	.45	-.28
Depth			1.00	-.38	.35	-.25	-.39	.41	-.08	-.18	.25	.22	.07	-.19	.37	-.04	-.02	-.04	-.43	-.37	-.28	-.23	-.05	.01	-.10	-.20	-.04	.04	.09	-.10
Mn				1.00	-.68	.74	.71	-.15	.31	.30	-.73	-.40	-.16	.08	-.65	.22	.00	.06	.76	.21	.27	.28	.28	-.28	.11	.08	.35	-.13	.21	-.20
Fe					1.00	-.74	-.54	.03	-.38	-.39	.40	.45	-.17	-.19	.63	-.23	-.04	-.03	-.58	-.01	.03	.07	-.19	.35	-.08	.03	-.47	-.22	.10	.02
Ni						1.00	.53	.19	.52	.21	-.38	-.34	.10	.04	-.59	.12	.03	.05	.42	-.01	-.10	-.03	.31	-.32	-.15	-.10	.50	.49	.12	-.17
Co							1.00	-.40	.29	.11	-.52	-.19	-.12	-.03	-.63	.16	-.01	-.17	.49	.30	.10	.13	.12	-.10	.01	.07	.21	-.50	.02	-.16
Cu								1.00	.04	-.02	.34	.15	.24	-.01	.27	-.20	.00	.33	-.28	-.29	-.20	-.21	.18	-.16	-.06	-.18	-.02	.74	-.01	.00
Mg									1.00	.05	.00	-.24	.22	.05	-.12	.43	.01	-.11	.19	.12	-.33	-.11	.07	-.36	-.21	.02	.49	-.67	.15	-.15
Ca										1.00	-.30	-.18	-.03	.82	-.35	-.05	.56	.26	.28	.03	.37	.17	.16	.32	.14	-.03	-.11	.82	-.01	-.02
Al											1.00	.39	.44	-.11	.82	-.07	-.06	.04	-.63	-.15	-.44	-.37	-.11	-.05	-.12	-.14	-.12	-.13	-.25	.14
Ti												1.00	.00	-.11	.37	-.33	.00	.25	-.47	.01	.07	-.17	-.02	.23	.16	-.16	-.42	.25	-.10	.04
K													1.00	-.02	.43	.01	-.13	.07	-.23	-.29	-.39	-.49	-.06	-.18	.05	-.12	.16	-.29	-.11	.12
P														1.00	-.17	-.07	.34	.28	.18	.20	.33	.20	.12	.46	.12	.01	-.15	.78	-.05	.03
Si															1.00	-.14	-.14	-.12	-.74	-.25	-.46	-.55	-.13	.06	-.10	-.12	-.44	-.57	-.10	.11
Na																1.00	-.03	-.21	.22	.23	-.15	-.01	-.03	-.21	.06	.34	.33	-.68	.17	-.13
CO2																	1.00	.09	-.13	-.15	.04	-.04	.05	.18	-.09	-.06	-.05	.71	.16	-.09
Ba																		1.00	.12	.04	.40	.15	.14	-.09	.35	.02	-.29	.83	-.10	.05
Mo																			1.00	.39	.42	.47	.11	-.19	.25	.22	.16	.08	.10	-.01
Pb																				1.00	.25	.33	.03	.04	.48	.24	-.14	-.34	.16	-.06
Sr																					1.00	.60	.10	.23	.25	.20	-.40	.62	-.12	.01
V																						1.00	.08	.08	.10	.24	-.25	.26	.09	.00
Zn																							1.00	-.10	-.13	-.03	.05	-.18	.10	-.09
Y																								1.00	.01	.01	-.39	.67	.01	.00
Ce																									1.00	.07	-.14	.90	.00	.01
As																										1.00	-.15	-.66	.11	.00
Cd																											1.00	-.33	.12	-.07
Pt																												1.00	.10	.36
H2O-																													1.00	.48
H2O+																														1.00

Table IX-10. Comparison of correlation coefficients for the Mid-Pacific. "All" data refer to all USGS (unmodified) data, with N = 956. "Exc" refers to exclusion data set, N = 702. "Lee" is a small data set of tops of crusts from the Mid-Pacific area reported in Hein et al. (1985), N = 19. Correlation coefficients are reported at the 95% confidence level.

Depth				Mn				Si				Ca				Al			
	All	Exc	Lee		All	Exc	Lee		All	Exc	Lee		All	Exc	Lee		All	Exc	Lee
Si	.44	.40	.76	Mo	.70	.84	.92	Al	.93	.83	.94	P	.96	.81	.99	Si	.93	.83	.94
Cu	.40	.40	.50	Ni	.65	.80	.87	K	.73	.40	.62	CO2	.81	.65	.68	K	.78	.38	.79
Fe	.34	.40	.48	Co	.60	.76	.88	Ti	.61	.50	.86	Sr	.10	.40	.45	Ti	.48	.48	.89
Co-	.37	-.43	-.64	H20	.18-	.16-	.14	Fe	.27	.72	.69								
Mn-	.37	-.43	-.75	Fe-	.37	-.77	-.78												
Mo-	.45	-.47	-.72																

Table IX-11. Pearson Biserial Correlation Matrix for Mid-Pacific area as defined by map in back flap (259 datapoints).

	Depth	Al	Ca	Co	Cu	Fe	K	Mg	Mn	Na	Ni	P	Si	Ti	CO2	H2O+	H2O-	As	Ba	Cd	Ce	Cr	Mo	Pb	Sr	V	Y	Zn	Thick
Depth	1.00																												
Al	.32	1.00																											
Ca	-.14	.00	1.00																										
Co	-.40	-.57	-.14	1.00																									
Cu	.31	.08	-.01	-.35	1.00																								
Fe	.28	-.15	-.47	-.04	.02	1.00																							
K	.22	.79	-.05	-.41	.10	-.34	1.00																						
Mg	-.02	.18	-.07	-.15	-.09	-.26	.02	1.00																					
Mn	-.39	-.80	-.17	.62	-.05	-.20	-.48	-.23	1.00																				
Na	.00	.27	-.16	.05	-.18	-.18	.36	-.18	-.01	1.00																			
Ni	-.36	-.53	.16	.58	.07	-.37	-.33	-.06	.64	-.04	1.00																		
P	-.13	-.03	.95	-.13	.02	-.42	-.04	-.09	-.16	-.20	.14	1.00																	
Si	.43	.93	-.12	-.63	.10	.03	.71	.32	-.87	.21	-.64	-.14	1.00																
Ti	.28	.42	-.21	-.18	.00	.49	.21	-.15	-.50	.00	-.45	-.26	.44	1.00															
CO2	-.17	.06	.80	-.14	-.04	-.36	-.02	.01	-.21	-.18	.10	.68	-.03	-.14	1.00														
H2O+	-.01	-.30	-.30	.11	.03	.23	-.21	-.02	.20	-.17	.01	-.25	-.21	-.11	-.26	1.00													
H2O-	.03	-.40	-.19	.28	-.01	.27	-.33	-.17	.33	.08	.29	-.18	-.36	-.07	-.21	-.10	1.00												
As	-.30	-.58	-.34	.57	-.31	.50	-.57	-.22	.42	-.12	.18	-.29	-.55	-.11	-.31	.26	.37	1.00											
Ba	-.02	-.02	.19	-.20	.23	-.41	.20	-.02	.17	-.21	.06	.24	-.08	-.34	.14	-.07	-.15	-.29	1.00										
Cd	-.16	-.06	-.12	-.05	.06	-.52	.18	.11	.47	-.01	.14	-.10	-.18	-.37	-.09	-.03	-.13	-.22	.58	1.00									
Ce	.01	-.50	-.06	.24	.12	.37	-.41	-.34	.31	-.08	.08	-.04	-.43	.06	-.15	.20	.31	.39	-.15	-.31	1.00								
Cr	-.13	.33	.20	-.19	-.16	-.12	.00	.43	-.37	-.24	-.21	.20	.28	.07	.24	-.12	-.25	-.18	-.13	-.04	-.35	1.00							
Mo	-.49	-.69	.05	.69	-.28	-.17	-.48	-.18	.76	.07	.62	.01	-.79	-.42	.00	.08	.34	.57	-.12	-.02	.33	-.23	1.00						
Pb	-.29	-.62	-.17	.65	-.33	.33	-.55	-.26	.48	.06	.26	-.14	-.58	-.10	-.23	.18	.42	.75	-.30	-.25	.65	-.25	.62	1.00					
Sr	-.32	-.79	.14	.46	-.11	.18	-.62	-.40	.62	-.25	.37	.15	-.81	-.26	.05	.21	.31	.59	.16	-.05	.54	-.37	.65	.59	1.00				
V	-.21	-.59	-.15	.45	-.17	.38	-.57	-.27	.45	-.13	.24	-.15	-.59	-.15	-.14	.23	.32	.70	-.27	-.26	.51	-.19	.66	.61	.62	1.00			
Y	.04	-.16	.33	-.02	.10	.13	-.17	-.20	-.06	-.18	.07	.38	-.16	-.13	.25	.07	-.01	.04	.04	-.23	.15	-.11	.00	.04	.24	.14	1.00		
Zn	-.25	-.34	.02	.11	.19	-.37	-.12	-.02	.57	-.22	.52	.04	-.47	-.34	.02	.05	.01	-.12	.41	.70	-.11	-.18	.18	-.18	.23	.01	-.01	1.00	
Thick	-.04	-.14	-.20	-.25	.13	-.33	.08	-.02	.45	-.19	-.14	-.15	-.22	-.31	-.17	.11	-.31	-.11	.50	.68	-.06	-.14	-.14	-.20	.11	-.05	-.04	.50	1.00

	Depth	Al	Ca	Co	Cu	Fe	K	Mg	Mn	Na	Ni	P	Si	Ti	CO2	H2O+	H2O-	As	Ba	Cd	Ce	Cr	Mo	Pb	Sr	V	Y	Zn	Thick
Depth	259																												
Al	259	259																											
Ca	259	259	259																										
Co	259	259	259	259																									
Cu	259	259	259	259	259																								
Fe	259	259	259	259	259	259																							
K	259	259	259	259	259	259	259																						
Mg	259	259	259	259	259	259	259	259																					
Mn	259	259	259	259	259	259	259	259	259																				
Na	259	259	259	259	259	259	259	259	259	259																			
Ni	259	259	259	259	259	259	259	259	259	259	259																		
P	259	259	259	259	259	259	259	259	259	259	259	259																	
Si	259	259	259	259	259	259	259	259	259	259	259	259	259																
Ti	259	259	259	259	259	259	259	259	259	259	259	259	259	259															
CO2	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257														
H2O+	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259													
H2O-	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259												
As	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259											
Ba	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259										
Cd	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	258									
Ce	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	257	258								
Cr	207	207	207	207	207	207	207	207	207	207	207	207	207	207	205	207	207	207	207	206	206	207							
Mo	255	255	255	255	255	255	255	255	255	255	255	255	255	255	253	255	255	255	255	255	254	203	255						
Pb	257	257	257	257	257	257	257	257	257	257	257	257	257	257	255	257	257	257	257	256	257	205	254	257					
Sr	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259				
V	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	257	258	206	254	257	258	258			
Y	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259	258	259		
Zn	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259	258	259	259	
Thick	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	99	99	100	99	100	100	100

Table IX-12. Spearman Rank Correlation Matrix for Mid-Pacific area as defined by map in back flap (259 datapoints).

	Depth	Al	Ca	Co	Cu	Fe	K	Mg	Mn	Na	Ni	P	Si	Ti	CO2	H2O+	H2O-	As	Ba	Cd	Ce	Cr	Mo	Pb	Sr	V	Y	Zn	Thick
Depth	1.00																												
Al	.36	1.00																											
Ca	-.20	-.33	1.00																										
Co	-.39	-.66	.16	1.00																									
Cu	.35	.24	-.10	-.40	1.00																								
Fe	.40	.14	-.52	-.08	.07	1.00																							
K	.23	.71	-.20	-.39	.25	-.16	1.00																						
Mg	-.17	.22	-.06	.09	-.19	-.42	.29	1.00																					
Mn	-.49	-.62	.20	.70	-.17	-.34	-.43	.08	1.00																				
Na	.01	.12	.01	.23	-.26	-.21	.24	.36	.06	1.00																			
Ni	-.45	-.67	.40	.65	-.03	-.47	-.32	.16	.78	.13	1.00																		
P	-.23	-.28	.59	.18	-.08	-.22	-.22	-.22	.10	-.13	.25	1.00																	
Si	.49	.93	-.36	-.66	.18	.30	.64	.09	-.89	.12	-.75	-.32	1.00																
Ti	.31	.38	-.22	-.20	.09	.51	.16	-.19	-.48	-.06	-.47	-.32	.47	1.00															
CO2	-.15	-.24	.70	.06	.00	-.32	-.19	-.21	.08	-.15	.26	.51	-.25	-.18	1.00														
H2O+	.05	-.14	-.21	.15	.03	.20	-.07	-.21	.13	-.08	.01	-.08	-.08	-.03	-.11	1.00													
H2O-	.01	-.38	-.07	.35	-.02	.21	-.32	-.11	.35	.09	.33	.00	-.32	-.05	-.08	.03	1.00												
As	-.27	-.49	-.17	.63	-.38	.38	-.52	-.17	.43	.01	.27	.10	-.44	-.08	-.21	.27	.38	1.00											
Ba	-.10	-.29	.21	-.01	.51	-.18	-.05	-.26	.27	-.27	.32	.27	-.36	-.22	.27	.03	.04	-.10	1.00										
Cd	-.45	-.52	.15	.61	-.14	-.46	-.15	.34	.80	.17	.79	.07	-.64	-.49	.06	-.05	.24	.21	.17	1.00									
Ce	.01	-.31	-.05	.21	.13	.21	-.20	-.28	.21	-.06	.10	.15	-.25	.04	-.06	.12	.25	.25	.24	.08	1.00								
Cr	.03	.64	-.12	-.25	-.12	-.12	.39	.51	-.44	.08	-.35	-.12	.52	.17	-.16	-.28	-.30	-.30	-.27	-.13	-.35	1.00							
Mo	-.55	-.84	.34	.71	-.33	-.27	-.54	.00	.85	.07	.75	.32	-.86	-.47	.20	.11	.36	.58	.20	.63	.27	-.46	1.00						
Pb	-.28	-.52	.00	.71	-.42	.16	-.40	.00	.50	.17	.33	.24	-.49	-.20	-.16	.17	.39	.67	-.09	.38	.50	-.19	.61	1.00					
Sr	-.37	-.82	.30	.51	-.14	.01	-.67	-.38	.82	-.20	.52	.41	-.78	-.26	.26	.13	.32	.55	.42	.29	.39	-.57	.74	.51	1.00				
V	-.34	-.69	.06	.58	-.34	.19	-.82	-.20	.58	-.08	.38	.25	-.64	-.22	.04	.22	.36	.72	.11	.28	.35	-.40	.78	.65	.77	1.00			
Y	.13	-.21	.25	.04	.08	.23	-.31	-.44	-.09	-.27	-.01	.50	-.15	-.08	.38	.01	.08	.09	.22	-.22	.18	-.30	.03	.04	.32	.14	1.00		
Zn	-.27	-.48	.18	.19	.30	-.23	-.26	-.11	.52	-.30	.60	.05	-.58	-.19	.24	.00	.15	-.04	.57	.53	-.01	-.29	.34	-.08	.40	.19	-.02	1.00	
Thick	.15	-.08	-.16	-.09	.29	.15	.07	-.28	.16	-.29	-.09	-.12	-.12	-.06	-.19	.32	-.29	.02	.30	.01	.22	-.29	-.05	.00	.12	.11	.13	.15	1.00

	Depth	Al	Ca	Co	Cu	Fe	K	Mg	Mn	Na	Ni	P	Si	Ti	CO2	H2O+	H2O-	As	Ba	Cd	Ce	Cr	Mo	Pb	Sr	V	Y	Zn	Thick
Depth	259																												
Al	259	259																											
Ca	259	259	259																										
Co	259	259	259	259																									
Cu	259	259	259	259	259																								
Fe	259	259	259	259	259	259																							
K	259	259	259	259	259	259	259																						
Mg	259	259	259	259	259	259	259	259																					
Mn	259	259	259	259	259	259	259	259	259																				
Na	259	259	259	259	259	259	259	259	259	259																			
Ni	259	259	259	259	259	259	259	259	259	259	259																		
P	259	259	259	259	259	259	259	259	259	259	259	259																	
Si	259	259	259	259	259	259	259	259	259	259	259	259	259																
Ti	259	259	259	259	259	259	259	259	259	259	259	259	259	259															
CO2	257	257	257	257	257	257	257	257	257	257	257	257	257	257	257														
H2O+	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259													
H2O-	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259												
As	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259											
Ba	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259										
Cd	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	258									
Ce	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	257	258								
Cr	207	207	207	207	207	207	207	207	207	207	207	207	207	207	205	207	207	207	207	206	206	207							
Mo	255	255	255	255	255	255	255	255	255	255	255	255	255	255	253	255	255	255	255	255	254	203	255						
Pb	257	257	257	257	257	257	257	257	257	257	257	257	257	257	255	257	257	257	257	256	257	205	254	257					
Sr	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259				
V	258	258	258	258	258	258	258	258	258	258	258	258	258	258	256	258	258	258	258	257	258	206	254	257	258	258			
Y	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259	258	259		
Zn	259	259	259	259	259	259	259	259	259	259	259	259	259	259	257	259	259	259	259	258	258	207	255	257	259	258	259	259	
Thick	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	99	100	99	99	100	99	100	100	100

Principal components analysis

Q-mode factor analysis was undertaken on an earlier data set, using standard methodologies as discussed in Harman (1967) and Davis (1986). Partial results were reported in Manheim and Lane (1987). Since the results yield little difference from relationships already noted from plots and the correlation matrices we offer only highlights here. For large data sets a "Mn oxide" factor includes Mo, Ni, Mn, Sr, Pb, Co, and V; a factor described as "Fe-Lat" includes Fe, latitude and Pb; and a "aluminosilicate phase" factor includes K, Al,mg and depth. A "depth" factor includes Na, Fe, depth and Cu, and a "phosphate" factor selected Ca, Y, P, Ba, CO_2, and Sr. Finally, with a small data set consisiting of tops of seamount crusts collected by the "S.P. Lee" cruise in 1983 an additional Ba-Zn-Cd factor not previously discerned was suggested.

Bathymetric base map

Because crusts are closely related, both by habitat and chemistry, to distinct topographic zones we have prepared a bathymetric base map for active investigation areas in the Central Pacific Ocean. Bathymetric data for the Central Pacific map in the pocket are plotted on a spheroidal Mercator projection using the National Geophysical Data Center gridded bathymetric data set, DBDB5. Computer contouring was performed by Peter Sloss at NGDC, Boulder, with subsequent modifications at Woods Hole. The computer contours have been manually smoothed in drafting, and obviously improper or erratic features such as line crossings removed or modified. A subprogram has been used to identify ambiguous contours and permit additional labelling.

The basemap is of importance because navigation problems have led to conflicting and questionable locations for given seamounts. The DBDB5 database, referred to in earlier versions as the U.S. Navy SYNBAPS, is a subset of the NGDC ETOPO5 database which is the most carefully controlled and readily available gridded global elevation data set known to us. It is stored as 360-degree longitude circles for each 5 minutes of latitude starting at the North pole and stepping southward. Each logical record contains 4320 (360 x 12) 5-minute grid points, and there are 2160 logical records in the file. Data values are positive above sea level and negative below and are given to the nearest whole meter. Following general oceanographic practice, the tape is "uncorrected" for local sound velocity, which permits intercorrelation with most bathymetric data bases of large scale.

Coastlines and land areas associated with ETOPO5 tend to be schematic and are often inaccurate. Hence, we have utilized the World Data Bank II (1984) data set for coastlines and land areas. We have added to the Central Pacific base map station locations and contours for normalized cobalt concentration for all depths.

Maps of elements

Graphic displays of chemical elements and components in map format offer many striking relationships. In this section we use two alternative display modes. The first, is computer gridding and contouring, and the second replaces contouring by gray scale maps. Computer gridding, interpolation and contouring are procedures that can yield very different final products, depending on the parameters utilized. The following briefly describes the parameters used in

this study. The GRIDS and CONTOUR subroutines were written by G. Evenden of this Branch.

GRIDS superimposes a rectangular grid on the area desired to be mapped, bounded by lat1, lat2, long1, and long2. A cell size of 1 cm for the original map size of 1:5,000,000 is arbitrarily chosen to correspond to an apparent sample density ranging from 0 to 10 points per cell. The interpolation method fits a least squares polynomial surface to the data points. The intersection of the surface with the grid establishes nodal values, which can then be contoured. In our gridding we arbitrarily chose a search radius of 5 cm. This ensures continuous interpolation in areas such as the northeast Pacific and Southeast Pacific, where relatively few data points are available, but where it is geologically reasonable to estimate data values.

The gridding option we chose divided points within the search radius into octants or pie slices, with no more than 10 points per octant. Cells that have more than 3 conterminous empty octants will be rejected, yielding "white space" on the map for these areas.

After examining 0th, 1st and 2nd degree polynomial surface options, we chose the first degree surface to establish nodal grid values for most maps. This permits relatively high-resolution mapping, and closer conformity of contours to actual data points, especially in the Central Pacific where the greatest data density is available. The computer derived contours, slightly smoothed manually in drafting, have been modified to remove some closely spaced contours in areas of sparse data coverage, where this degree of detail is not justified, to connect contours where continuity appears reasonable and to terminate contours at the coasts where needed. The influence of the change in elemental values that is often obtained due to the influence of the continental margin, could not be incorporated into the gridding software. For example, cobalt values often decrease to about the 0.1 percent level at or near the shelf break. Thus, unrealistic values may be projected by contours in close proximity to land areas.

The normalized cobalt map at a >4000 m depth horizon (Figs. IX-20) is gridded with fewer data points. For this figure we have utilized the zero-degree polynomial surface function. This yields smoother, more generalized contours whose nodal values may not "honor the data points"; i.e. contours drawn through the nodal values do not necessarily agree with the data points themselves, but project the influence of data values to greater distances from these points. It should be noted that this map and a large base map were drawn on the database at an earlier date (early 1986) than the other maps. However regional anomalies depicted by the contours are little affected.

The regional base map in the pocket of the first production of this report also excluded points having Mn/Fe values of <.5 and >5 in order to emphasize "normal" hydrogenetic crust distribution. In the Central Pacific area, occasional older generation of hydrothermal crusts have been found (Manheim and Halbach, 1984; DeCarlo and others, 1987). The recent maps located at the end of this chapter eliminate these restrictions, which permits more detailed control in the more peripheral areas of the Pacific ocean.

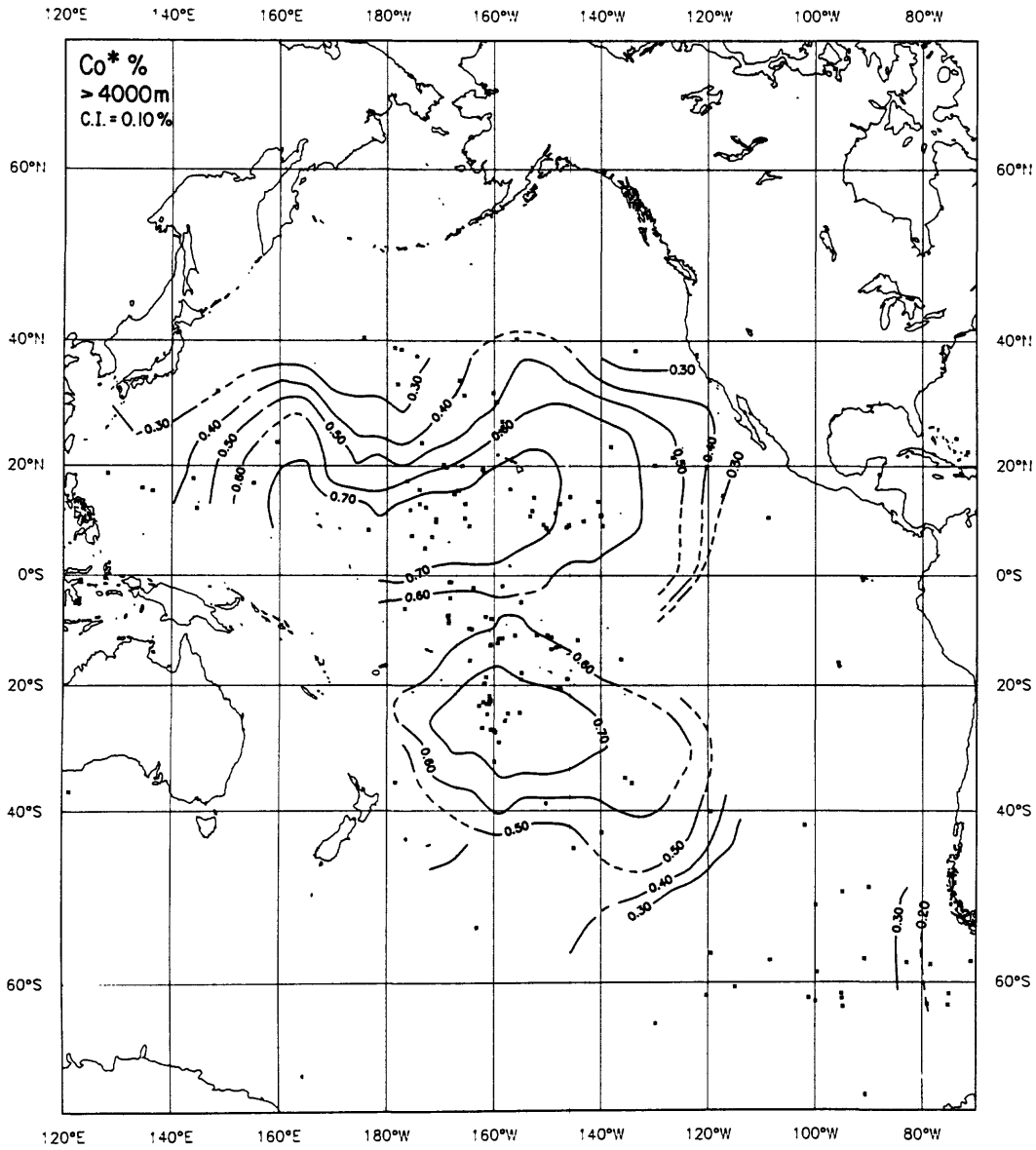


Figure IX-20 Elemental concentration of normalized cobalt in the Pacific Ocean, water depths > 4000m.

Where appropriate we have displayed both the contoured and gray scale maps for a particular element (Figs. IX-21 to IX-65). Most of the trace elements are shown only in the gray scale map output. Both contour and gray-scale maps are based on a grid cell size of 1 cm for a 1:50 million map. Contoured and gray scale maps each have their advantages and disadvantages. Contours offer greater detail, but also have greater potential to mislead, if not carefully controlled and checked. The gray scale maps are particularly effective and convenient for the minor constituents that have lesser sample coverage.

Within the main Central Pacific seamount crust areas manganese oxides of hydrothermal origin are rare, and when found usually can be shown to be formed early in seamount history (Halbach and Manheim, 1984). On the other hand, in the eastern Pacific large regional areas are characterized by modern and subrecent hydrothermal influence (Manheim, Lane-Bostwick, 1988). This means that for insight into the distribution of hydrothermal phases, maps of normalized but unqualified data provide a better indicator of the extent of chemical influence of hydrothermally discharged water on the Pacific Ocean floor. These relationships indicate that no one data set can be used for all purposes; one must be prepared to explore a variety of data combinations, manipulations, and presentation modes to realize the full value of available information.

In Table IX-13 we give a brief discussion of some major features of crust composition and their relationships, as depicted in (Figs. IX-21 to IX-65). It is noteworthy that in virtually all cases large regional features of composition are the rule, not scattered local patterns. We believe that these large features support the hypothesis (Manheim, 1986, and references cited) that metals in crusts come mainly from ambient water rather than from underlying sediment and rock substrates. Abyssal manganese nodules, in contrast, get much of their metal content from host sediments (Dymond and others, 1984, and references cited).

Cobalt is probably the most distinctive representative of hydrogenetic metals in crusts, and its distribution is particularly informative of processes taking place in the bottom water-crust interface. From the regional point of view cobalt-enriched areas occupy the central parts of the Pacific ocean, far from continental influence or sources of Fe and Mn, such as the vent zones that discharge fluids at temperaturs over 350°C (Von Damm and others, 1985). A recent article suggests that the isolation and selective loss of Fe and Mn from water masses in the central area, not special sources of Co, cause enrichment of Co as well as other metals such as Pb and Ce in these areas (Manheim and Lane-Bostwick, 1988).

From the geochemical point of view the cobalt-depleted areas are of equal interest as the cobalt-enriched ones. We have pointed out that major submarine hydrothermal discharge areas in the Pacific: the Galapagos, Juan de Fuca, and the Tonga-Lau rift zones, and the Marianas back-arc area all are characterized by halos of cobalt-depleted crusts (Manheim and Lane-Bostwick, 1988), and that cobalt (Fig. IX-21, IX-22) serves as a monitor of such discharge in the ocean in the present and the past.

The rate of accumulation of crusts was demonstrated by Halbach and others., 1983 to be inversely proportional to their cobalt content. This relationship was further extended by Manheim (1986) to a variety of marine manganese-rich

sedimentary phases, and suggested to be described by the algorithm $R = 6.8 \times 10/Co^{1.67}$. A preliminary map of accumulation rate based on this algorithm is included in this report (Fig. IX-37, IX-38). The age/Co relationship was analyzed in more detail by F.T. Manheim and D.E. Olson (unpublished data) recently, refining the formula but in general terms confirming the inverse log-linear relationship.

Recent studies have enhanced this data base. Several offer additional discussion of discrete areas in the Pacific Ocean, for which only sparse information existed before: the maps are discussed in more detail by recent field studies of discrete areas, such as those of Chave and others, 1986, DeCarlo and others, 1987 (Circum-Hawaii area); Halbach, 1986, Hein and others, 1985a, 1987 (Mid Pacific Mountains area), Hein and others, 1988 (Marshall Islands area), and Usui (1987) seamount crusts from the Izu-Bonin area, and the De Carlo and others (1988) (Kiribati area). Most recent mean chemical values for discrete areas in the Pacific are given by Hein and others., 1988.

Data from other areas of the world oceans are much sparser than for the Pacific. They were summarized briefly in Manheim (1986), and descriptive statistics are listed in Tables IX-1 to IX-4. In the Atlantic Ocean a large collection of data are available for the Blake Plateau, where pavements having up to 5 cm -thick oxide layers encrust phosphorite substrates under the Gulf Stream. Similar substrates and encrustations are present in the Caribbean (Kang et), 1986, and the Ceira platform off Brazil, and, in the New England Seamounts.

In the Mid-Atlantic Ridge new data by Goddard and others (1987) have obtained compositions that tend to be either Mn or Fe-rich and impoverished in trace metals when they are of hydrothermal origin, or higher in Co, Pb, etc. when they are hydrogenetic. Co values approaching 1.0 percent are obtained in the Sierra Leone Rise area, but reach very low values in the Mid Atlantic Ridge (Goddard and others, 1987) and in the New England Seamount crusts (<.1 percent Co). Values in our data base for the New England Seamount are closer to normal hydrogenetic Atlantic types, and this discrepancy has not been resolved yet.

Synthesis of the Atlantic and Indian crusts has not been undertaken. A greater geographic distribution of crust material needs to be recovered to prepare meaningful regional maps.

Table IX-13. Some principal features of chemical constituents are enumerated below. Areas in the third column refer to enrichments except where noted.

Component	Elements with similar patterns	Regional distributions & notes
A1203	Si(limited)	Lowest in Galapagos rift, Chatham and Shatskiy rise area; high toward polar regions
As	Ce, Pb, Co	Highest in the Tonga-Lau-Fiji area, off southern South America
Ba	Cu, Zn, Ni	Highest in the Clarion-Clipperton fracture zone & Cook Is. area
Ca	P	Wide N-S band in E. Central Pacific; also Peru Basin; probably due mainly to physical phosphorite admixture
Cd	Zn	High in Clarion Clipperton zone but lacks sample distribution
Ce	Co	Low in hydrothermal areas, highest values unclear affinity
Cr	Al	Tonga-Lau-Fiji
Co	Ce, Pb, Ni	Marshall Is., French Polynesia, 140°W, Northern Line Islands, S. Central Pacific
Cu	Zn, Ni, Cd	Clarion-Clipperton zone
Fe	V, Ti	10°S, 110°W, Juan de Fuca, SW of Tasmania, Tonga-Lau-Fiji
mg	Cr	Juan de Fuca fracture zone
Mn	Cu	NW Pacific, SE Pacific, Clarion
Mn/Fe	Cu	Galapagos, Clarion-Clipp., erton zone, Tonga Lau-Fiji, Marianas
Mo		Juan de Fuca, NW Pacific
Ni	Cu, Zn	Clarion-Clipperton Zone, off New Zealand, SE Pacific
P	Ca	E. Central Pacific, Peru Trench
Pb	Ce, Co	Enriched areas roughly similar to those of Co
Si/Al	Al	Low near New Zealand

SiO2	Al	Off New Zealand
TiO2		Southern Marshall Is.; 40°S, 130°W Hawaiian Islands
Ti/(Mn+Fe)	Co	Hydrothermal indicator less precise than Co
V	Fe	SE South America, Juan de Fuca (+)
Zn	Cu, Ni, Cd	Clarion Clipperton zone, S. Marshalls, Micronesia(+)

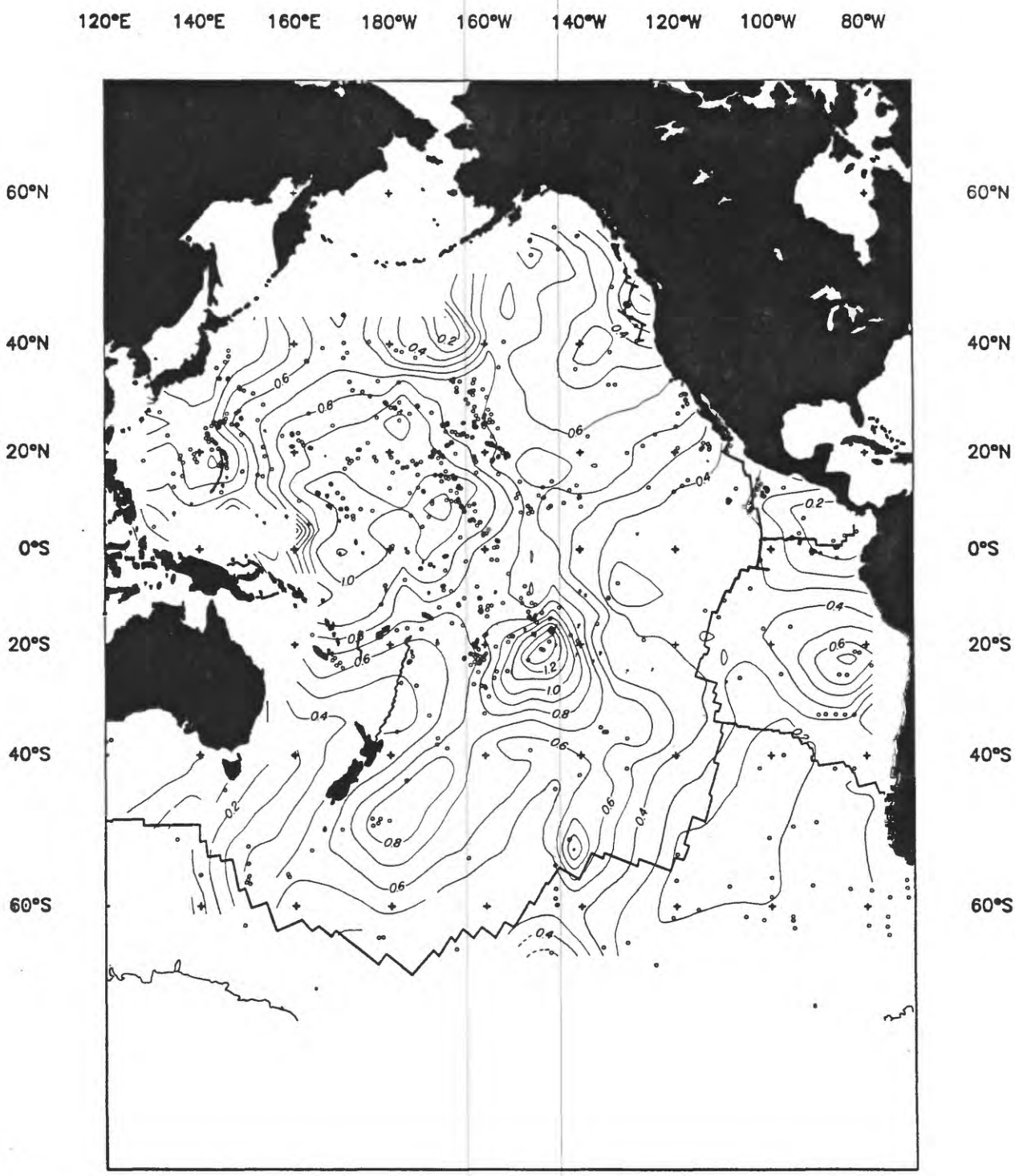


Figure IX-21 Elemental concentration of Co% in the Pacific Ocean, c.i. = .1%

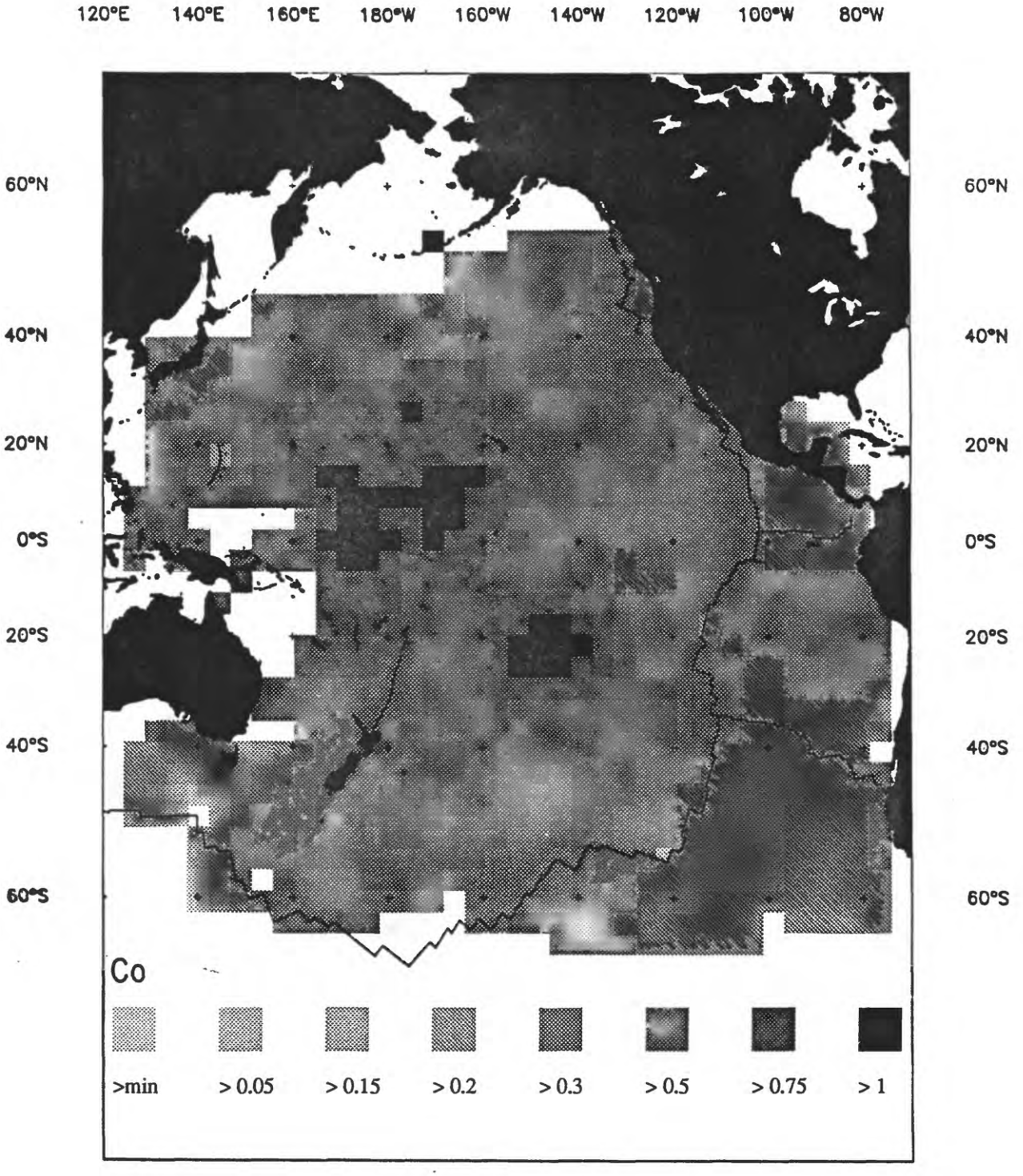


Figure IX-22 Gray scale map of Co% in the Pacific Ocean.

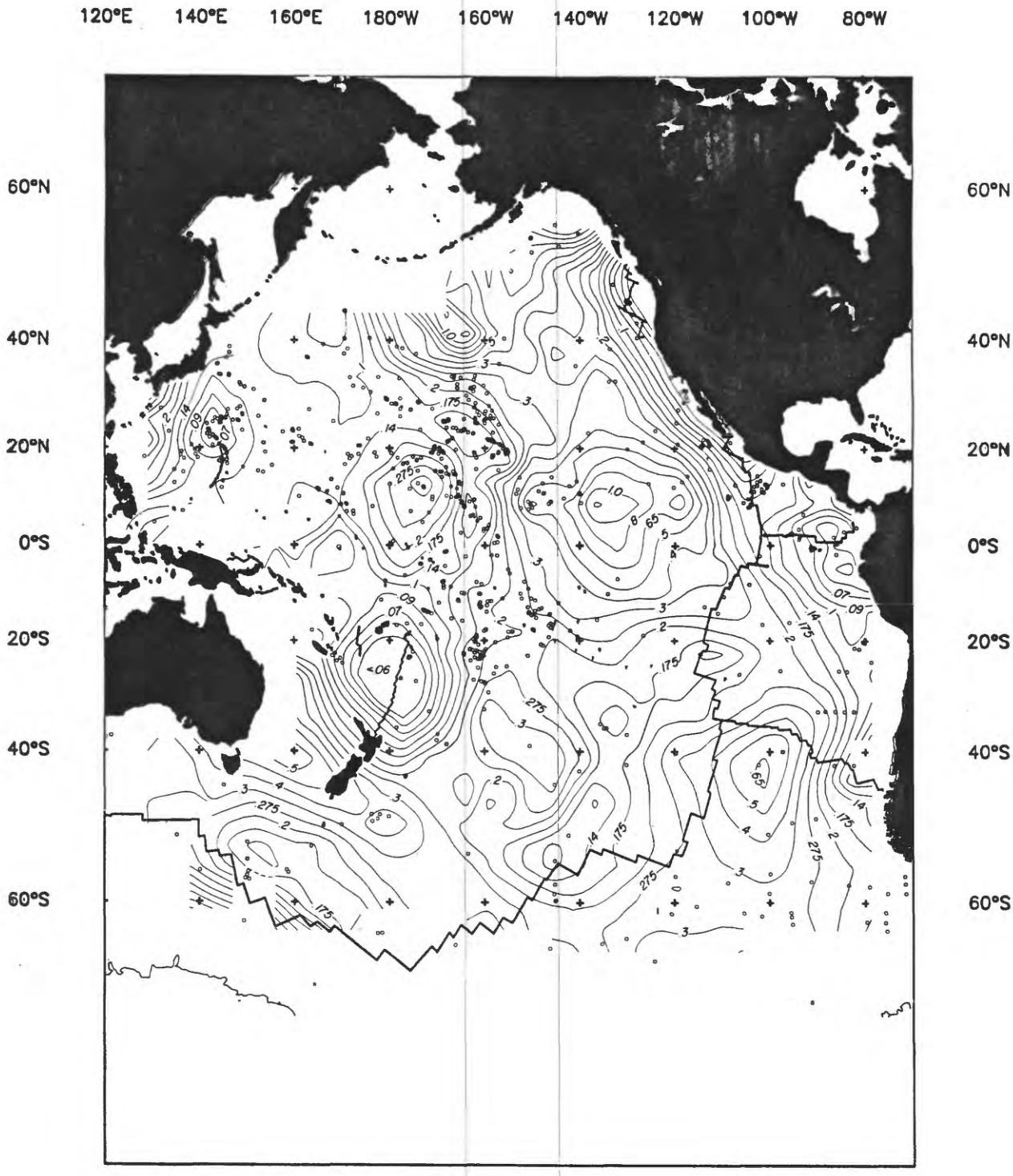


Figure IX-23 Elemental concentration of Cu% in the Pacific Ocean; c.i. n = .2 for Cu% = 3^n.

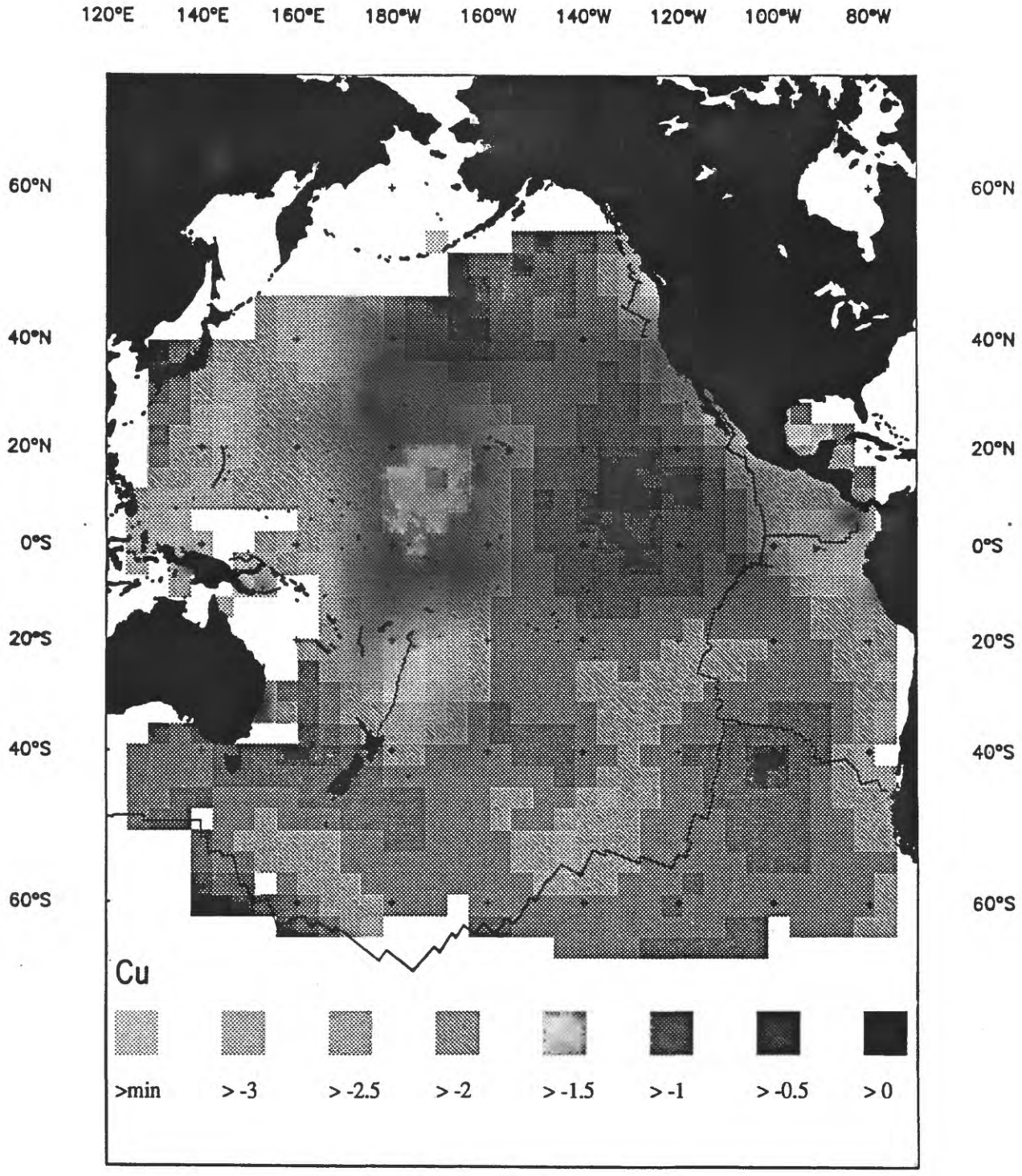


Figure IX-24 Gray scale map of LOG3Cu% in the Pacific Ocean.

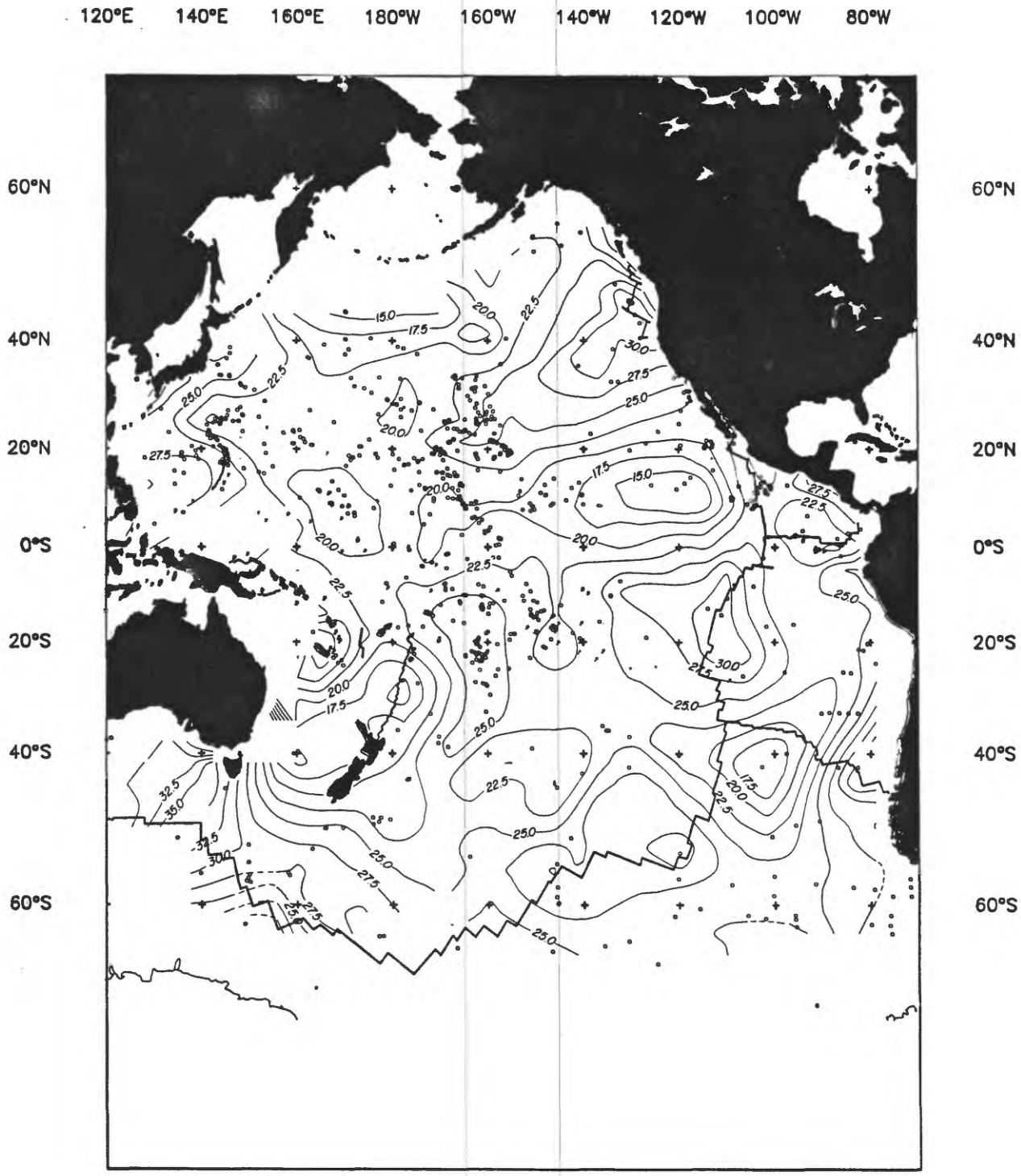


Figure IX-25 Elemental concentration of Fe% in the Pacific Ocean, c.i. = 2.5%

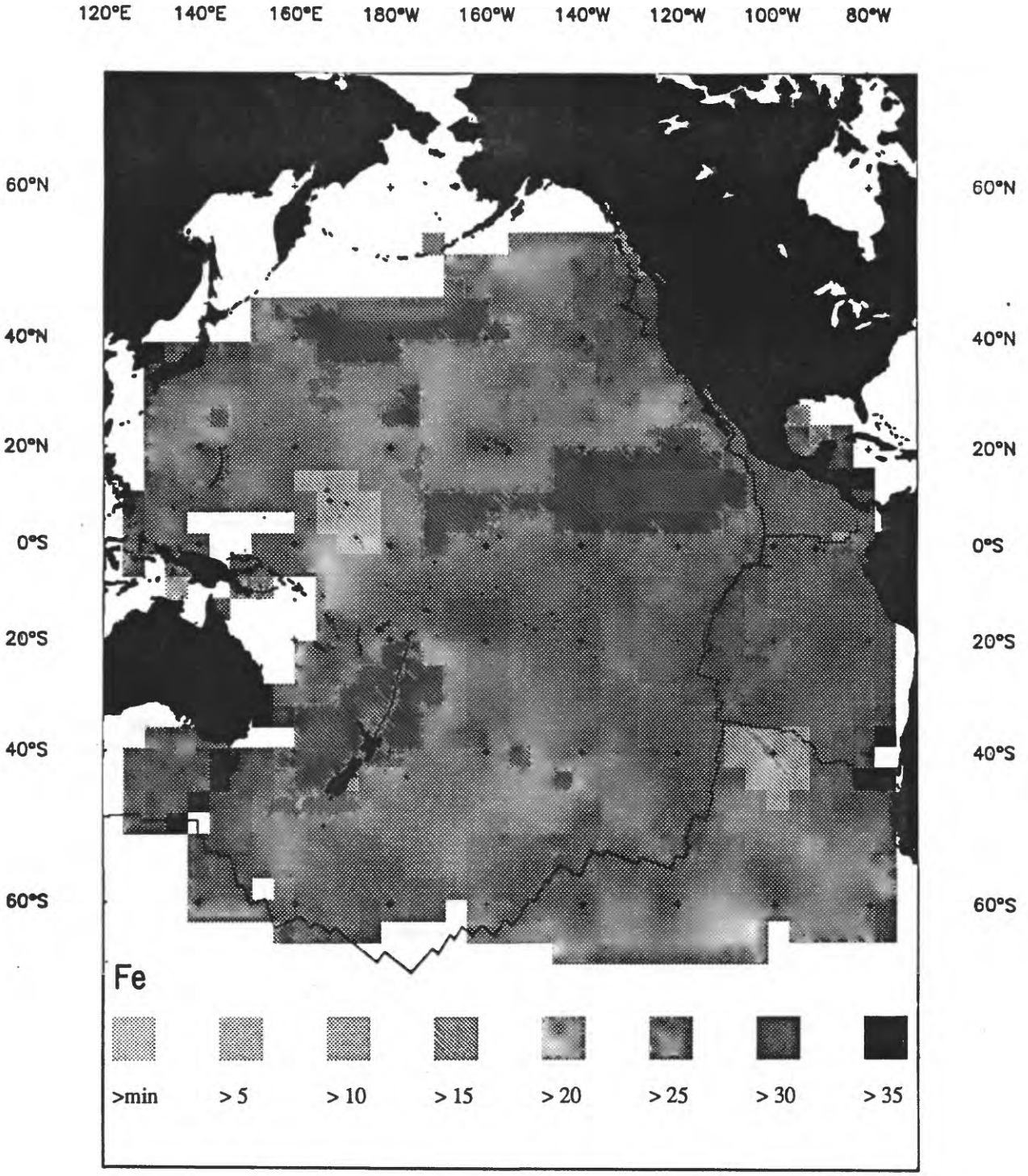


Figure IX-26 Gray scale map of Fe% in the Pacific Ocean.

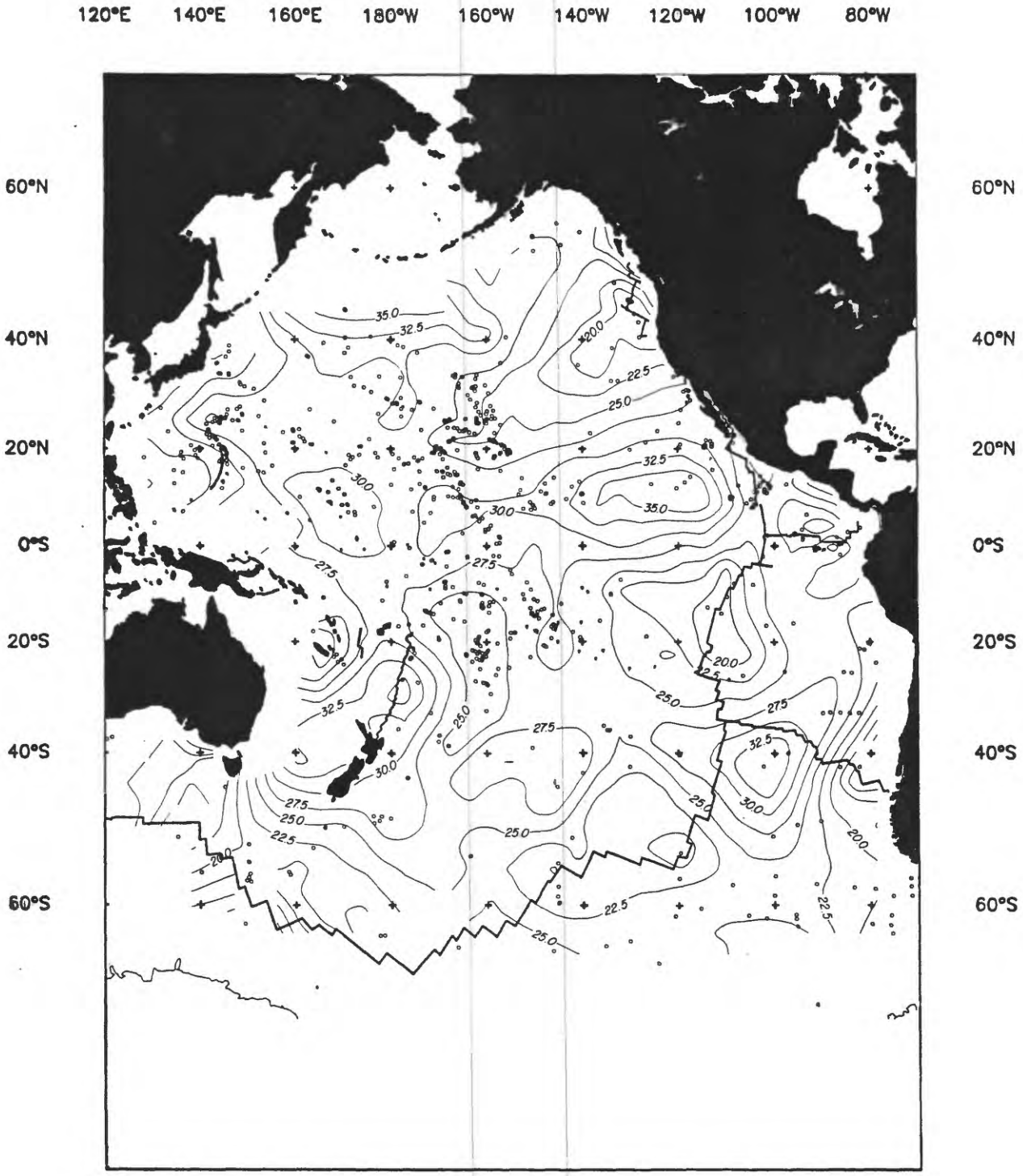


Figure IX-27 Elemental concentration of Mn% in the Pacific Ocean, c.i. = 2.5%

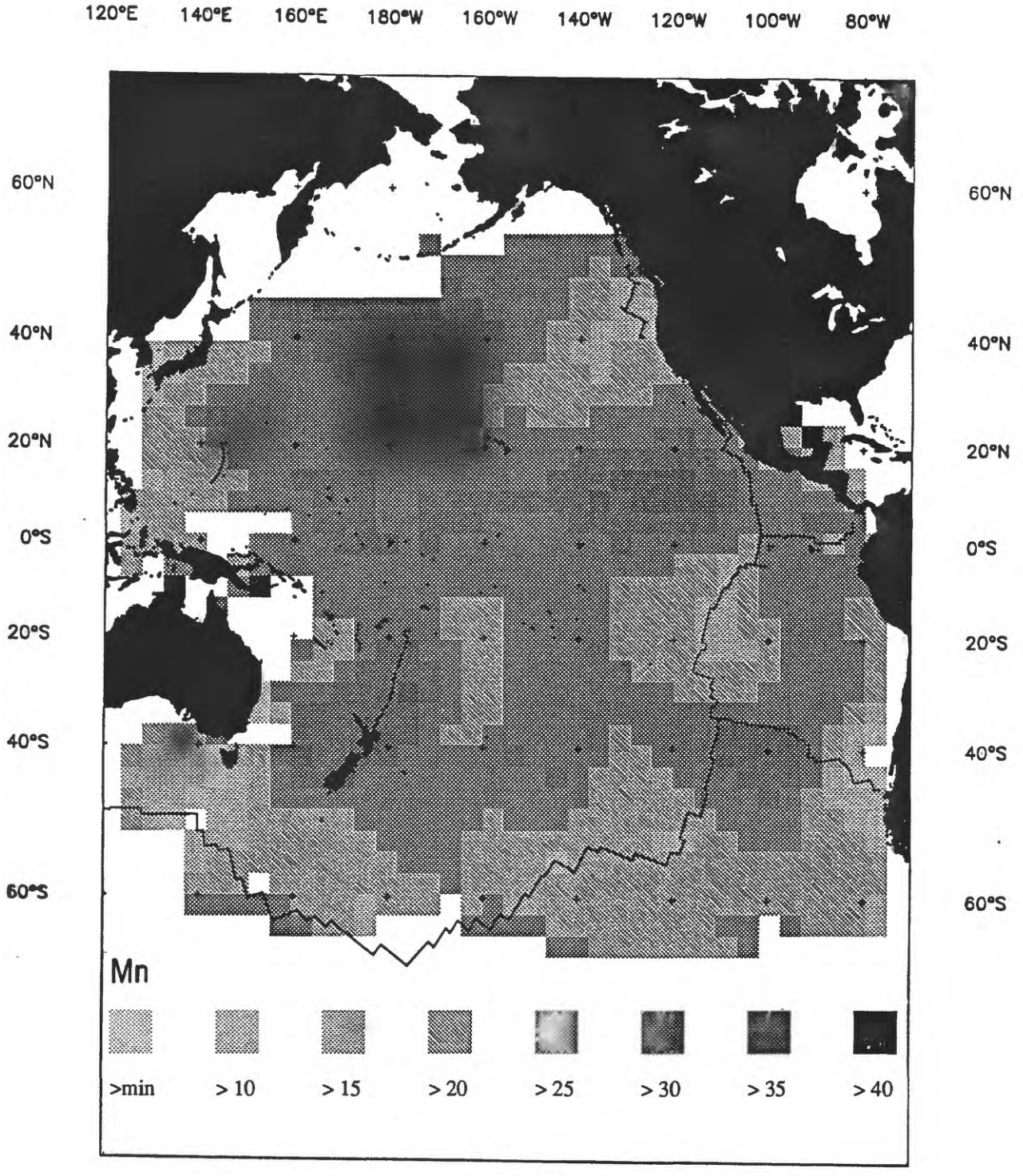


Figure IX-28 Gray scale map of Mn% in the Pacific Ocean.

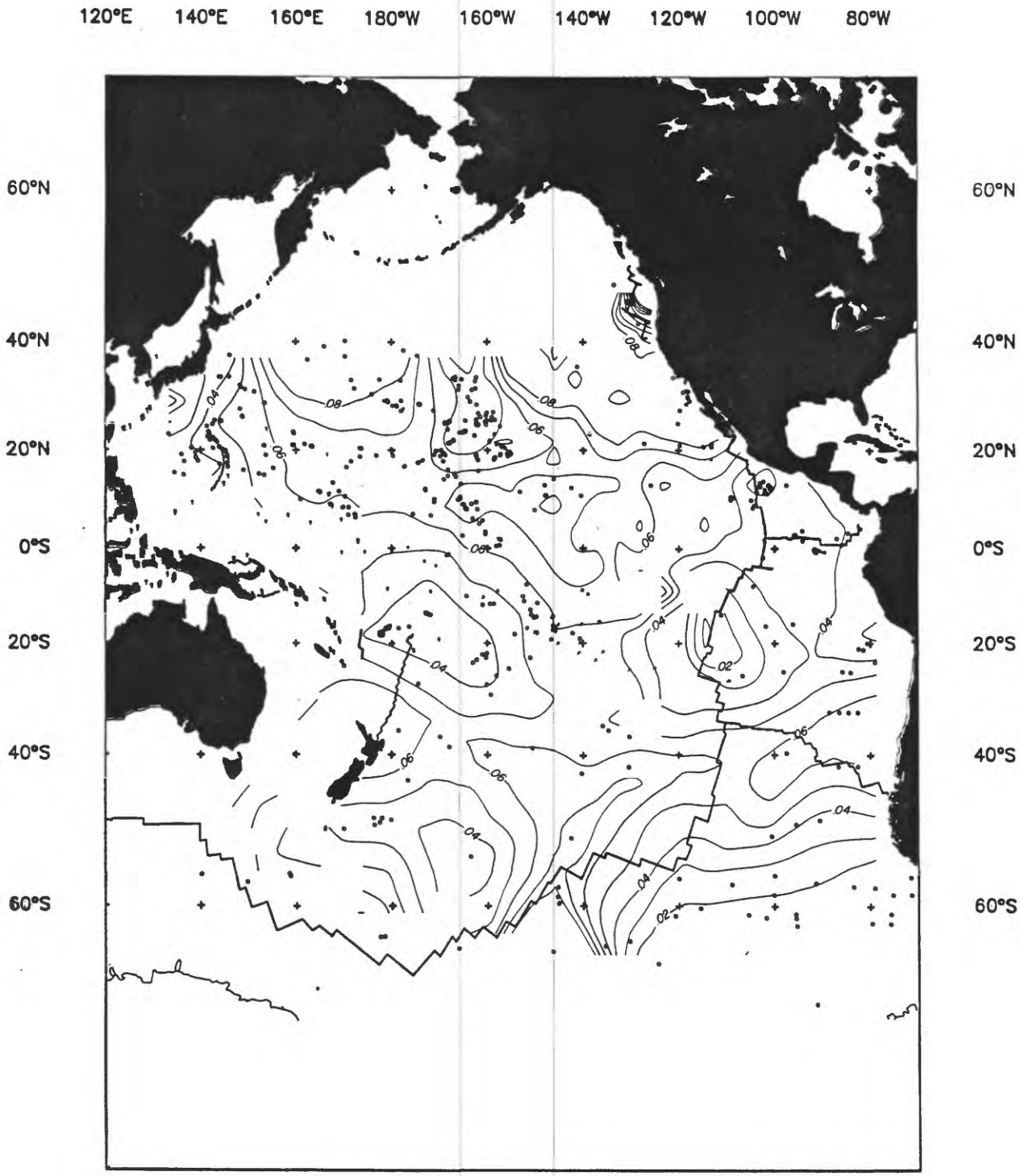


Figure IX-29 Elemental concentration of Mo% in the Pacific Ocean, c.i. = .01%

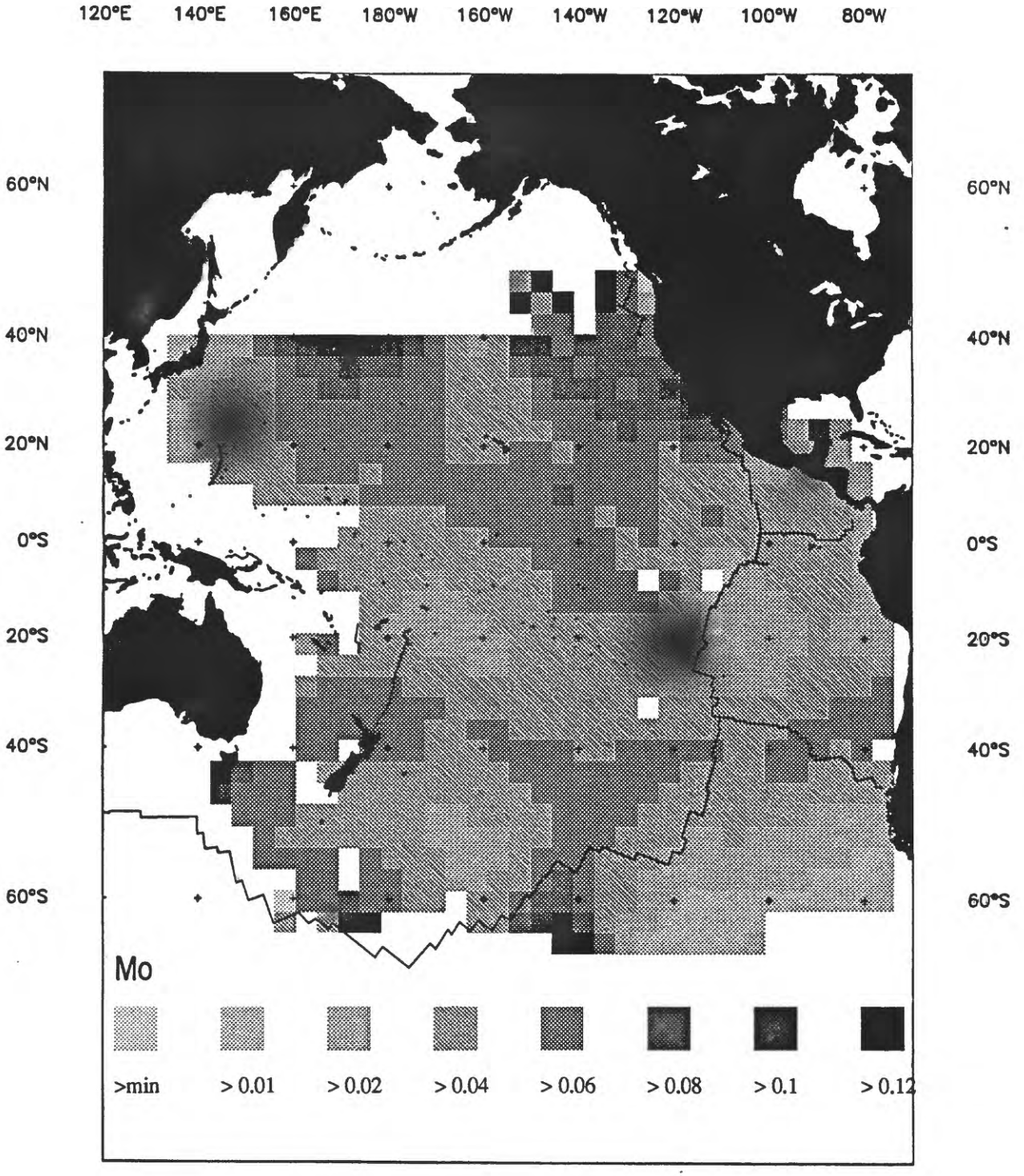


Figure IX-30 Gray scale map of Mo% in the Pacific Ocean.

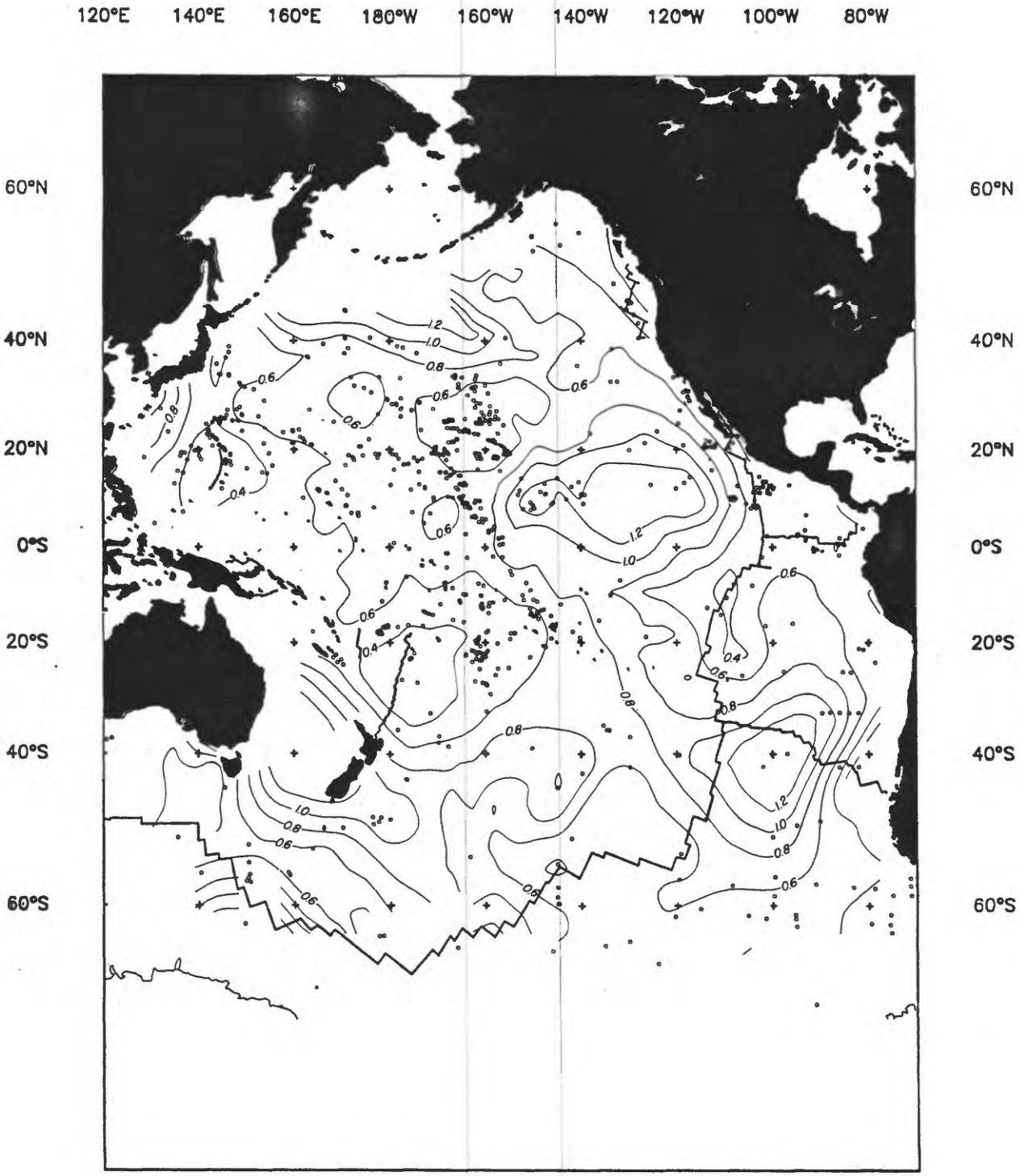


Figure IX-31 Elemental concentration of Ni% in the Pacific Ocean, c.i. = .2%

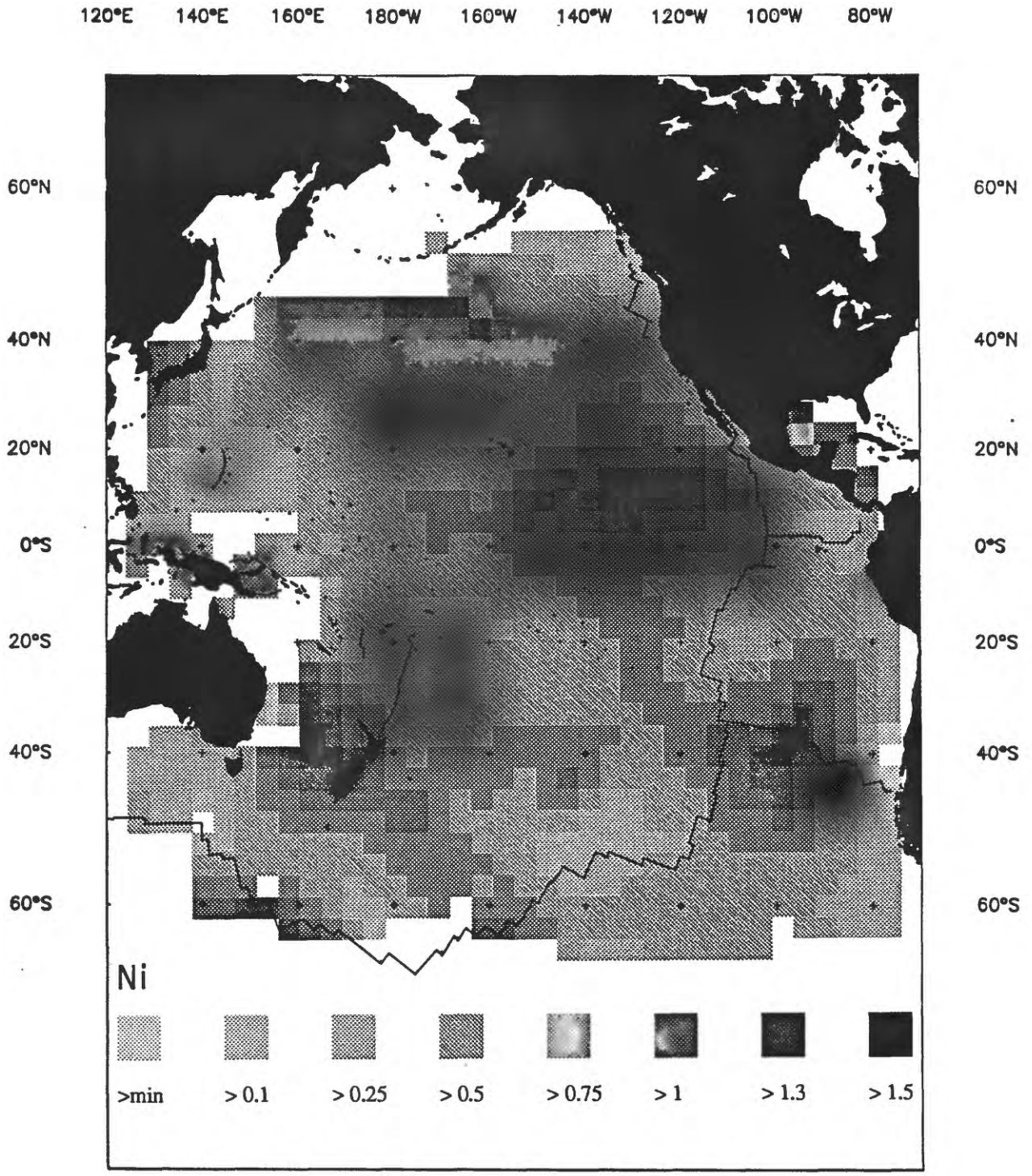


Figure IX-32 Gray scale map of Ni% in the Pacific Ocean.

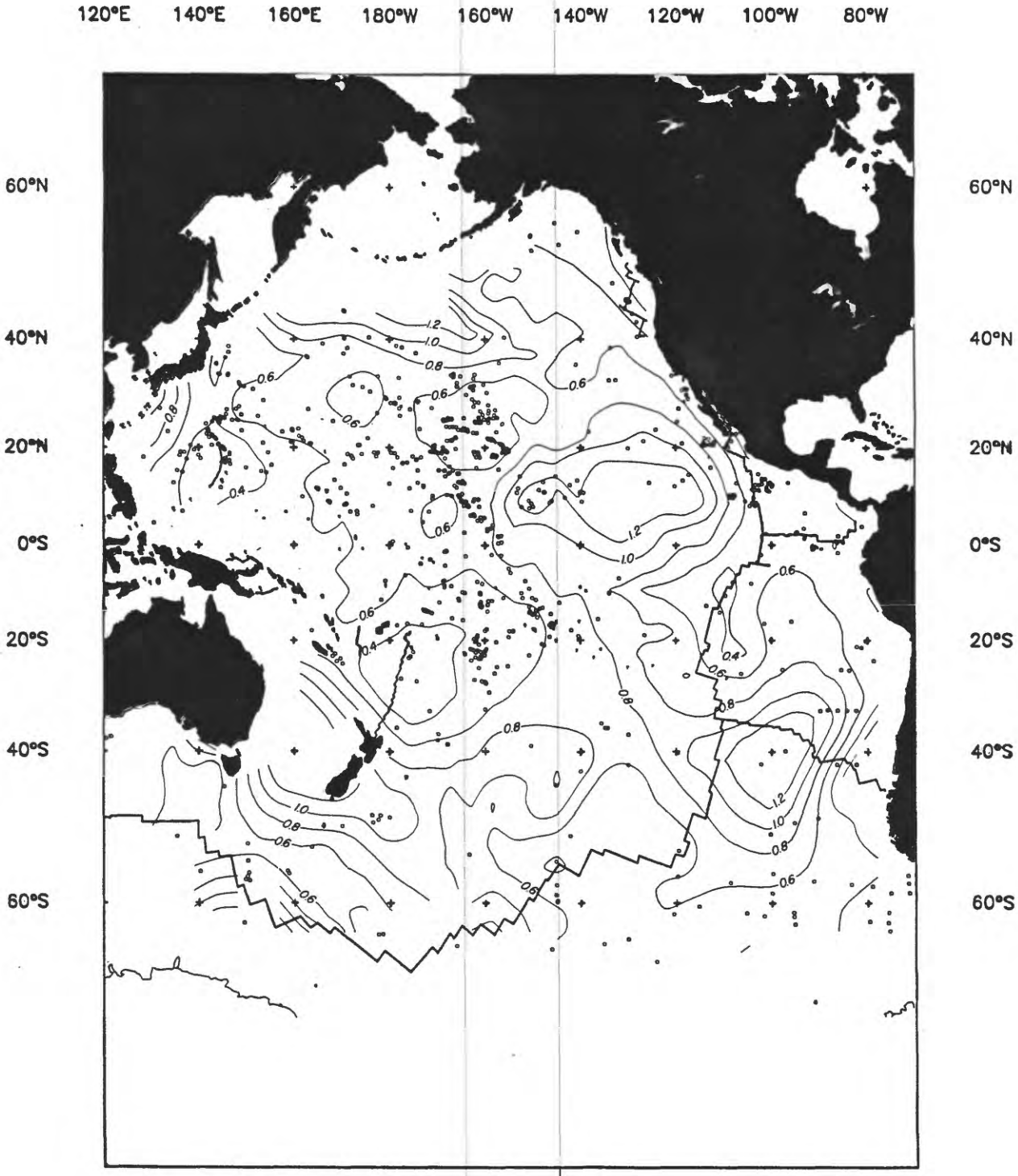


Figure IX-33 Elemental concentration of Ni% in the Pacific Ocean; c.i. n = .2 for Ni% - 3^n.

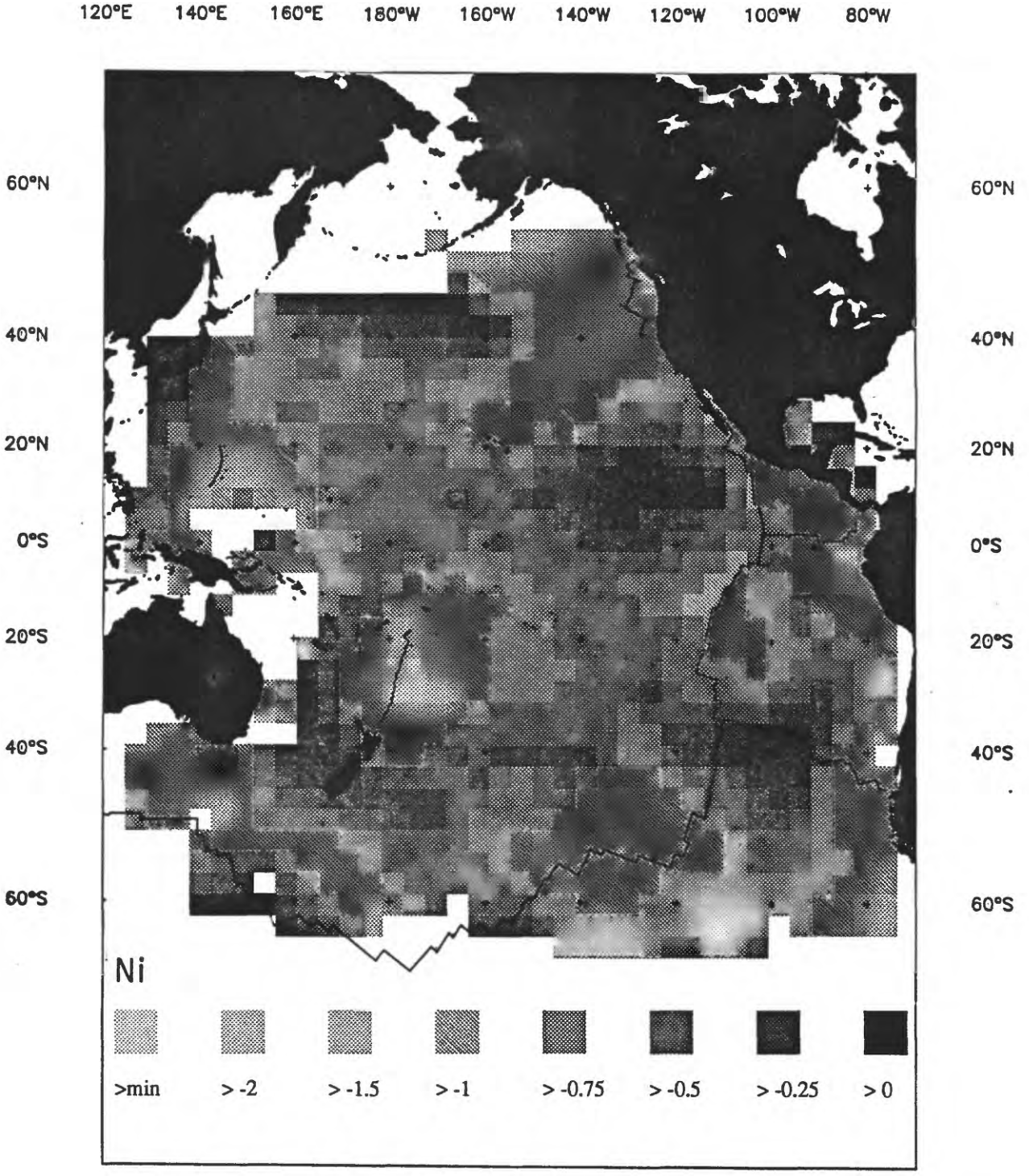


Figure IX-34 Gray scale map of LOG3Ni% in the Pacific Ocean.

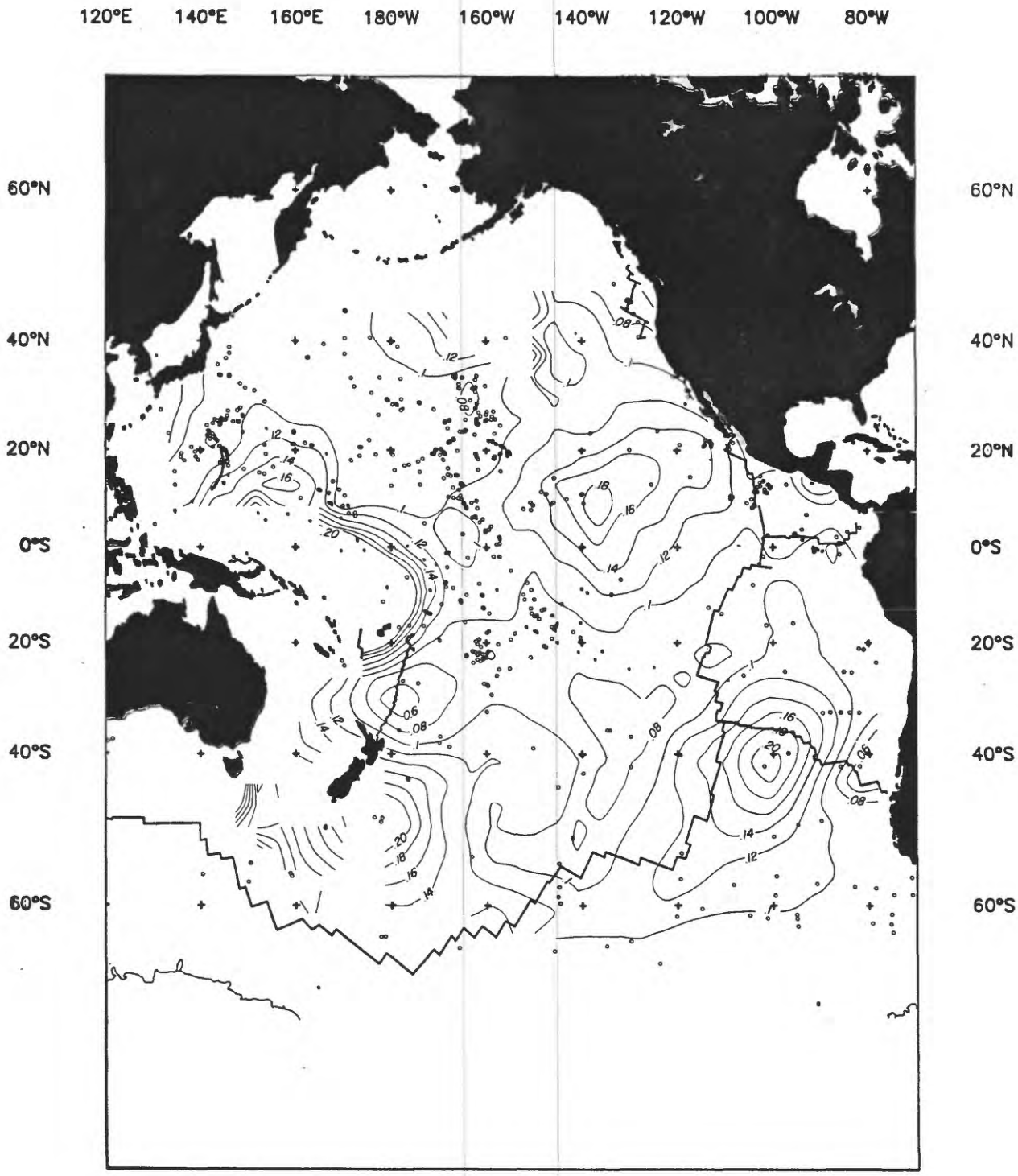


Figure IX-35 Elemental concentration of Zn% in the Pacific Ocean, c.i. = .02%

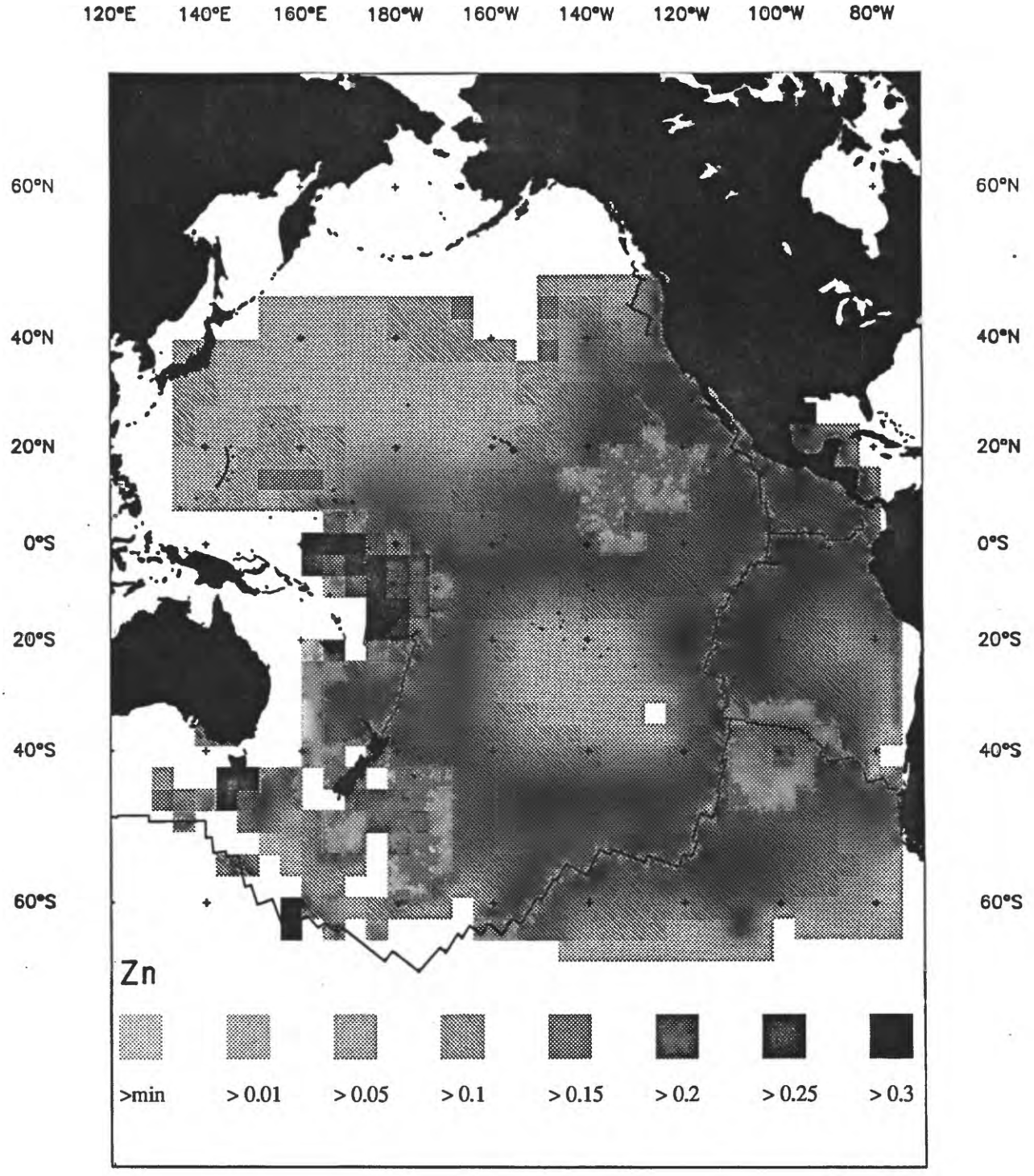


Figure IX-36 Gray scale map of Zn% in the Pacific Ocean.

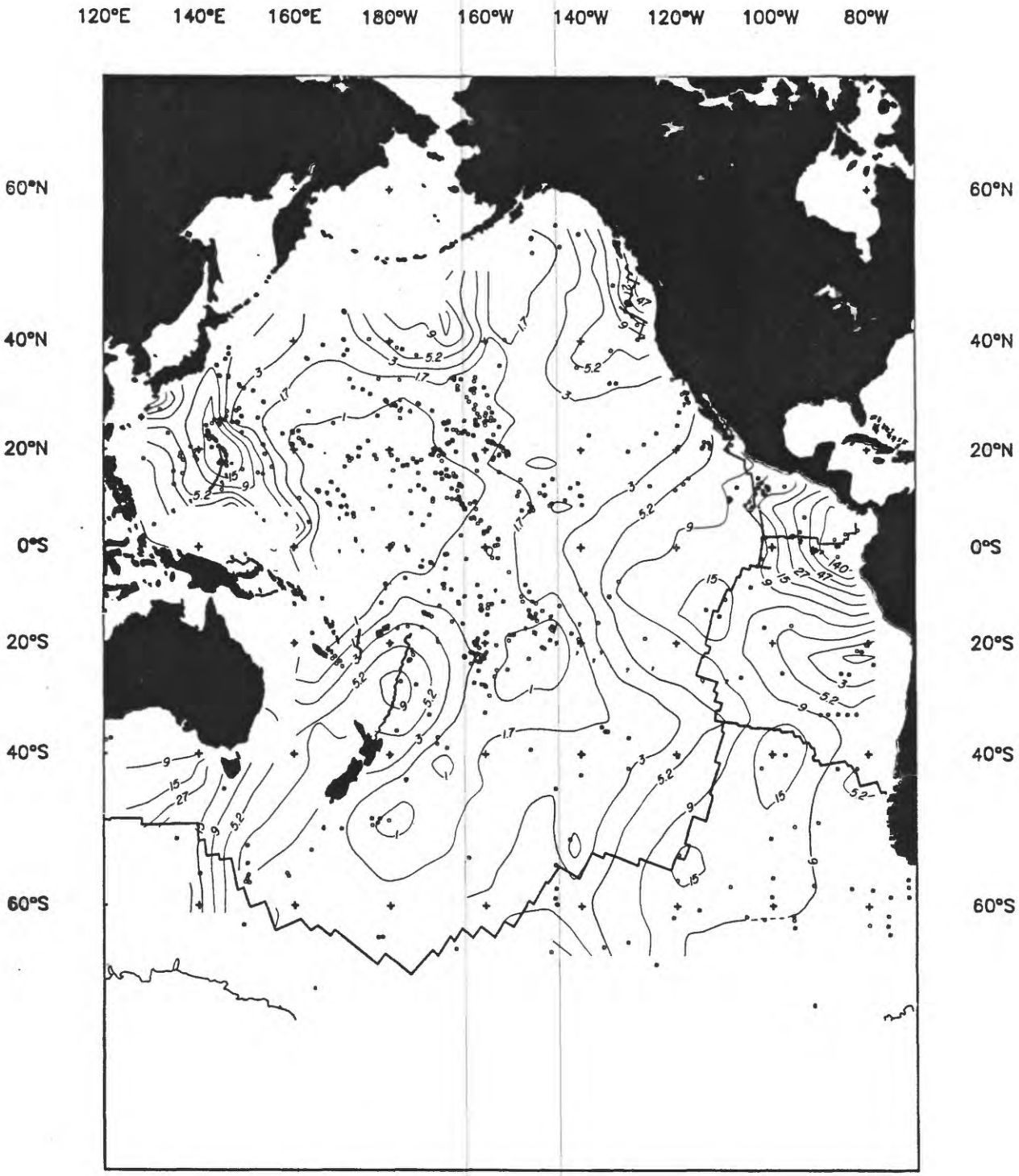


Figure IX-37 Accumulation rate R(mm/m.y.) in the Pacific Ocean; c.i. n = .5 for R = 3^n.

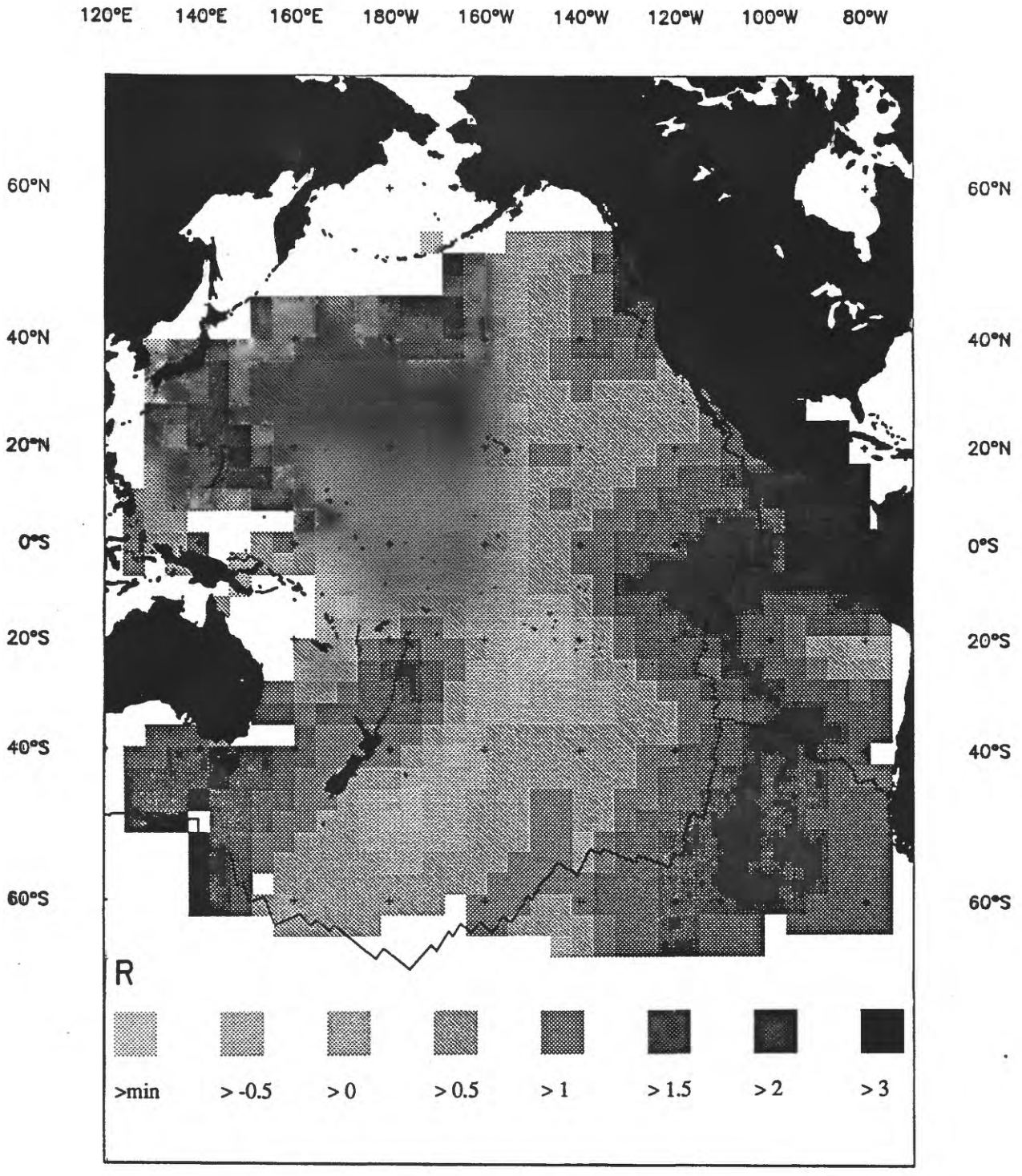


Figure IX-38 Gray scale map of Rmm/m.y. in the Pacific Ocean.

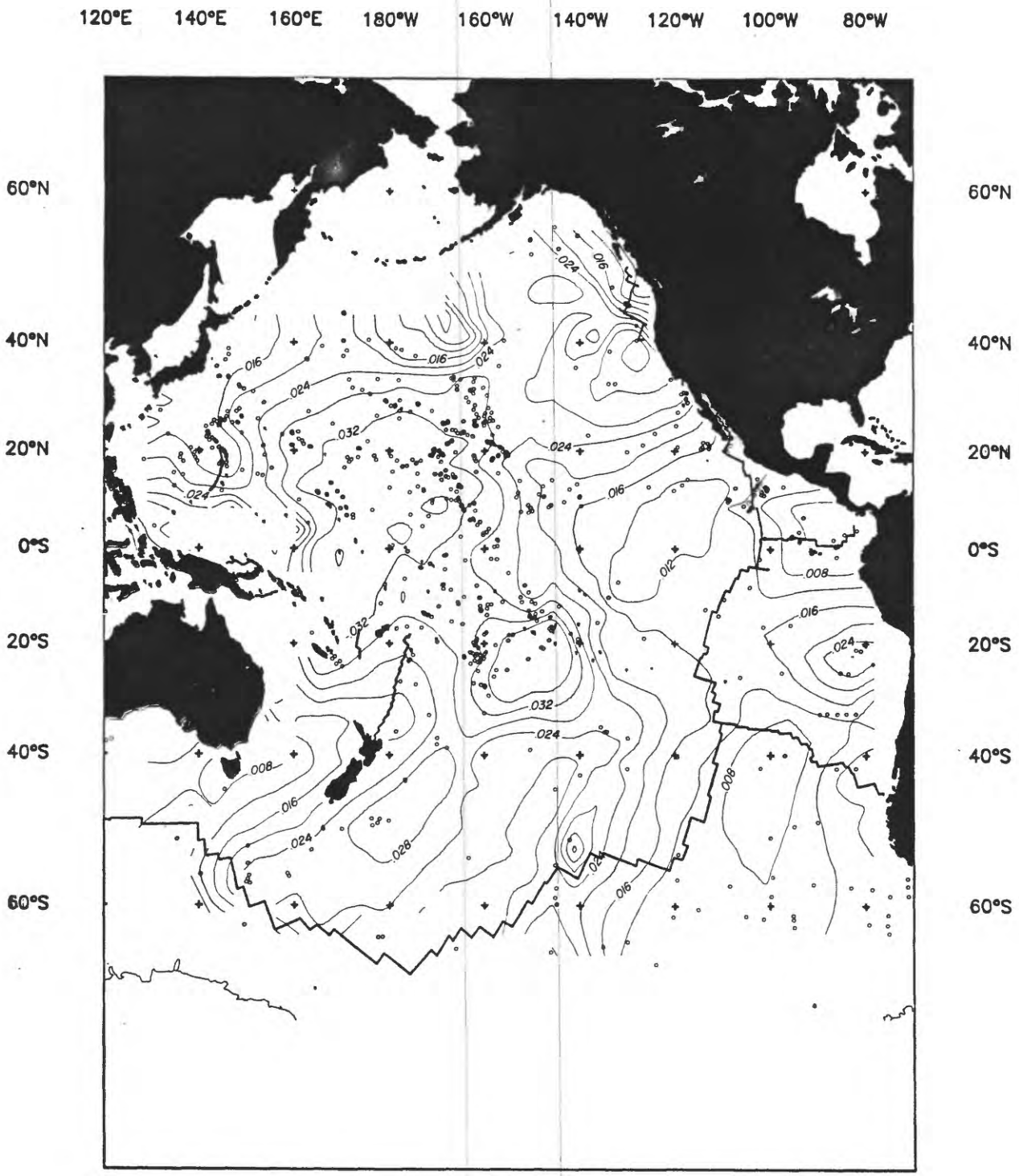


Figure IX-39 Elemental concentration of Co/Mn% in the Pacific Ocean, c.i. = .008%

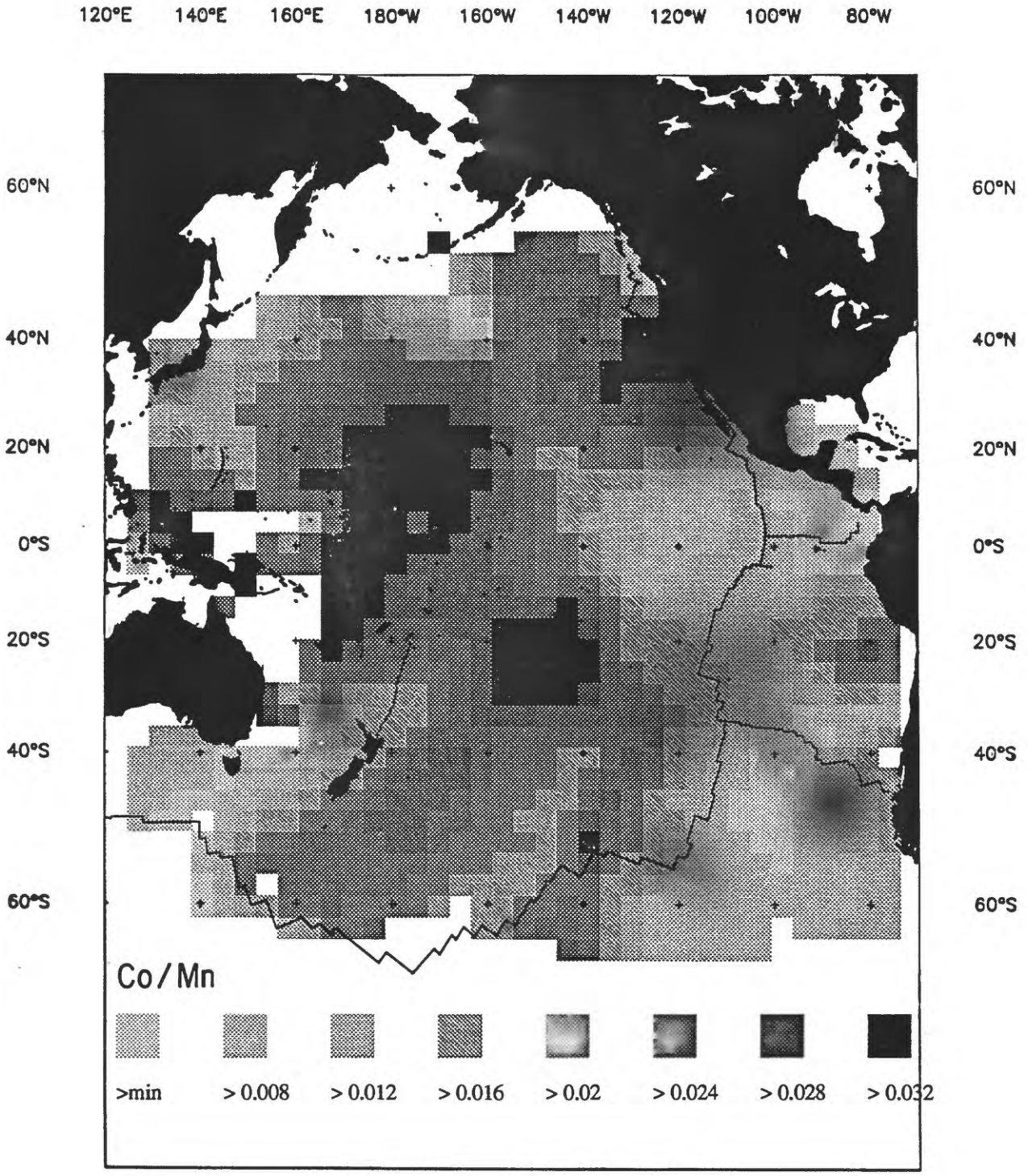


Figure IX-40 Gray scale map of Co/Mn% in the Pacific Ocean.

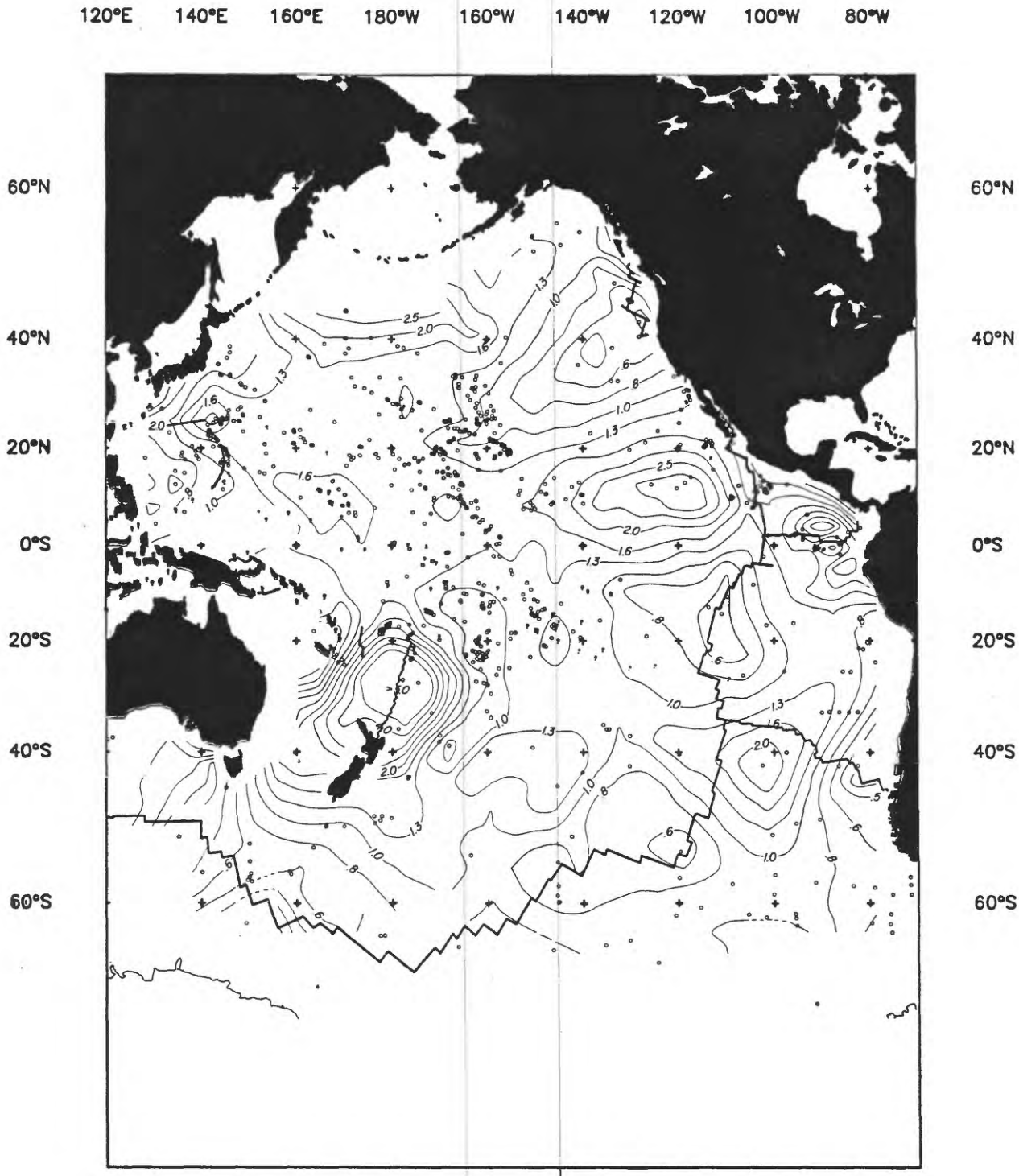


Figure IX-41 Elemental concentration of Mn/Fe in the Pacific Ocean; c.i. n = .1 for Mn/Fe = 10^n.

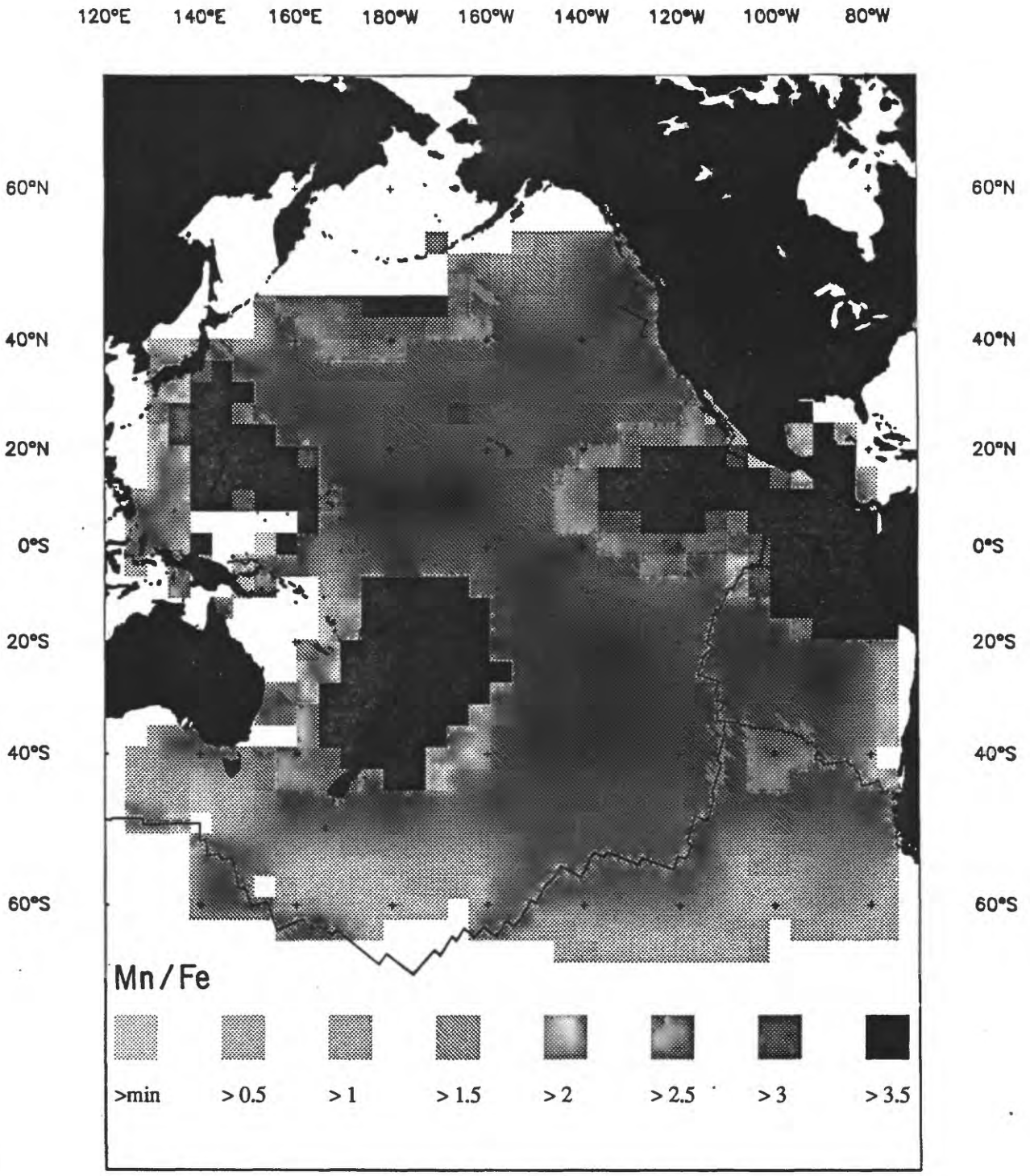


Figure IX-42 Gray scale map of Mn/Fe% in the Pacific Ocean.

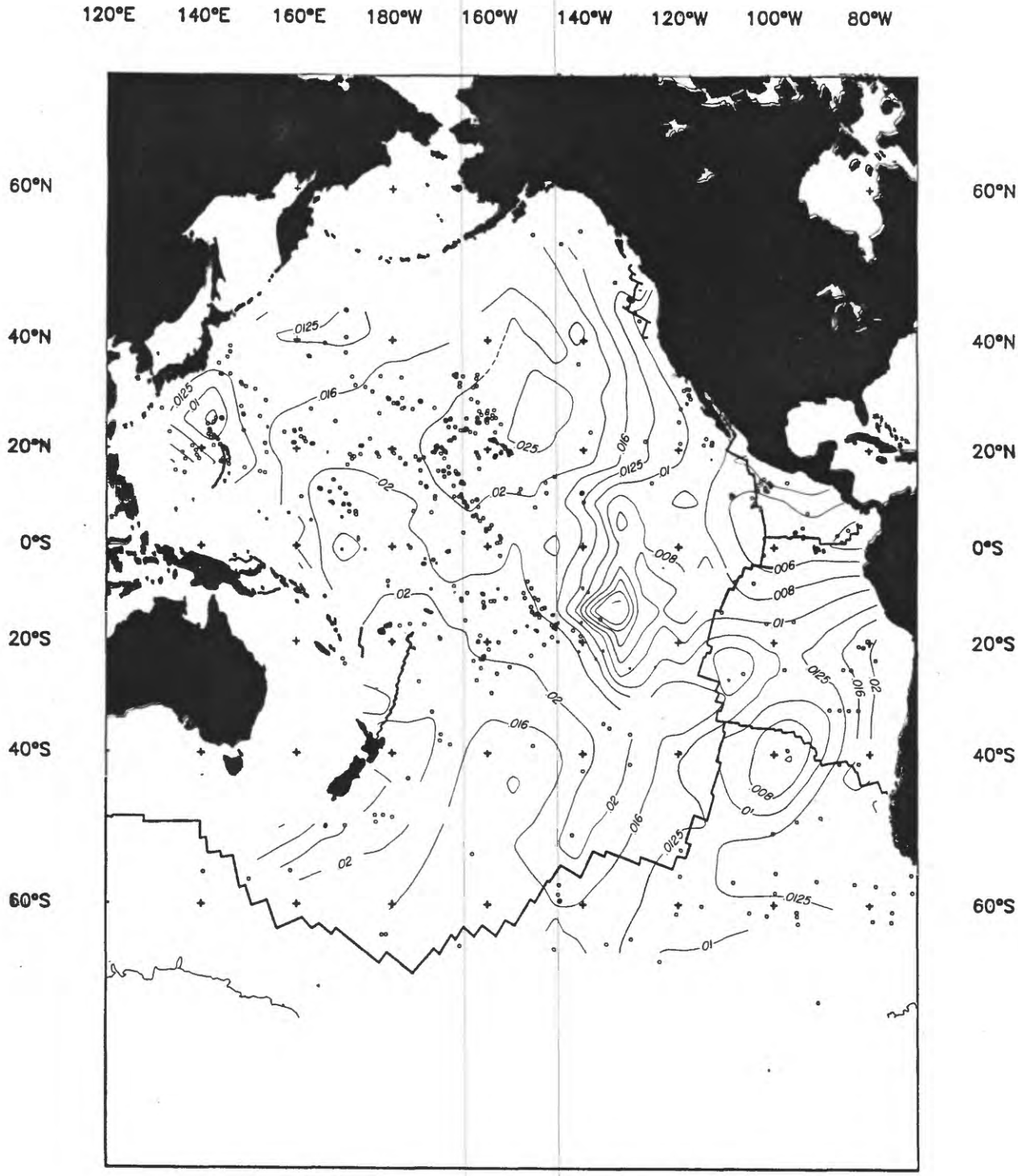


Figure IX-43 Elemental concentration of Ti/(Mn+Fe) in the Pacific Ocean; c.i. n = .1 for Ti/(Mn+Fe) = 10^n.

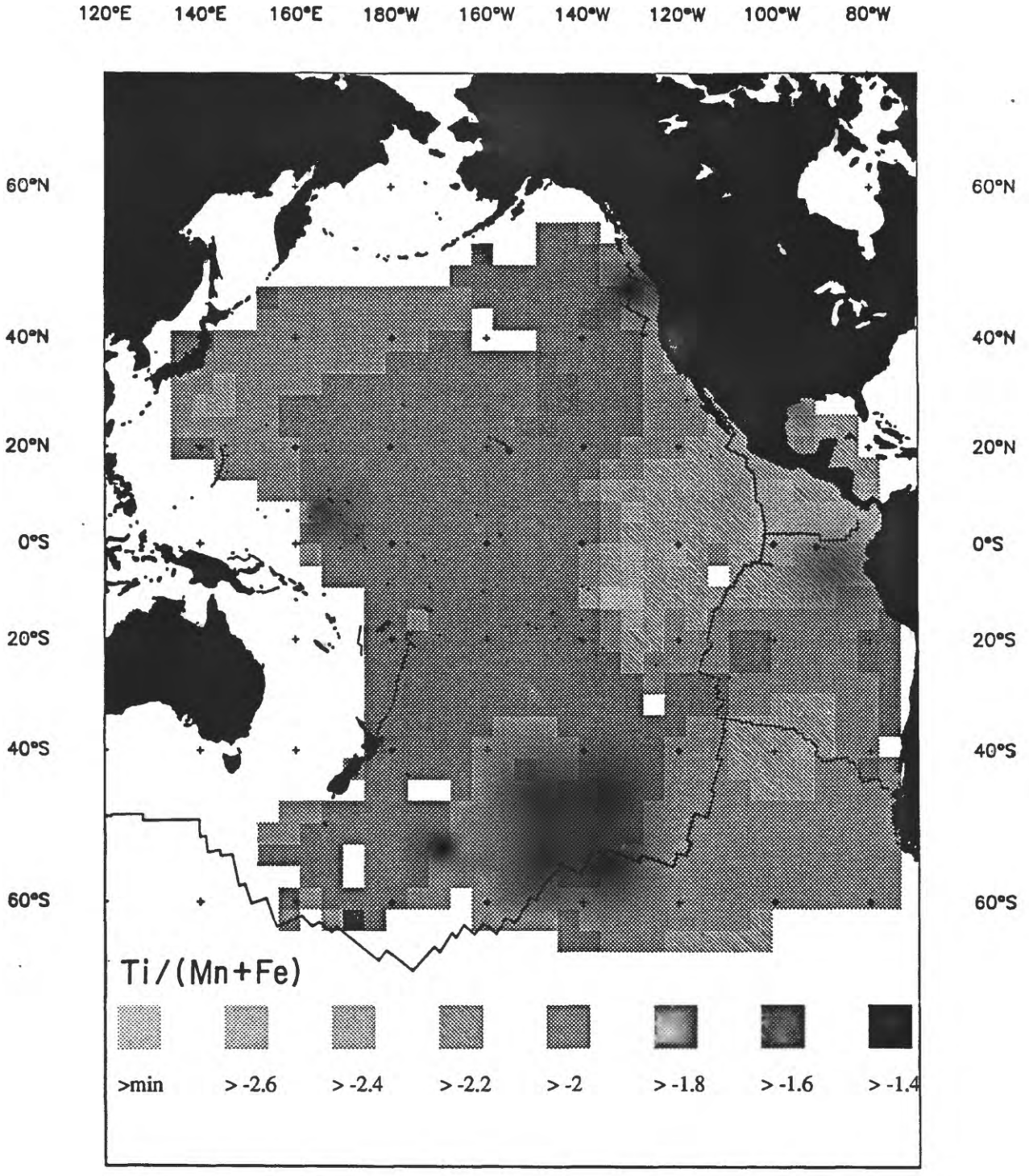


Figure IX-44 Gray scale map of Ti/Mn+Fe(%) in the Pacific Ocean.

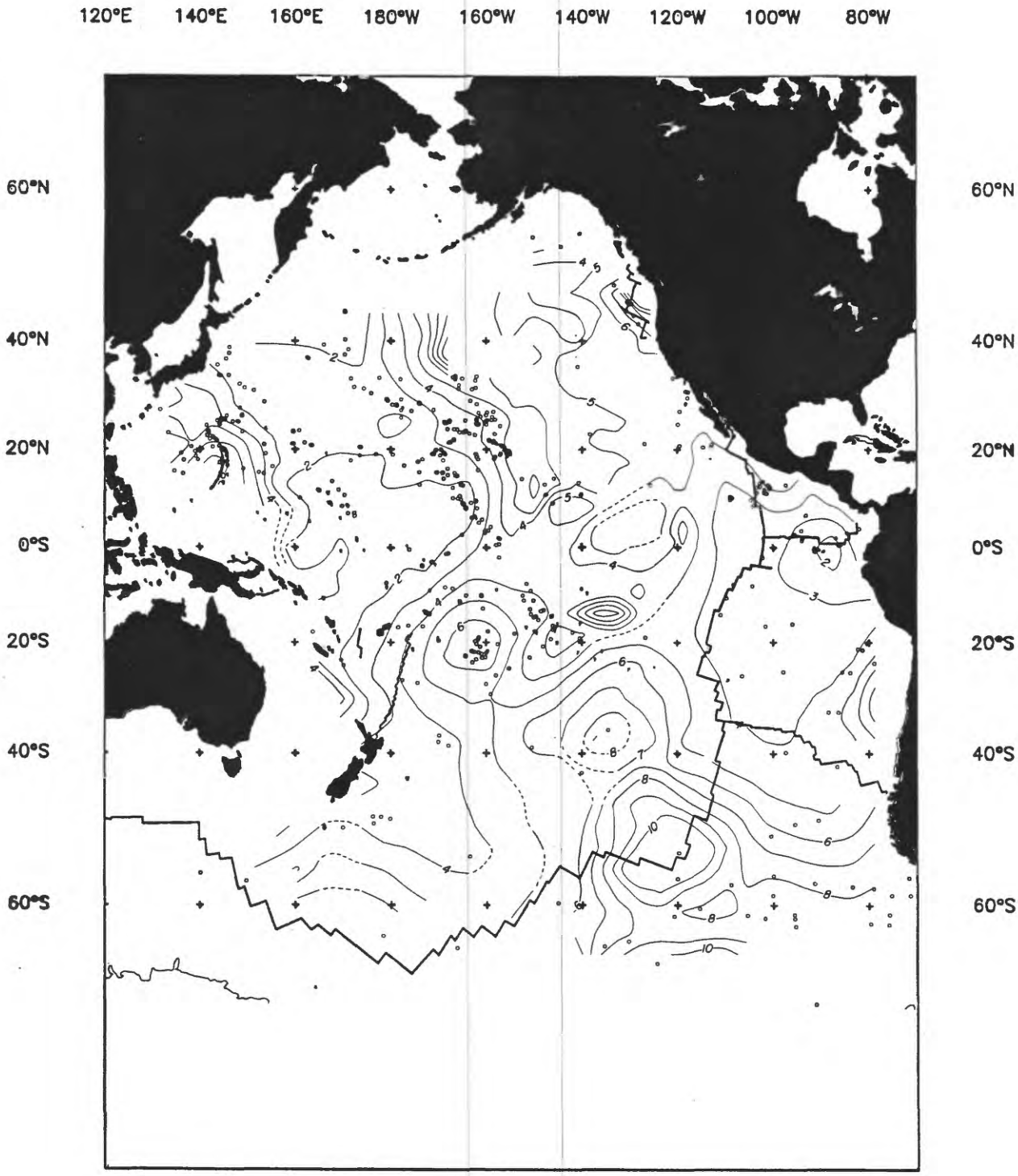


Figure IX-45 Elemental concentration of Al_2O_3% in the Pacific Ocean, c.i. = 1%

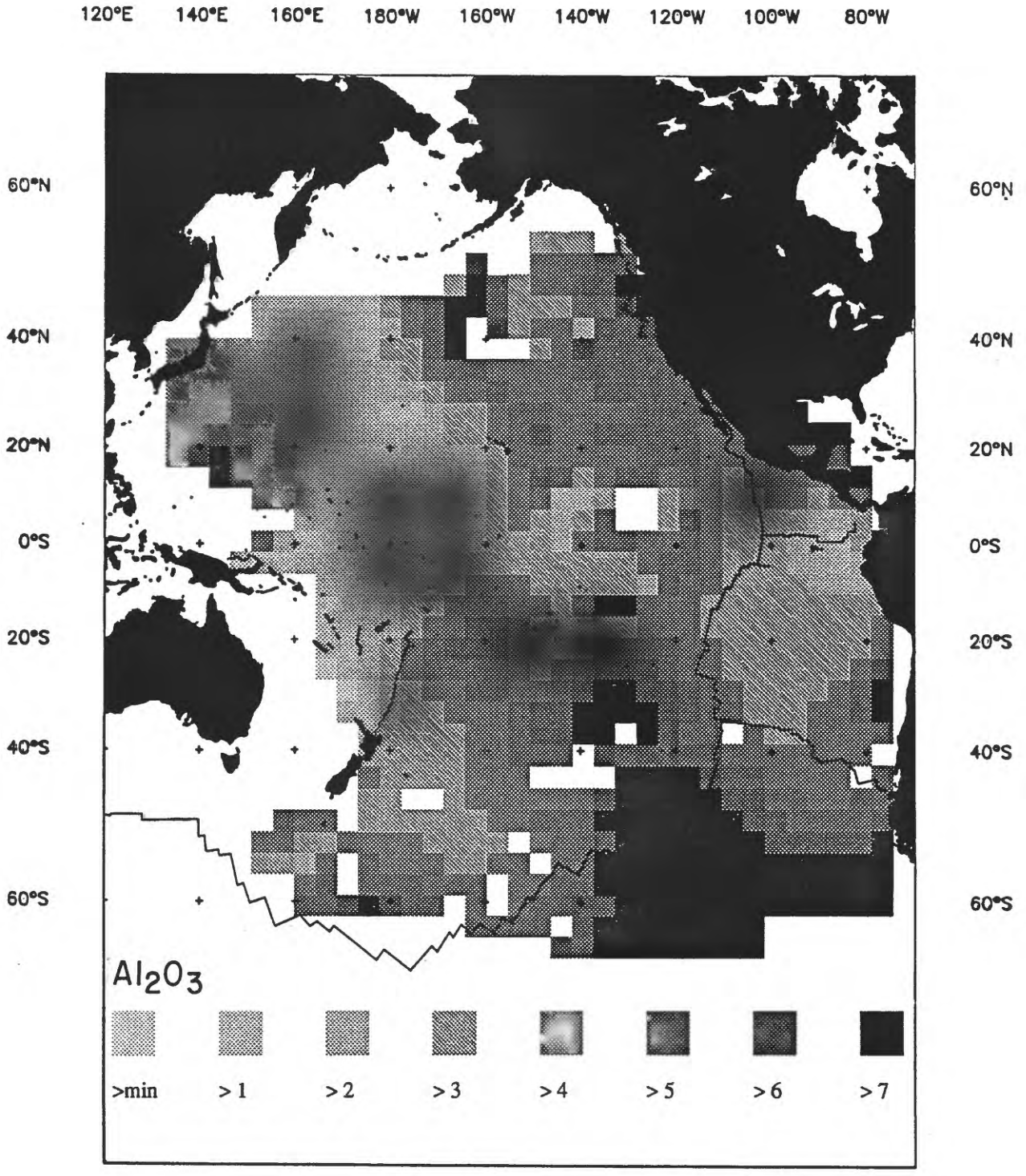


Figure IX-46 Gray scale map of Al_2O_3% in the Pacific Ocean.

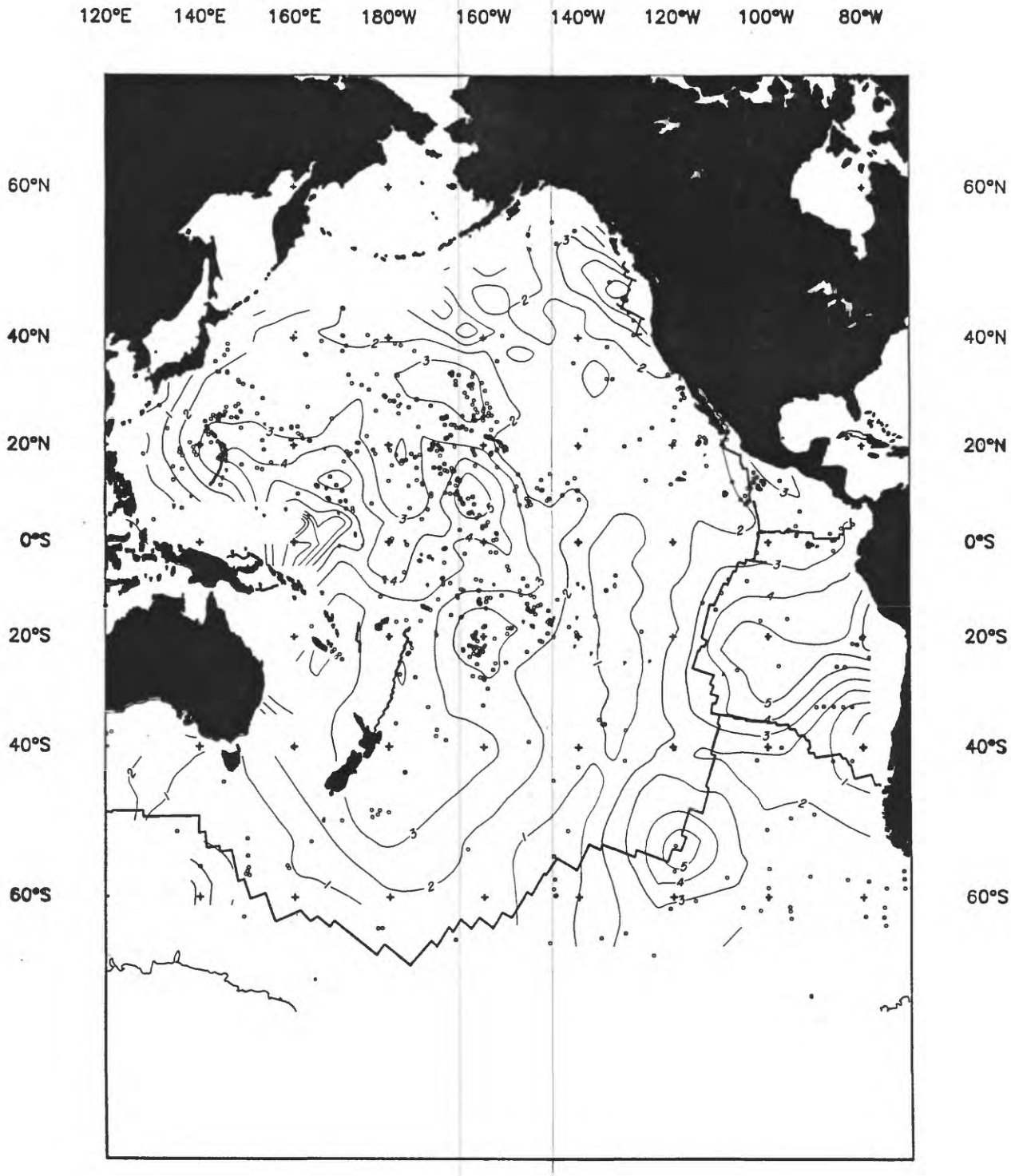


Figure IX-47 Elemental concentration of CaO% in the Pacific Ocean, c.i. = 1%

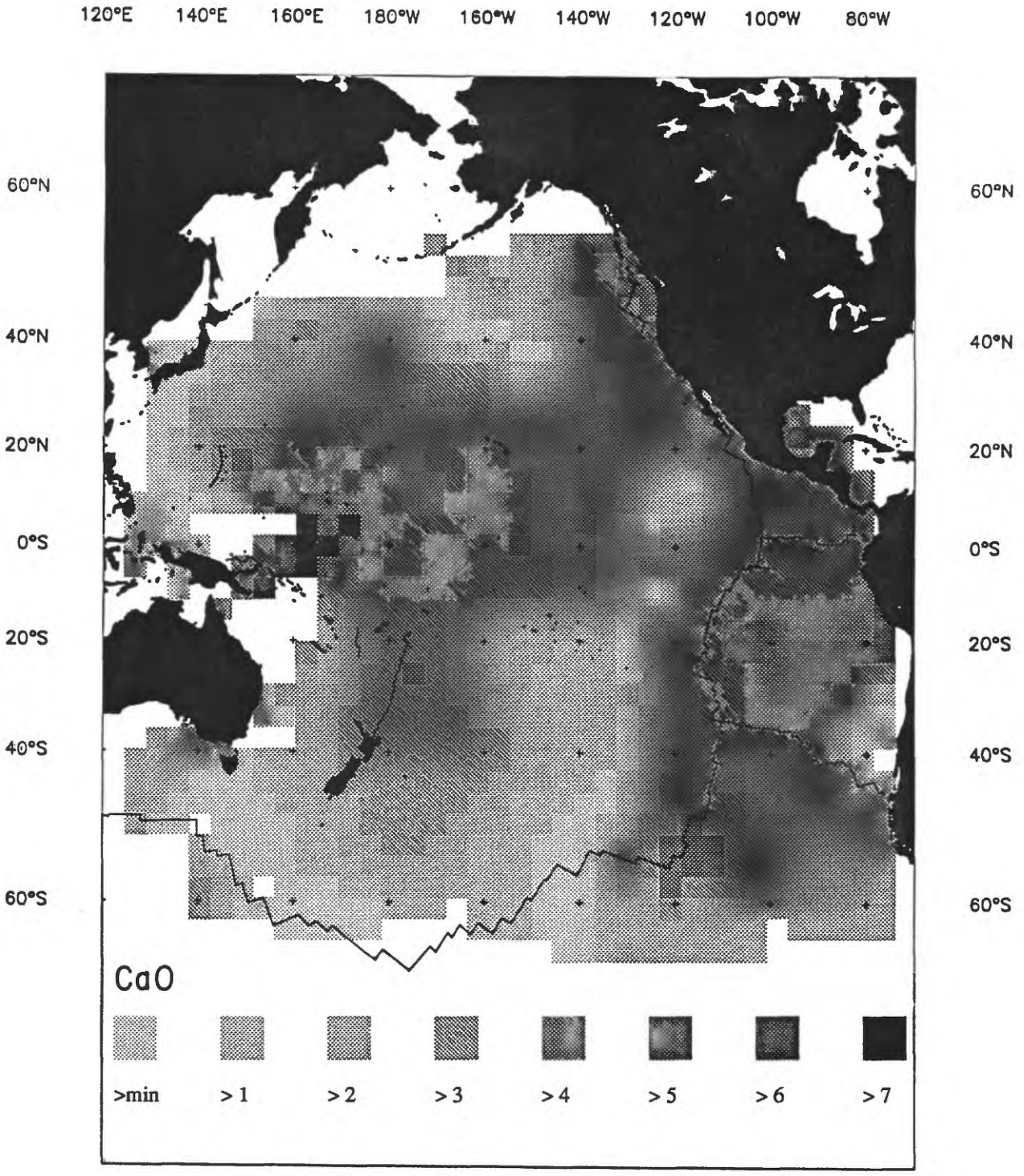


Figure IX-48 Gray scale map of CaO% in the Pacific Ocean.

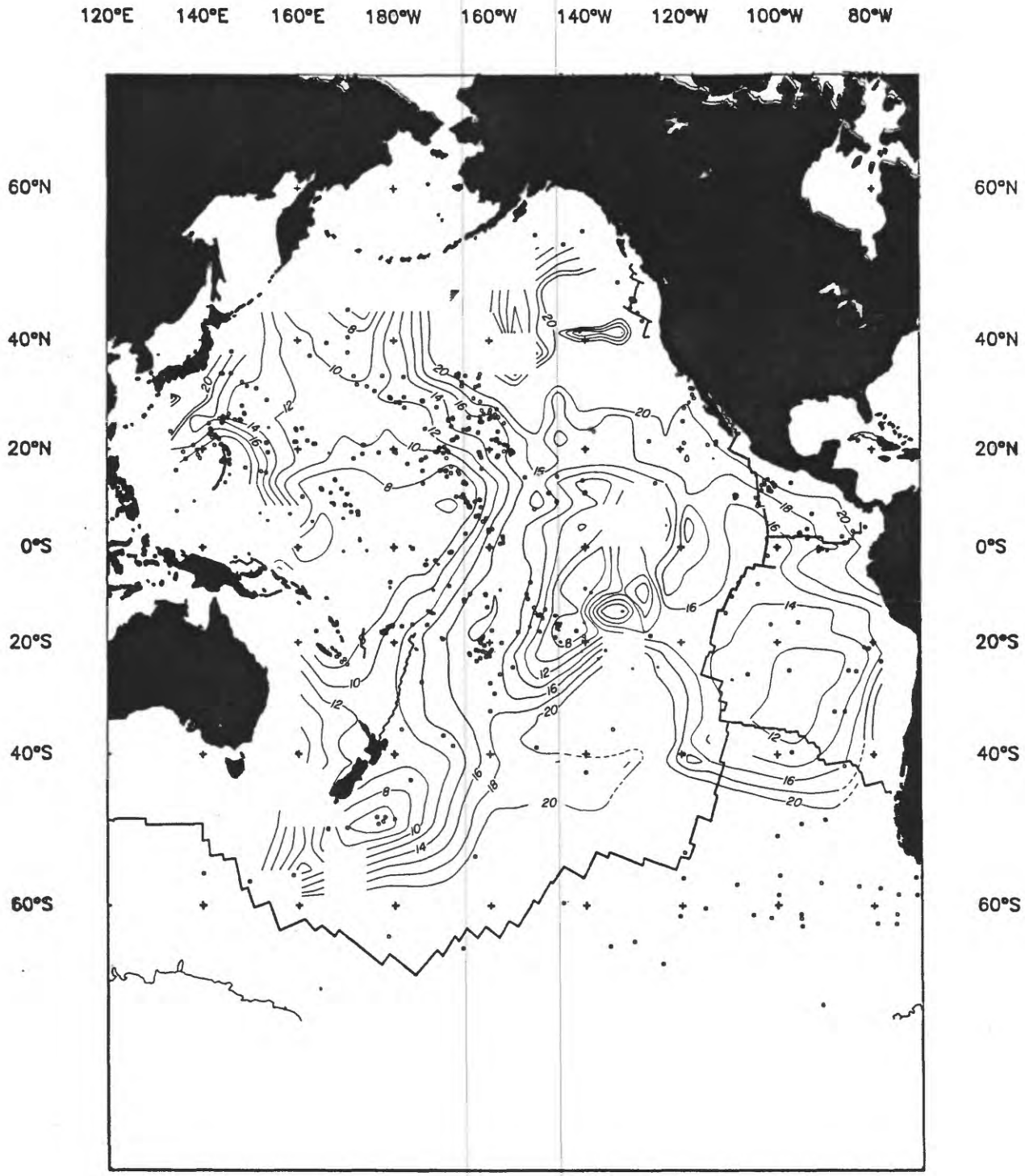


Figure IX-49 Elemental concentration of SiO_2% in the Pacific Ocean, c.i. = 2%

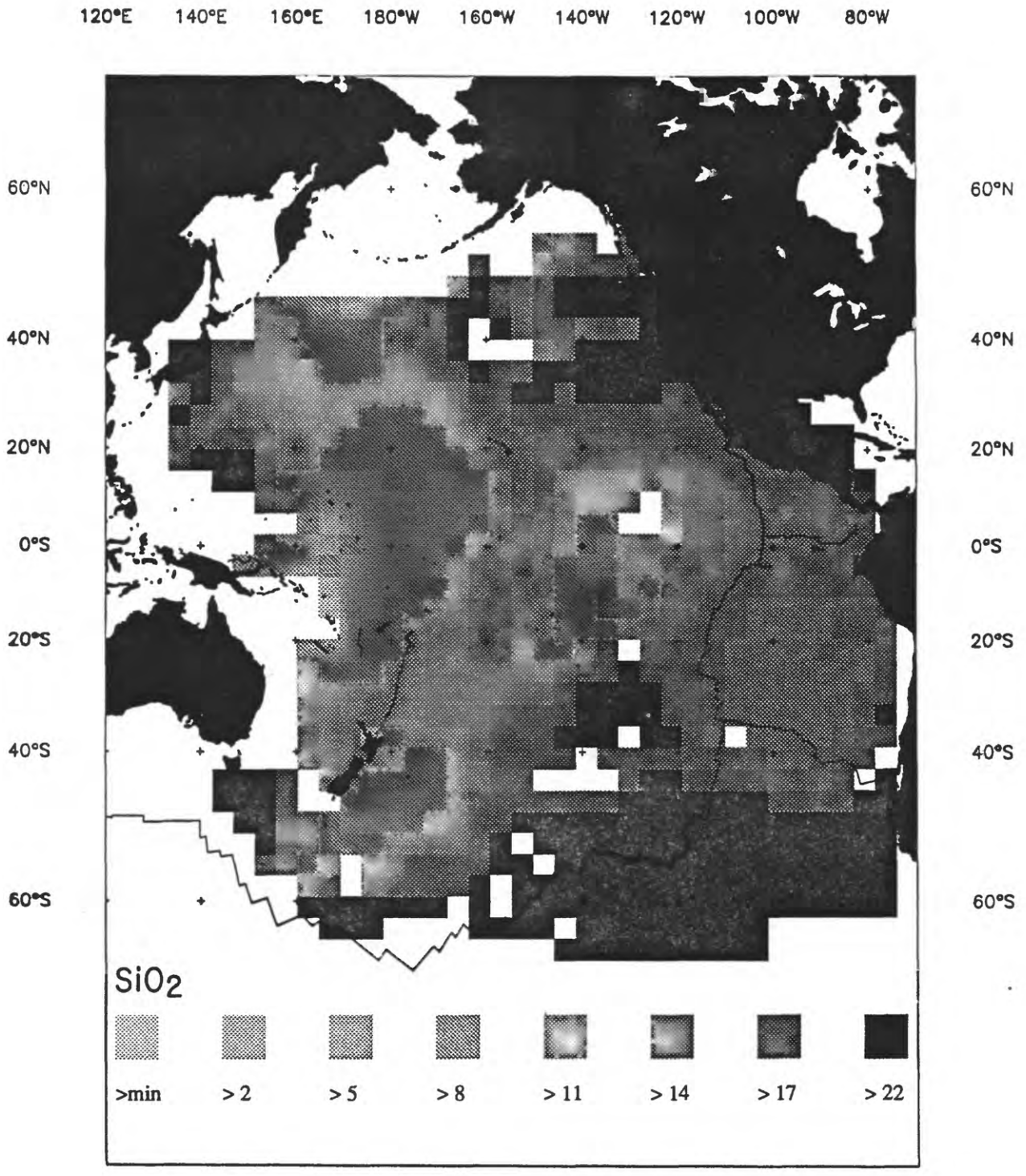


Figure IX-50 Gray scale map of SiO_2% in the Pacific Ocean.

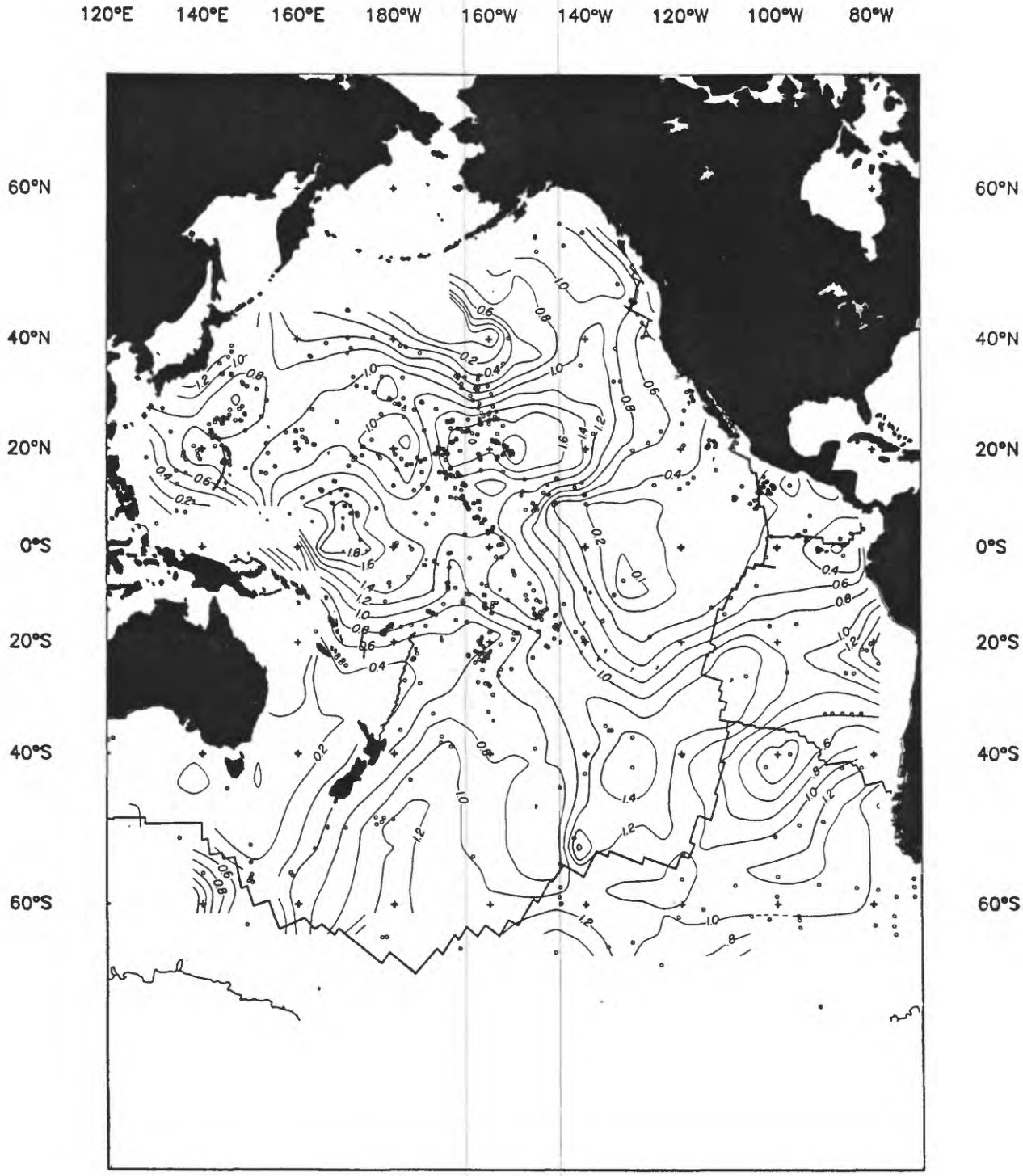


Figure IX-51 Elemental concentration of TiO_2% in the Pacific Ocean, c.i. = .2%

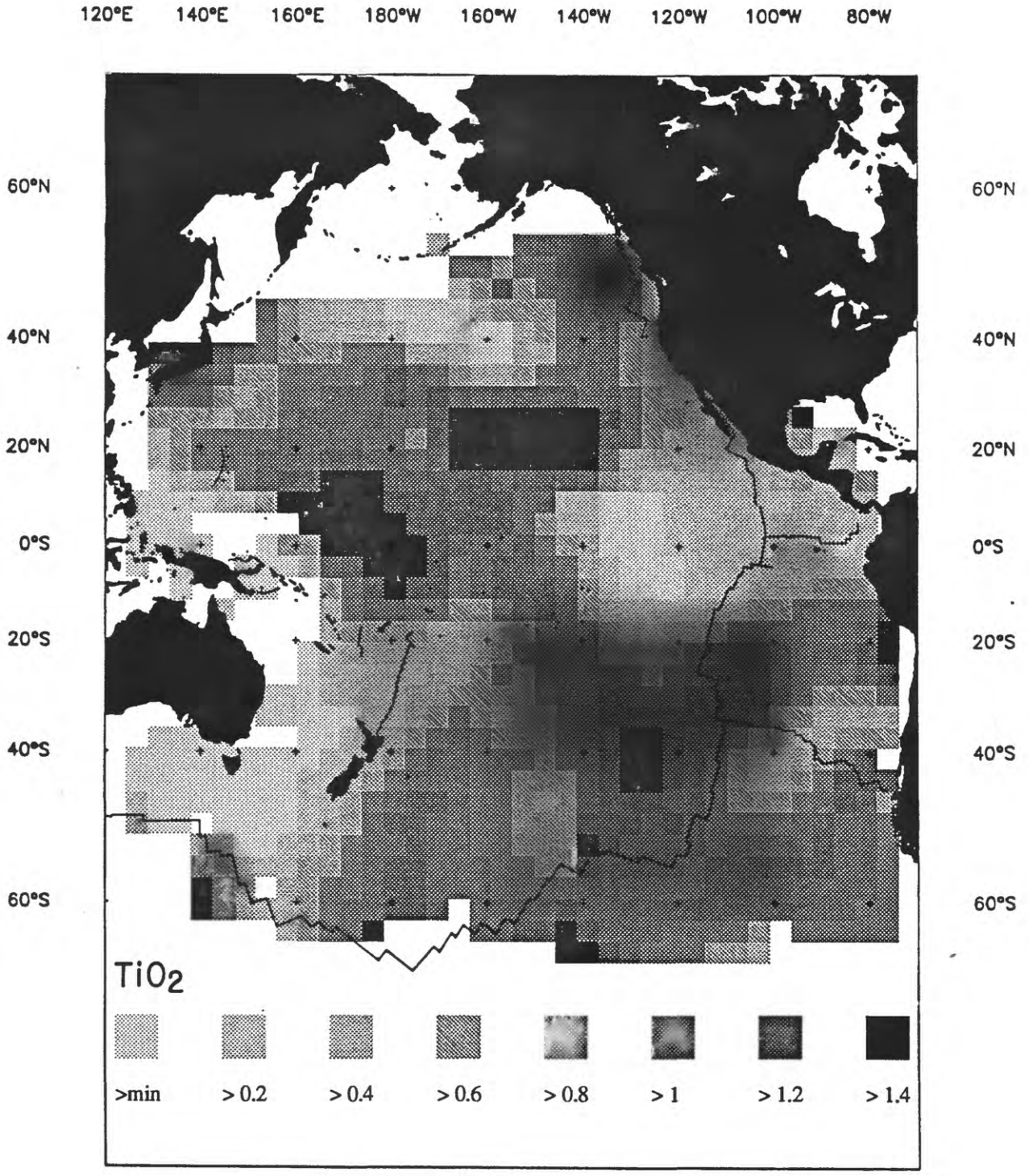


Figure IX-52 Gray scale map of TiO_2% in the Pacific Ocean.

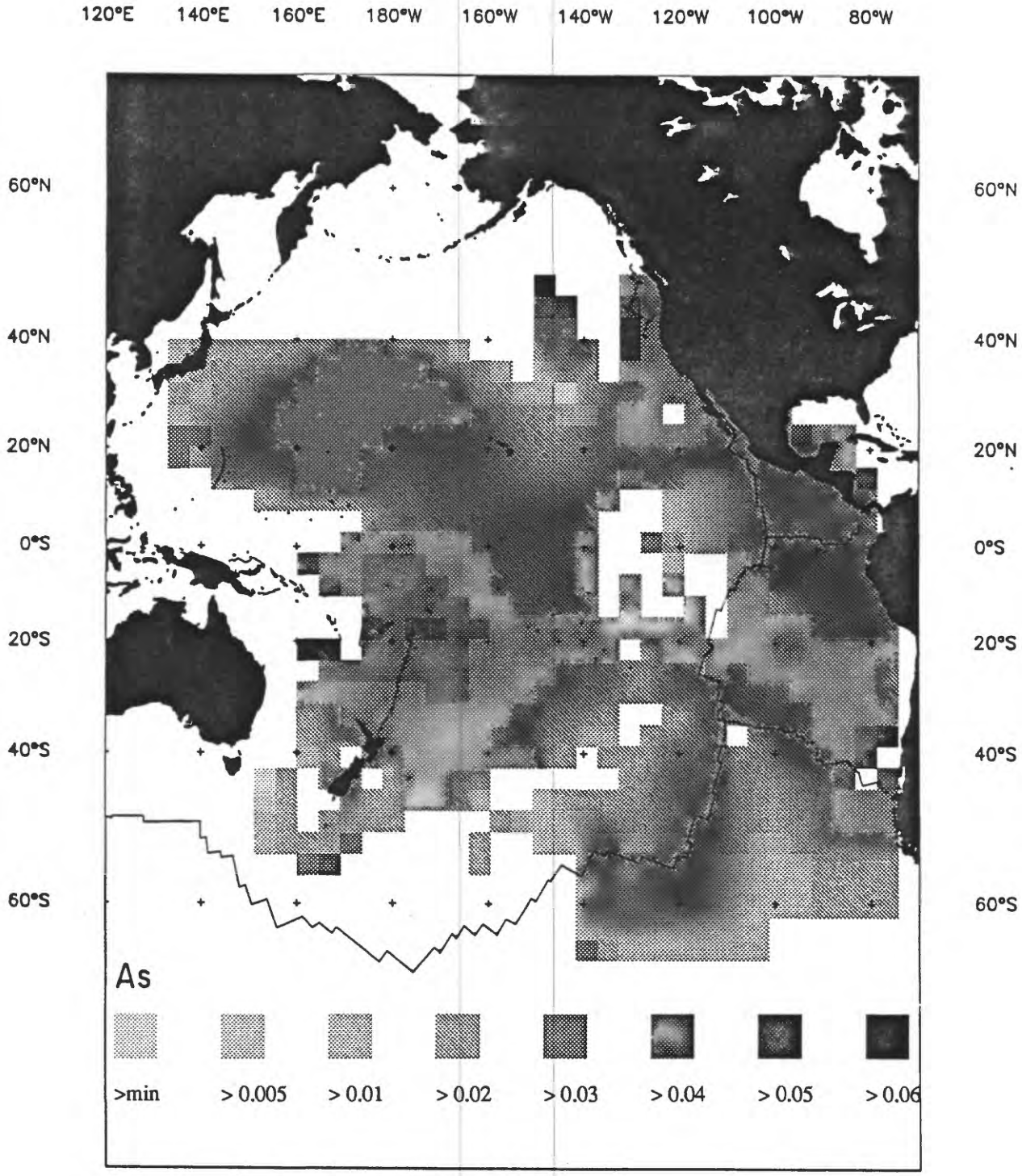


Figure IX-53 Gray scale map of As% in the Pacific Ocean.

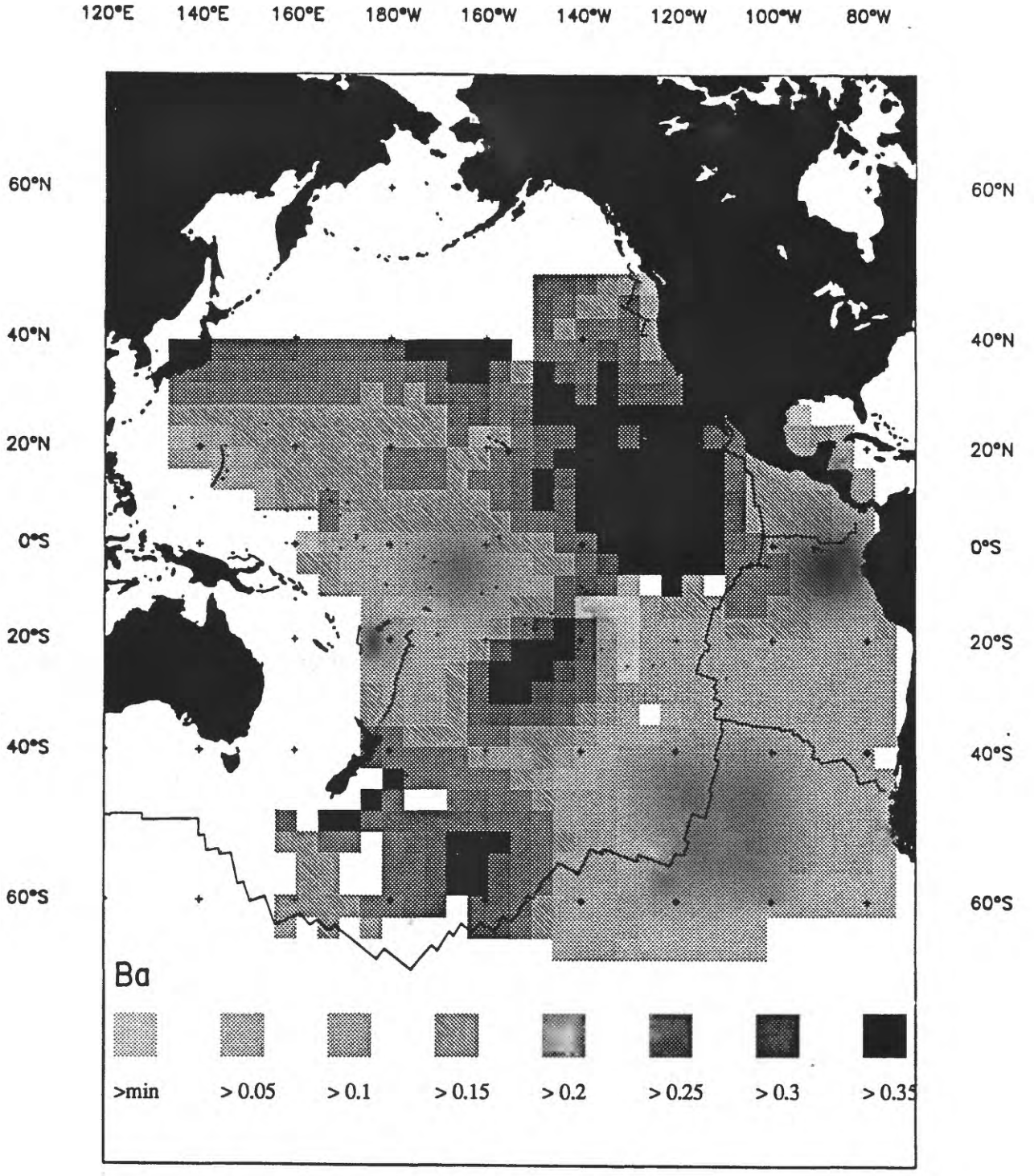


Figure IX-54 Gray scale map of Ba% in the Pacific Ocean.

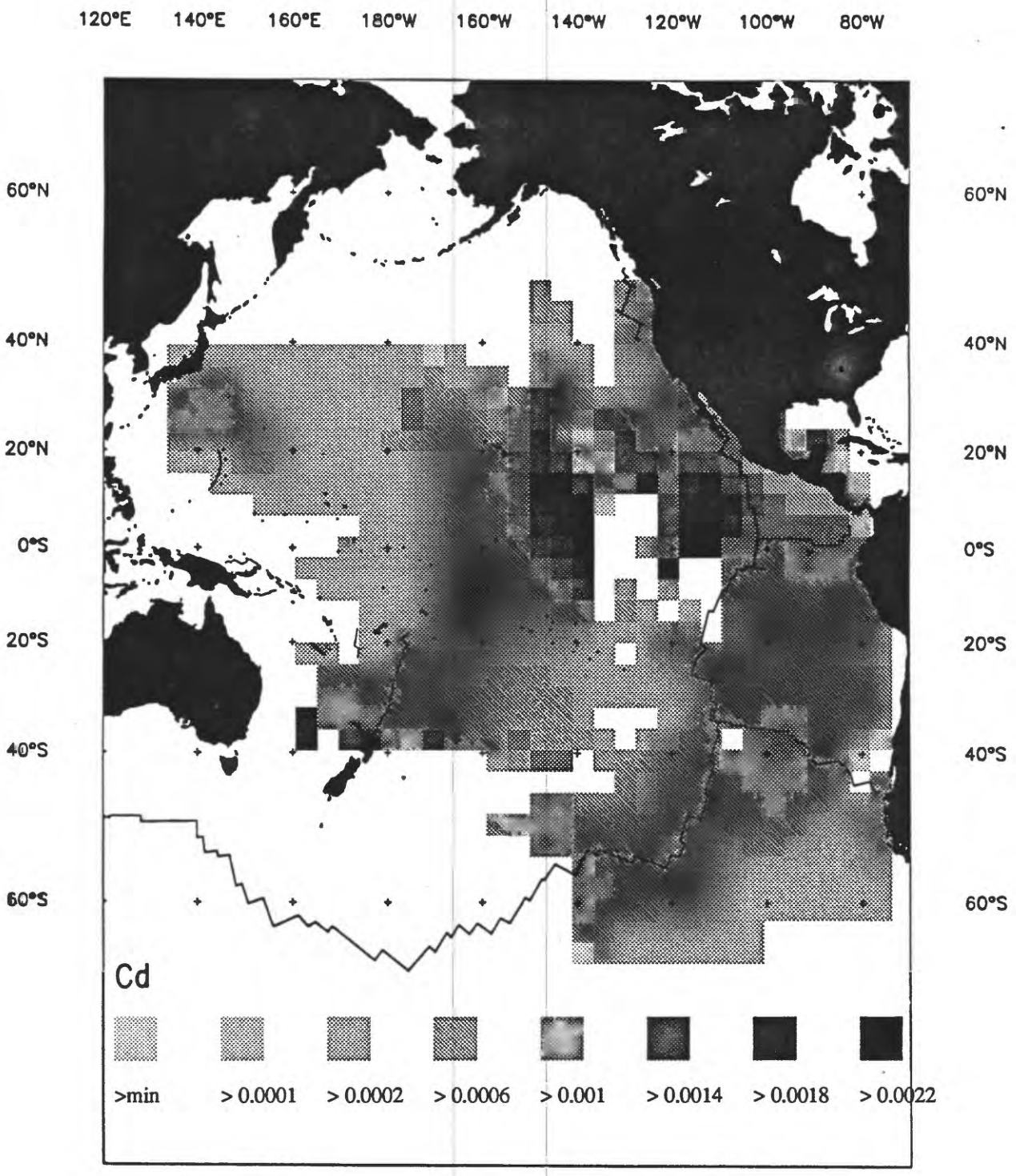


Figure IX-55 Gray scale map of Cd% in the Pacific Ocean.

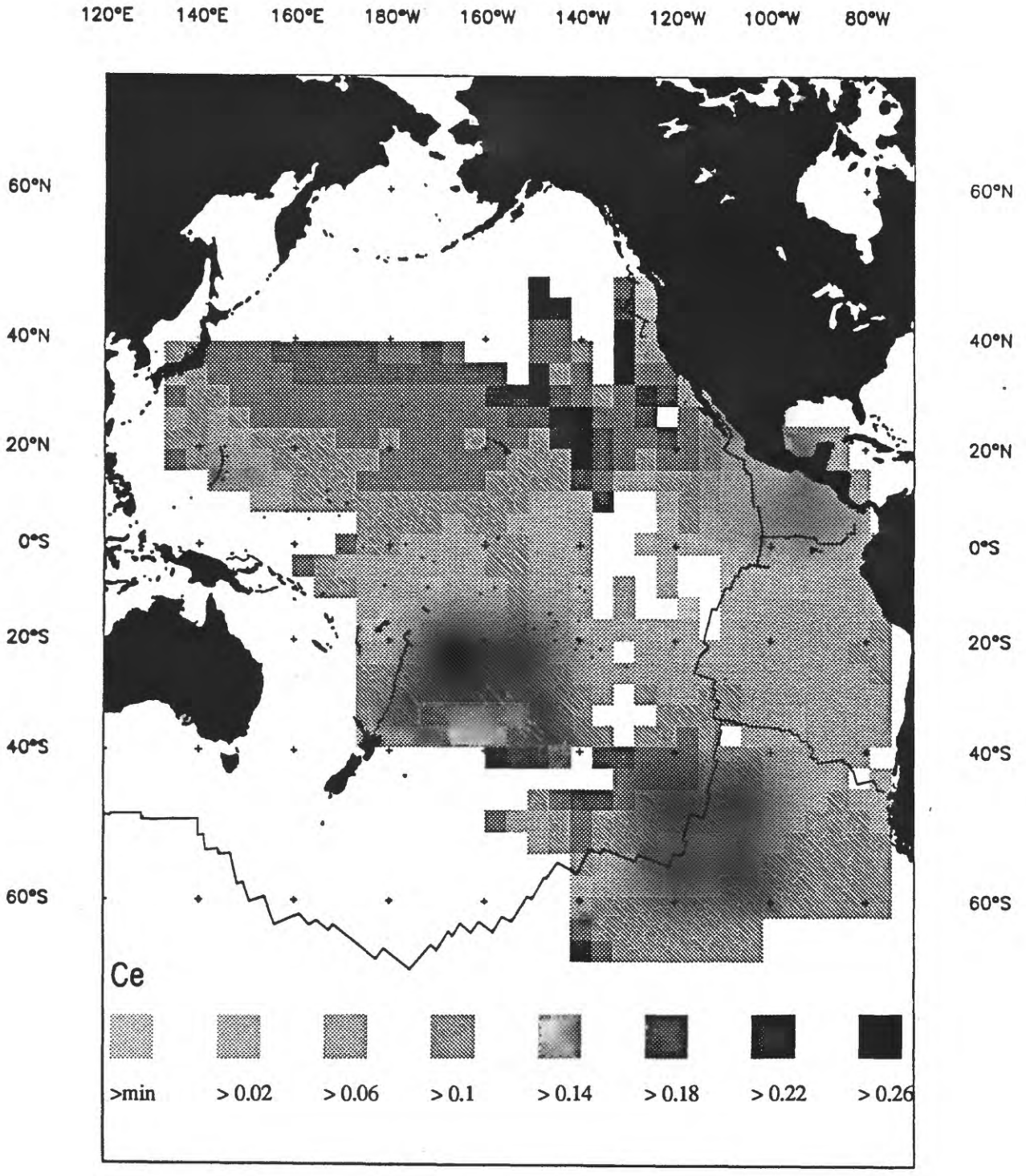


Figure IX-56 Gray scale map of Ce% in the Pacific Ocean.

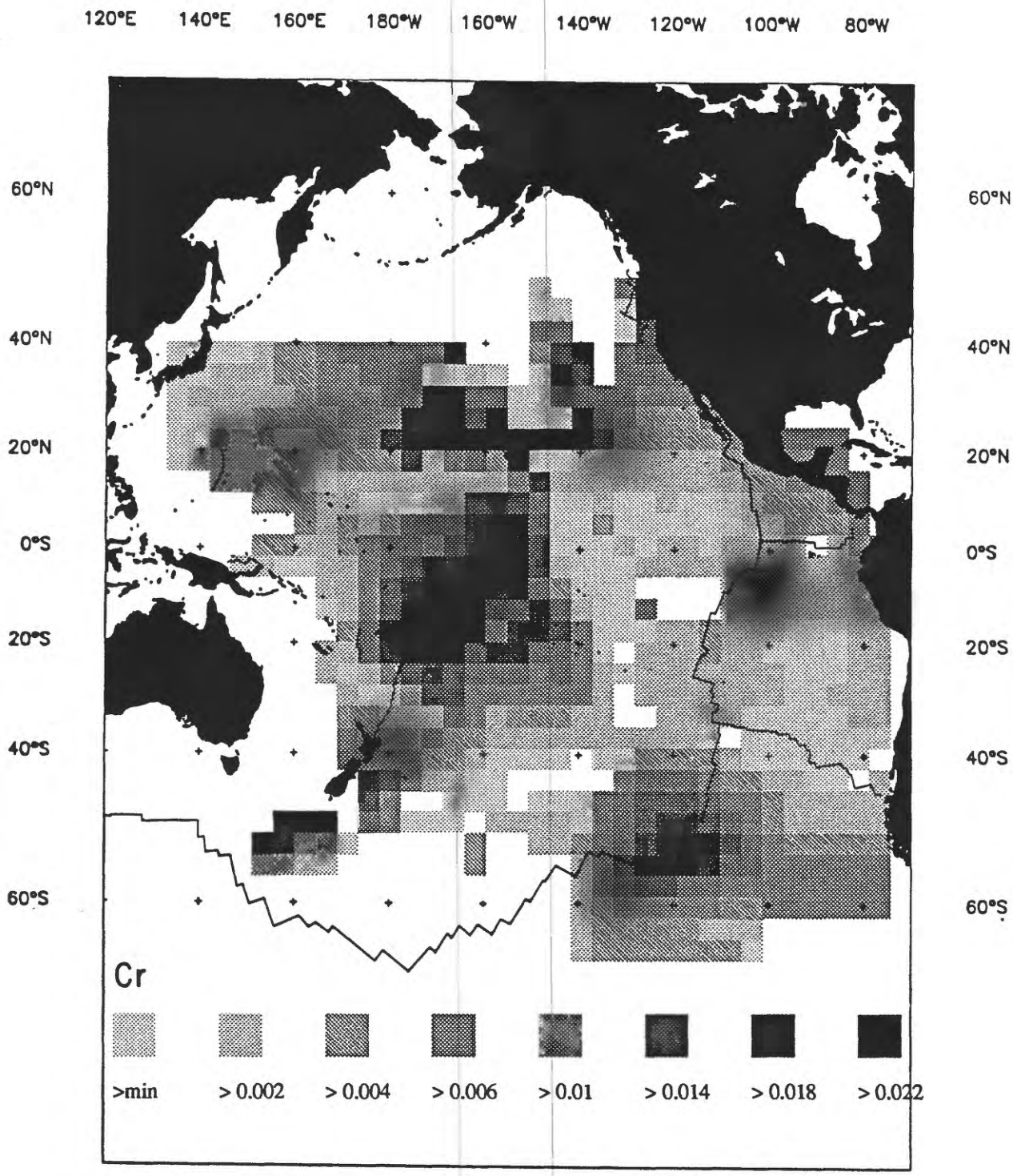


Figure IX-57 Gray scale map of Cr% in the Pacific Ocean.

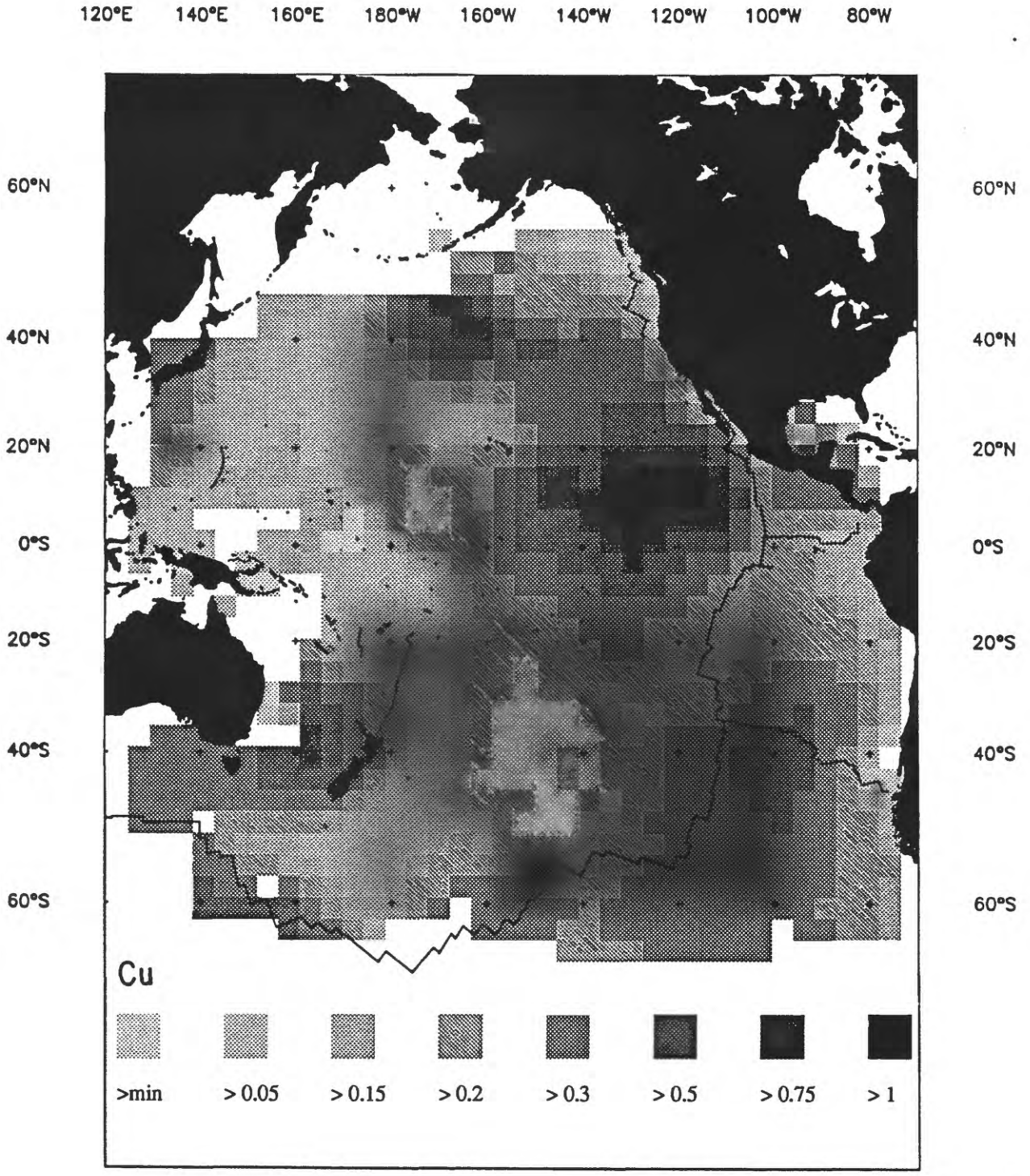


Figure IX-58 Gray scale map of Cu% in the Pacific Ocean.

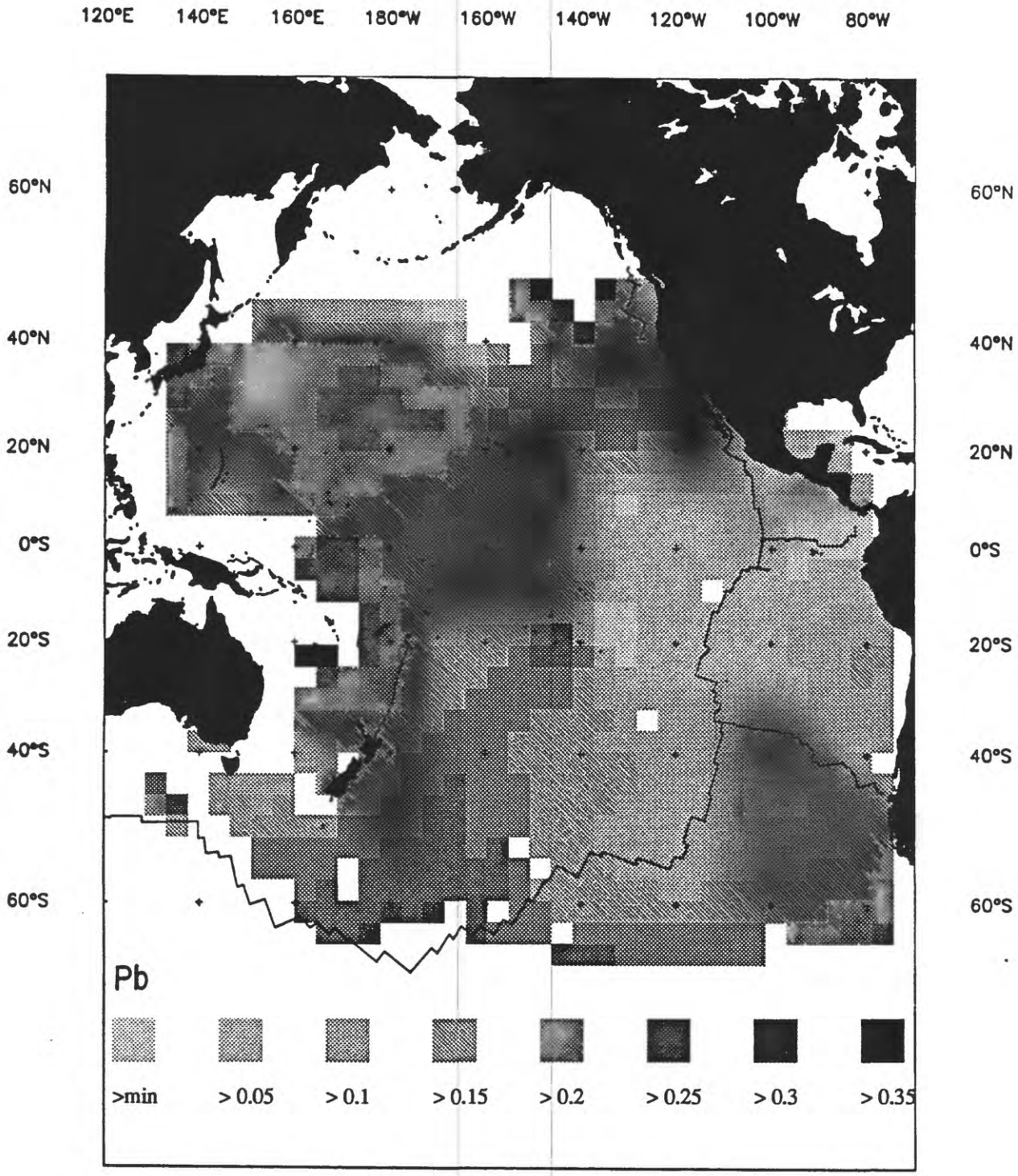


Figure IX-59 Gray scale map of Pb% in the Pacific Ocean.

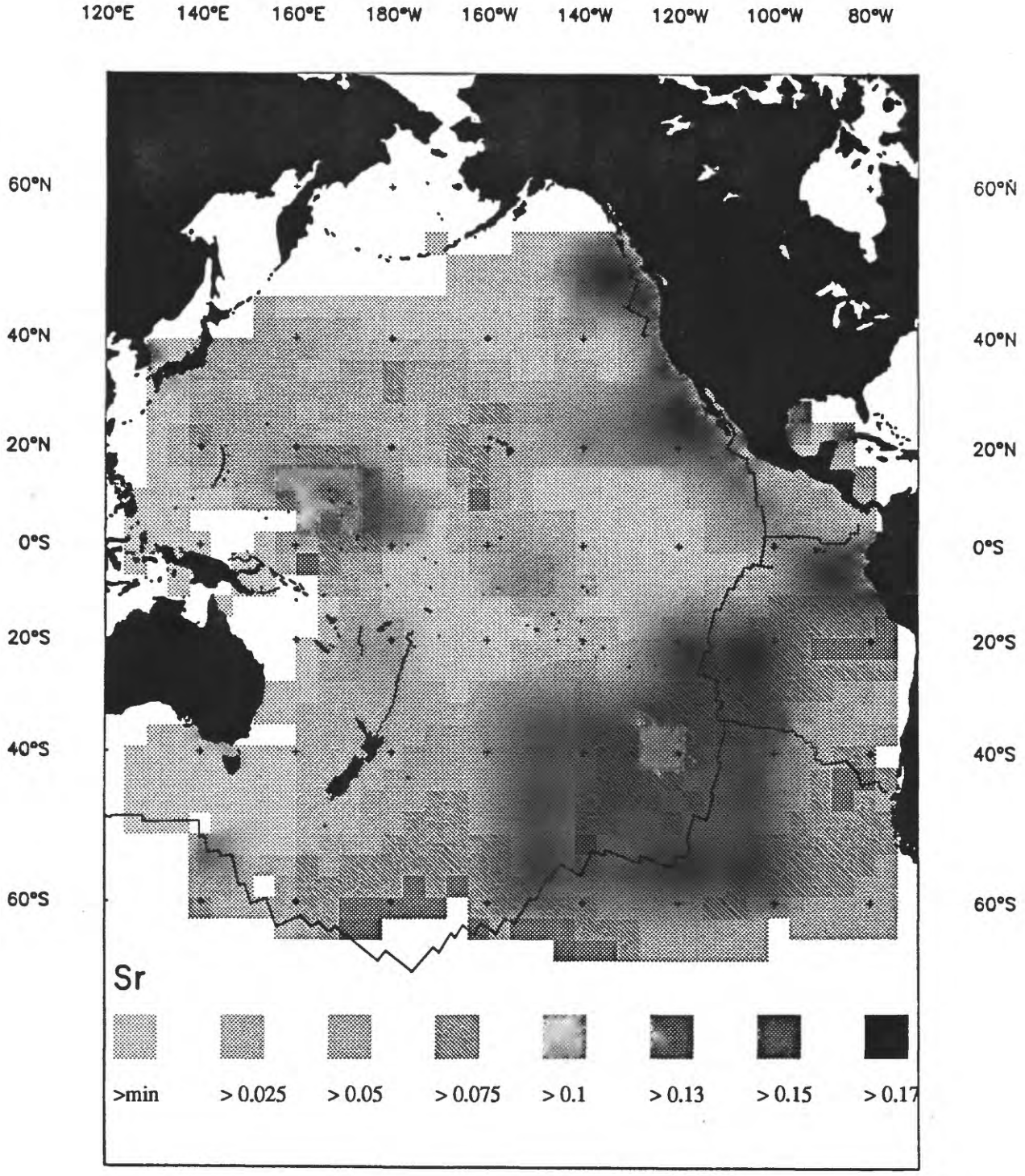


Figure IX-60 Gray scale map of Sr% in the Pacific Ocean.

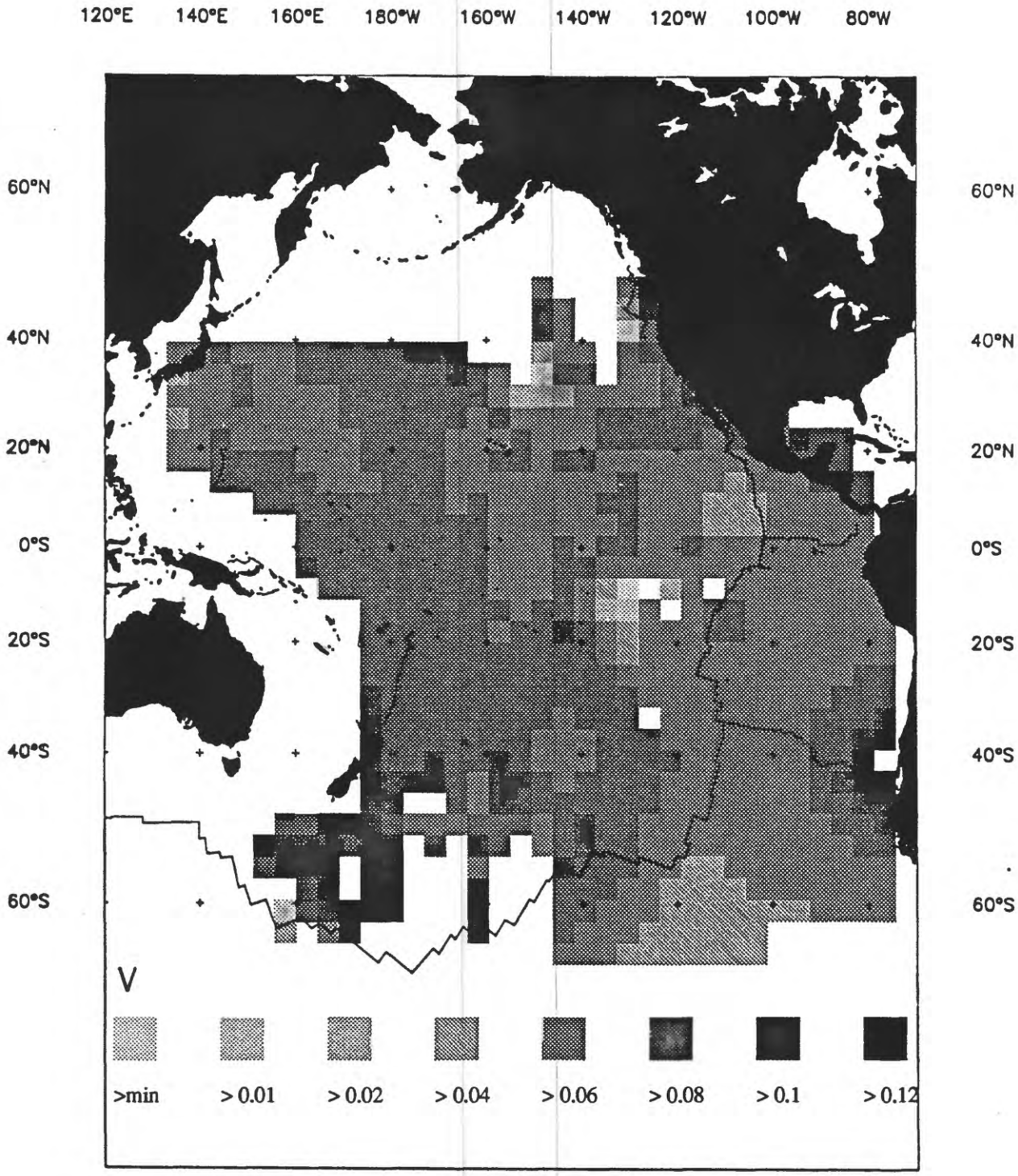


Figure IX-61 Gray scale map of V% in the Pacific Ocean.

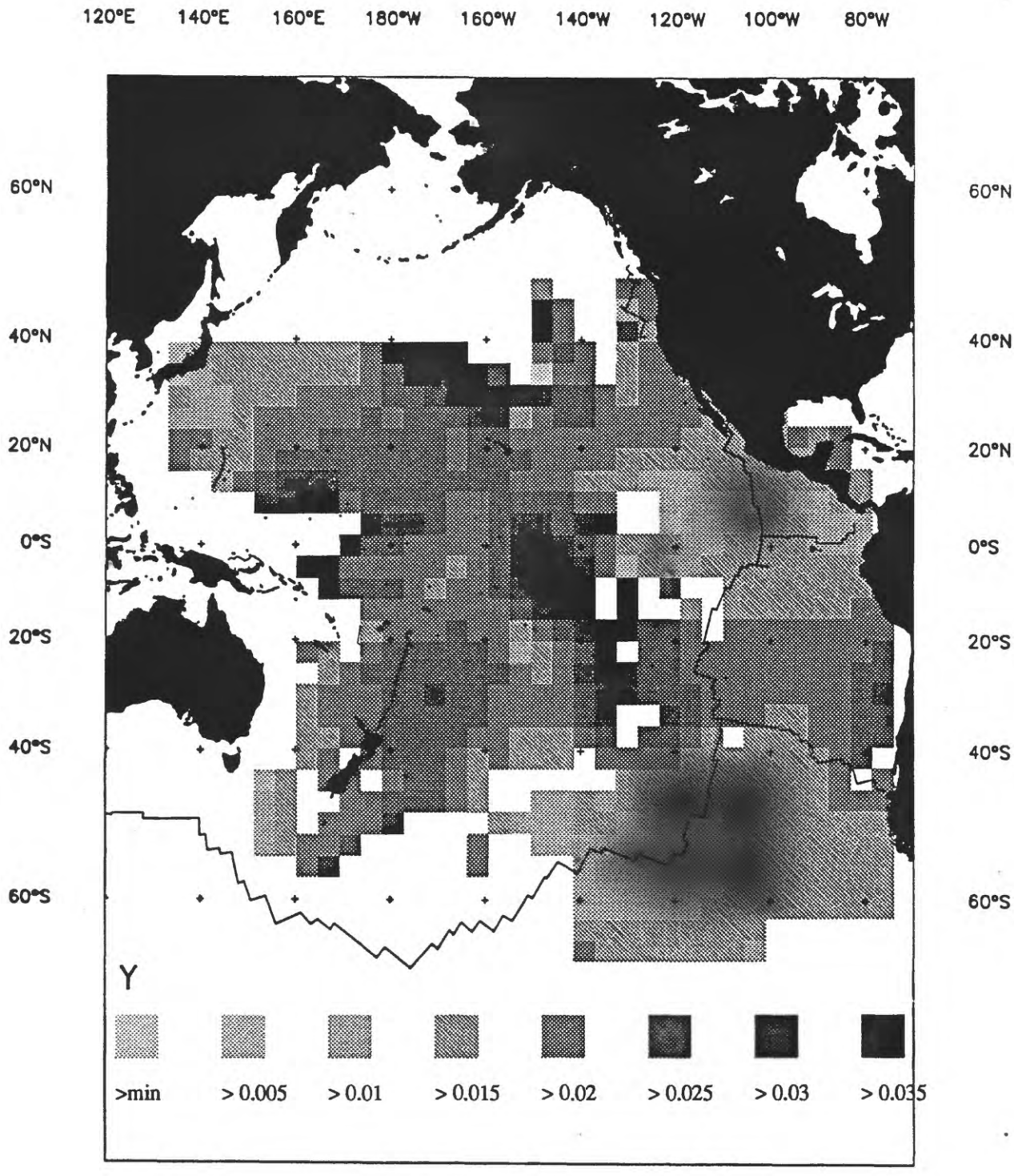


Figure IX-62 Gray scale map of Y% in the Pacific Ocean.

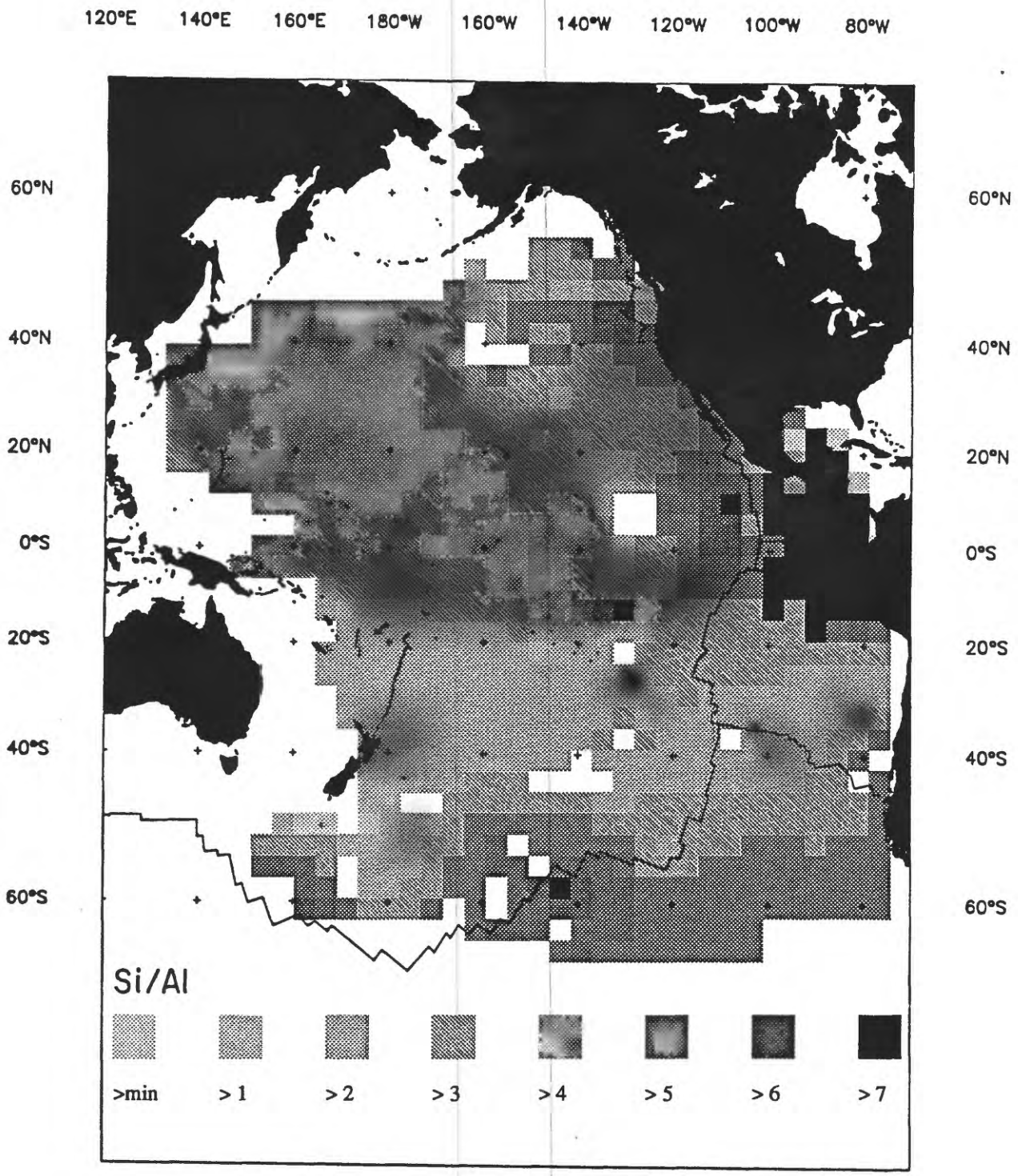


Figure IX-63 Gray scale map of Si/Al% in the Pacific Ocean.

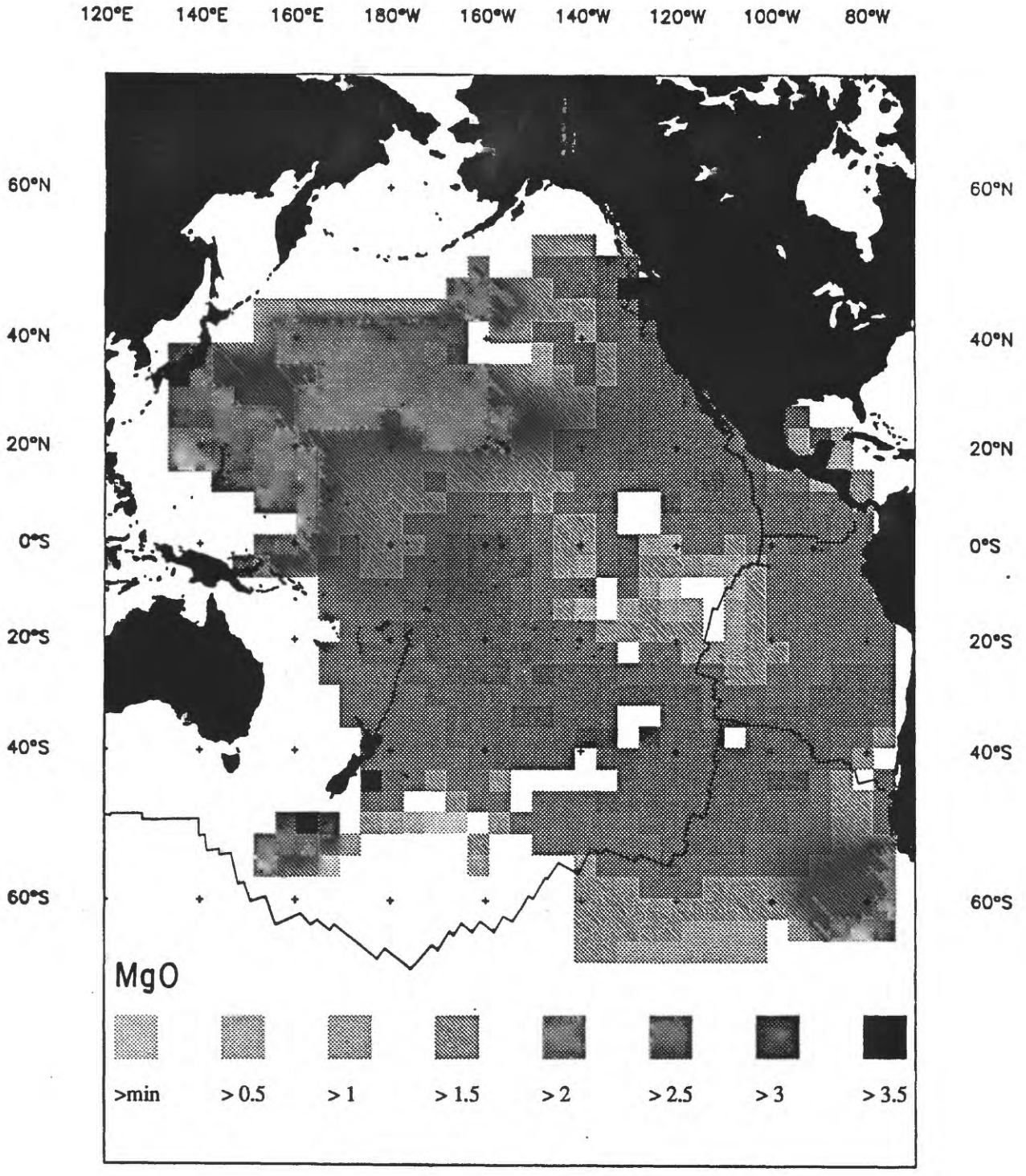


Figure IX-64 Gray scale map of MgO% in the Pacific Ocean.

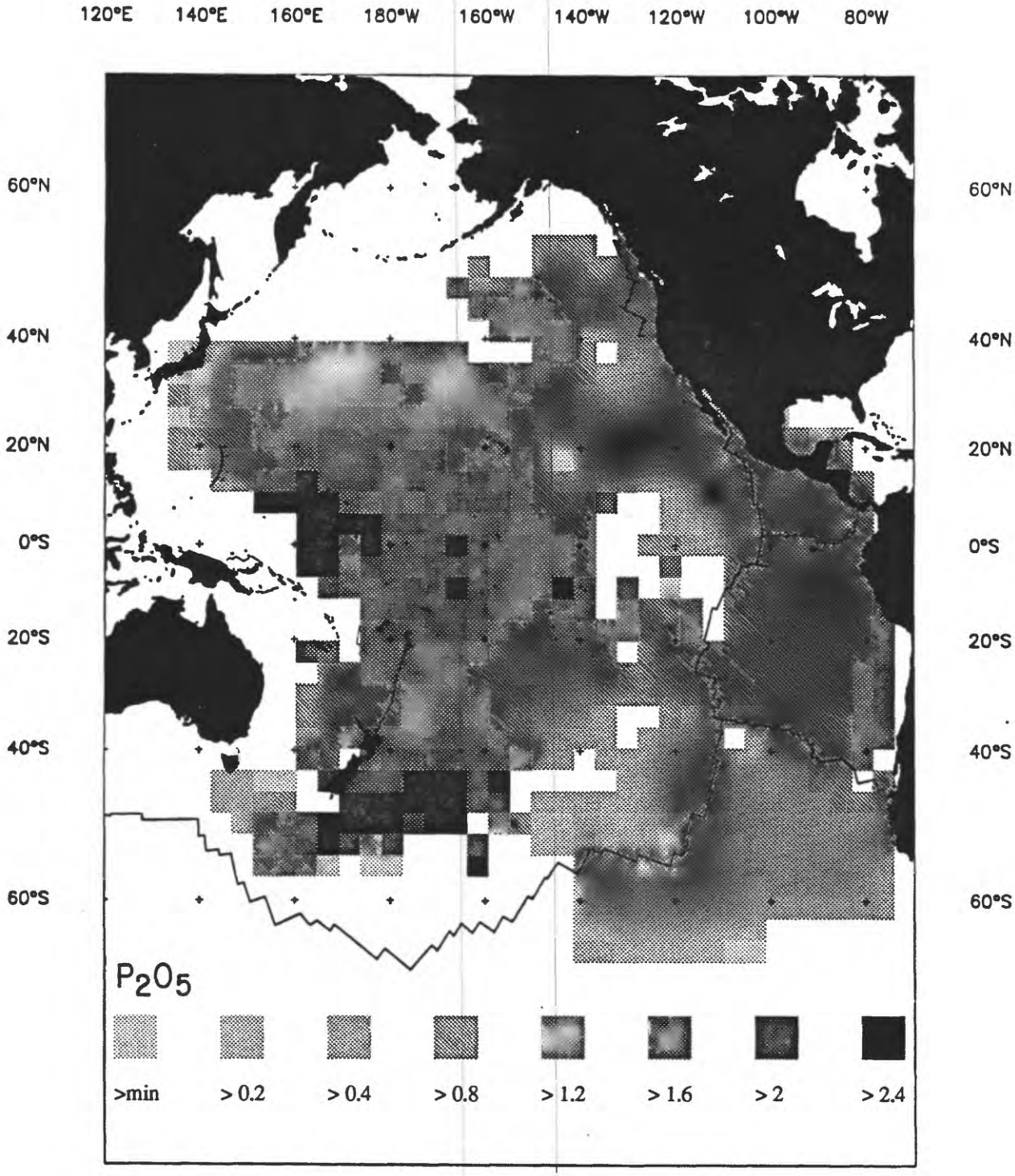


Figure IX-65 Gray scale map of P_2O_5% in the Pacific Ocean.

X DISCUSSION

Much of the interest in element mapping of crust composition lies in the postulate that sources of the metalliferous crust components are largely obtained from ambient water, rather than from underlying sediment and rock substrates. Because water masses show coherent chemical character over much larger areas than do bottom sediments and substrates, crust compositions should show a more consistent and and predictable regional chemical composition than do abyssal nodules. The maps (of cobalt distribution) strikingly bear out this expectation, not only showing a series of high-cobalt bullseyes, but also showing distinct regional lows that correlate closely to what is known about the distribution of hydrothermal fluid discharge in the oceans. These patterns also suggest other active hydrothermal areas in parts of the Pacific Ocean that have not yet been explored for polymetallic deposits and discharge zones. The southeast Pacific south of the Peru basin is a case in point.

For application to more local economic targets the cobalt maps reported here appear to reflect real regional variability, although the distribution of shallow seamounts is an ancillary factor that affects cobalt highs on all-depth maps. This conclusion tends to reduce changes that isolated high-cobalt crust regions will be found in peripheral areas of the Pacific ocean.

Second, the maps show several cobalt-enhanced areas for which only sparse sampling exists. Most of these areas are outside the US EEZ zones, but some occur within the EEZ zones of independent countries (Cook and Society Islands, and Tuamotu Archipelago, Marshall Islands), and need to be confirmed by additional sampling.

The data suggests that there is no constant cobalt-depth zonation throughout the oceans, but that the relationships, though remaining inversely correlated, in hydrogenetic areas are quite different in different parts of the ocean. A future task will be to explore details of depth zonation for other elements besides cobalt.

Although the data on crust thickness is far more limited than the chemical information, and some is of very poor quality. We should use what there is to examine regional relationships that will add to the base of scientific and economic knowledge. A current subject of expanding interest is chemical "crust stratigraphy", which promises to shed light on the distribution of seamounts, water masses and hydrothermal activity in earlier oceans.

XI SUMMARY AND CONCLUSIONS

Our database has placed in usable and coherent form more than three times the number of crust analyses available than when we began the work in 1983. The current total is about 2400 analyses, approaching 100,000 individual data items. Many of the new data maintain a higher standard of sampling and analytical quality than preexisting data, and have been preferentially used here to develop normalization and correction algorithms for earlier data.

The Scripps Institution Nodule Data Bank (SNDB), updated by the NGDC, was carefully searched and qualified with respect to crust data. We searched some 13 U.S. repositories for existing seafloor samples containing crusts. We followed this by applications of a carefully-controlled analytical methodology for 27 chemical constitutents, and conducted interlaboratory calibrations of various sampling and analytical procedures. The new shipboard samples and data were added to the database.

The database was implemented on the UNIX system and desktop microcomputers at USGS, Woods Hole, Mass. offices. Mapping and statistical software were applied to data manipulation, samples of which are included in this report, specially designed for hard-copy viewing by persons with a variety of interests: geological/resource analysis, geochemical, analytical, and administrative. All chemical tables in this paper copy are in standard rock and geochemical analysis format, and are preceded by location and depth, as well as sequence number data.

Ferromanganese crusts and their composition are subject to many sources of error, and critical use of data are shown to be even more important than for abyssal nodules. A system of values normalized against Fe+Mn concentrations helps compensate for the serious problem of substrate contamination as well as variable treatments of hygroscopic and bound moisture in past reports.

Our efforts at elemental mapping confirm that ferromanganese crusts have chemical coherence over large geographical regions. Our maps of cobalt concentration show three well-defined high concentration areas. The largest one, in the central-western Pacific is a true regional feature extending deeper than 4000m; i.e. it is not merely a function of prevalence of shallow seamounts. Regions having low cobalt concentration in crusts are found in the vicinity of submarine hydrothermal vents and characterize a large part of the East Pacific Ocean. Other trace metals show distinctive associations; Zn, Ni, and Cu are highly concentrated in the Clarion-Clipperton fracture zone, Ce, Pb and As show some common features with Co, whereas V is enriched along with Fe, for examples in the East Pacific Rise and Juan de Fuca areas.

We hope that this database and updated versions will be useful in evaluating and synthesizing economically useful relationships pertaining to ferromanganese crust composition, as well as offering new scientific knowledge bearing on a variety of ocean geological and geochemical problems.

XII ACKNOWLEDGMENTS

This report could not have been completed without the aid of many persons and institutions. We express gratitude to all those persons and institutions cited in Chapter III for their cooperation and assistance, as well as C. Moore and P. Sloss of NGDC, NOAA, Boulder, Colorado and their colleagues for key data transfers and base maps created for us. At the Geological Survey an essential building block for this work has been the first-rate analytical data on crusts determined by the analysts at the Reston analytical laboratories (see Chapter IV). At the Branch of Atlantic-Gulf Marine Geology, J. Commeau contributed significantly to the analytical effort, and in many other ways. We thank our colleagues G. Evenden, J. Botbol, L. North, J. Fredericks and C. Polloni for invaluable computer assistance and advice, P. Forrestel, J. Zwinakis, and D. Blackwood for suggestions and aid regarding drafting and photography, and W. Schwab and R. Commeau for discussion and data. Student assistants M. Kashgarian, P. Davis, K. Schmitz, J. DaSilva and M. Bourne aided in the earlier stages of the work. In the Menlo Park office of USGS J. Hein, D. Clague, L. Morgenson, C. Madison and others materially aided sampling, data collections, and data output. D. Clague aided in coordinating the early cooperation with the German effort. M. Cruickshank and J.L. Bischoff provided key stimulus at critical junctures for this work.

T. Hillman of the Bureau of Mines, Spokane, and M. Fisk of the United Nations provided early data and assistance with respect to the Scripps Nodule Data Bank (SNDB). A special debt is owed to P. Halbach of the Technical University, Clausthal, for his early inspiration, collaboration and information, and to his student D. Puteanus, as well as V. Marchig of the German Geological Survey, and B. Haynes for cooperation in interlaboratory analytical calibrations. D. Root of the USGS Branch of Resource Analysis guided us in aspects of this work. The manuscript was improved by reviews of J. Botbol, J.L. Bischoff and E. Winget. Finally, the Minerals Management Service's support of this work made the present scope and degree of completeness of our effort possible.

XIII REFERENCES

The references are provided in two tables. The first (Table XI-1) is an index for references pertaining to both the station and chemical data of the SNDB. Then follows the Scripps Institution reference file, presented as in the original in both a chronological and alphabetical order.

Most of the references in the U.S.G.S. crust reference list are supplementary to the Scripps reference file, although a few duplications of commonly-referred to papers have been retained to permit ready reference to the discussion sections without switching back and forth between the two references lists. Some of the articles in the USGS references pertain primarily to nodules, but have pertinent sections in them relating to crusts. Others that have minor references to crusts have not been included in this list. Finally, a few ancillary references pertaining to subjects mentioned in the text are also included.

Table X-1. Cross reference table of SIO "REFID" and SIO references to be used in conjunction with station and chemical tables as needed.

A005	---	1960	List of cores, Tethys expedition - SIO.
A033	---	1965	List of cores, Wahine expedition - SIO.
A056	---	-	Confidential Source.
A098	---	-	Joint Oceanographic Institutions for Deep Earth Sampling (JOIDES), preliminary core reports.
A105	---	1968	Preliminary megascopic descriptions of cores taken on Vema, LDGO.
A108	---	1968	Megascopic core descriptions - Vema 22, LDGO.
A109	---	1966	Megascopic core descriptions - Vema 23, LDGO.
A110	---	1965	Preliminary megascopic descriptions of cores taken on Vema, LDGO.
A114	---	1969	Preliminary megascopic core descriptions taken on Robert D. Conrad, LDGO.
A115	---	1966	Preliminary megascopic descriptions of cores taken on Robert D. Conrad cruise 10, LDGO.
A116	---	1967	Preliminary megascopic core descriptions of cores taken on Robert D. Conrad cruise 11, LDGO.
A117	---	1970	SIO list of cores and dredge hauls, Scan expedition.
A119	---	1971	SIO list of Samples, 7-TOW.
A121	---	1966	List of cores and dredge hauls, Zetes expedition, SIO.
A123	---	1969	Preliminary megascopic description of cores taken on Vema, LDGO.
A125	---	1969	List of cores, Circe expedition, SIO.
A130	---	-	Trawls, dredges and grab samples, LDGO.
A140	---	1965	Akademiia Nauk, SSSR.
A145	---	1968	List of cores and dredge hauls and visual core description log, Styx expedition.
A146	---	1966	List of cores, Tripod expedition - SIO.
A150	---	-	Florida State University, Core description.
A158	---	1970	Preliminary megascopic core descriptions of cores taken on Robert D. Conrad cruise 13, LDGO.
A167	---	1971	List of cores and dredge hauls, Aries expedition, SIO.
A174	---	1971	List of cores and dredge hauls, Antipode expedition, SIO.
A194	---	1967	National Institute of Oceanography, RSS Discovery cruise 16.
A213	---	1973	Unidentified Source, coded as Amigo.
A221	---	1972	List of sediment cores, Cato expedition, SIO.
A226	---	1973	Florida State University, Eltanin cruise 4-54.
A233	---	1973	List of cores and dredge hauls, Benthiface expedition, SIO.
A241	---	1974	Inter-University Program Research on Ferromanganese Deposits of the Ocean. Station summary and sample logs.
A242	---	1975	Inter-University Program of Research on Ferromanganese Deposits of the Ocean. Station summary and sample logs.
A252	---	1975	National Oceanographic Data Center. Bottom Photograph Camera Station File (photo). Note: depth of photo stations may refer to camera depth.
A257	---	1974	List of cores and dredge hauls.
A265	---	1972	Megascopic core descriptions Vema 29, LDGO.
A266	---	1971	Megascopic core descriptions Vema 28, LDGO.

A267	---	1972	Megascopic core descriptions, Conrad, LDGO.
A269	---	1975	List of cores and dredge hauls, Eurydice expedition, SIO.
A290	---	1965	Kennecott Copper Inc., (Special Products). Analyses of manganese nodules obtained from Scripps Institution of Oceanography.
A306	---	1973	Megascopic core descriptions (R/V Robert D. Conrad cruise 16, LDGO.
A308	---	1973	Megascopic core descriptions. R/V Vema cruise 30, LDGO.
A325	---	1976	Sample data index, Deepsonde expedition, SIO.
A333	---	1976	Nodule analyses done by Kennecott Exploration, Inc.
A336	---	1975	Preliminary megascopic core descriptions taken on Robert D. Conrad, LDGO.
A337	---	1977	Domes Project. Index of Box Cores.
A339	---	1976	List of cores and dredge hauls. Pleiades expedition, SIO.
A340	---	1976	Sample index, Indopac, SIO.
A352	---	1973	Kennecott Exploration, Inc.
A386	---	1977	Seascope Exploration Data Summary.
A392	---	1977	International CLB Group.
A393	---	1977	International CLB Group.
A407	---	-	Kennecott Exploration, Inc.
A409	---	-	Deepsea Ventures, Inc.
A419	---	1978	Kennecott Copper Corporation.
A421	---	1979	List of cores and dredge hauls Indomed expedition, SIO.
A426	---	1979	Preussag, VA-07.
A430	---	1979	U.S. Navy Cruises Bartlett (1971) and Kane (1970).
B509	---	1958	Preliminary megascopic description of cores taken on Vema, LDGO.
B511	---	1960	Vema 16 preliminary description, LDGO.
B540	---	1966	Data file, WHOI ref. no. 66-8.
B579	---	1965	Preliminary megascopic descriptions of cores taken on Vema, LDGO.
B733	---	1963	Preliminary megascopic descriptions of cores taken on Vema, LDGO.
B830	---	1964	Preliminary megascopic descriptions of cores taken on Vema, LDGO.
M001	---	1961	Core and dredge lists, Monsoon expedition, SIO.
M002	---	1962	Various logs, Proa expedition.
M003	---	1963	Lusiad Expedition core and dredge list, SIO.
M004	---	-	Carrousel II expedition list of cores
M009	---	1958	Downwind expedition core and dredge lists, SIO.
M013	---	1964	Various logs, Dodo expedition, SIO.
M015	---	1961	List of cores, Japanyon expedition, SIO.
M025	---	1963	Core and dredge list, Luciad expedition, SIO.
M033	---	1958	Downwind expedition list of cores and dredge samples, SIO.
N184	---	1954	List of cores collected on Acapulco Trench (Chubasco) expedition, SIO.
N684	---	1962	Akademiia Nauk, SSSR.
N729	---	1958	Akademiia Nauk, SSSR.

????	Heezen
A006	Revelle
A009	Murray
A010	Murray
A012	Murray
A033	Moore
A068	Goldberg
A069	Khristianova
A077	Young
A082	Fisher
A083	Bruun
A088	Von Gumbel
A117	Johnson
A119	Johnson
A140	Skornyakova
A148	Bezrukov
A165	Goldberg
A166	Barnes
A178	Skornyakova
A179	Horn
A189	Cronan
A194	Glasby
A195	Glasby
A197	Mero
A199	Bender
A200	Ahrens
A201	Willis
A202	Grant
A203	Cronan
A206	Tin
A217	Glasby
A220	Isaeva
A223	Glockhoff
A227	Meylan
A230	Bonatti
A232	Burns
A240	Cronan
A243	Ostwald
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A247	Frazer
A248	Shima
A249	Okada
A250	Glasby
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A280	Mizuno
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A289	Cassidy
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A303	Korkisch
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A309	Greenslate
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A324	Morgan
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A477	Morten
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M025	Conolly
M036	Krause
M038	Hamilton
N170	Stetson
N682	Riedel

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APPENDIX A

NORTH PACIFIC AREA A-2

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
.544	-157.898	1750-1900	KK790808/STA121/RD-42	016002	-	Dredge	HIG	Large breccia boulders encrusted with botryoidal Mn crust up to 80mm (average thickness 50mm).
.707	-157.287	2300-3000	KK8106/STA123/RD-43	016005	-	Dredge	HIG	Mn coated "sediment".
*2.083	-157.350	1350-1550	KK79-08-08/041/1/1	016008	5.0	Dredge	HIG	Volcanic breccia fragments; enclosed fragments appear to be clinopyroxene, plagioclase, olivine, altered olivine phyric set in a glassy to holocrystalline matrix with 1-3mm Mn crust.
2.087 2.092	-157.341 -157.336	1520-1350	KK79-08-08/STA120/RD41	016001	-	Dredge	HIG	Volcanic breccia encrusted with approx 10mm Mn.
2.755	-165.022	1326	7-TOW/118-D	017103	-	Dredge	SIO	Weathered basalt with 1-15mm Mn crust and vesicular, well altered basalt.
2.767	-165.017	1298	7-TOW/119-D	017104	-	Dredge	SIO	Basaltic pebbles with 5mm Mn crust.
3.092	-160.243	1350-1520	KK81-06/STA120/RD-41	017045	20.0	Dredge	HIG	Mn slabs 20mm thick.
3.532	-160.243	2150	KK81-06-20/STA116/RD-35	017044	5.0	Dredge	HIG	5mm Mn over "sediment".
*3.633	-159.517	2800	KK79-08-08/054/1/1	016009	6.0	Dredge	HIG	Mixture of massive non-vesicular basalts and vesicular lavas; thin (<1cm) and patchy crusts.
3.640	-159.523	2800	KK79-08-08/STA133/RD-54	016003	-	Dredge	HIG	Breccia covered with thin (<1mm) and patchy Mn crust, some pieces with up to 5mm Mn crust.
*4.367	-159.083	2150-2650	KK79-08-08/055/3/3	016010	2.0	Dredge	HIG	Large chalky limestone boulder; fine grained basaltic sandstone fragments with pelecypod burrows; grey mud balls.
5.232	-161.497	1307	7-TOW/D-122	017001	-	-	SIO	Fresh vesicular basalt with 1-5mm Mn crust.
5.872	-160.848	1604	7-TOW/D-123	017002	-	Dredge	SIO	Mn encrusted altered basaltic boulder with up to 10mm crust.
6.174 6.172	-162.865 -162.864	3778-3735	MIDPAC2A-SO33/28MS/28MS	017076	-	Multisonde	TUCLZ	Oxygen minimum zone at 180 dbars.
6.216	-162.755	1451	MIDPAC2A-SO33/32KH/32KH	017081	-	Box Core	TUCLZ	No recovery.
6.263 6.276	-162.963 -162.951	2887-2387	MIDPAC2A-SO33/33DS/33DS MIDPAC2A-SO33/33DS/33DS2 MIDPAC2A-SO33/33DS/33DS3	017082 017083 017084	2.5	Chainbag Dredge	TUCLZ	<1kg crust, columnar basalts, "sediment", chalk.

*Sample data as described in Aplin, 1983.

NORTH PACIFIC AREA A-2

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
6.269	-162.773	1090	MIDPAC2A-S033/27GTV/27GTV3	017075	-	TV Grab	TUCLZ	
6.271 6.273	-162.876 -162.872	2957-2414	MIDPAC2A-S033/29DK/29DK3	017077	2.5	Box Dredge	TUCLZ	<1kg crust on basalt and chalky breccia.
6.274 6.282	-162.886 -162.883	2217-1388	MIDPAC2A-S033/30DK/30DK1	017078	2.5	Box Dredge	TUCLZ	Thin veneer on breccia and basalt.
6.281 6.279	-162.878 -162.877	1376-1378	MIDPAC2A-S033/31DK/31DK1 MIDPAC2A-S033/31DK/31DK2	017079 017080	-	Box Dredge	TUCLZ	Crust veneer on oxidized glassy substrate.
6.281	-162.776	893	MIDPAC2A-S033/27GTV/27GTV2	017074	-	TV Grab	TUCLZ	
6.290 6.301	-162.970 -162.927	2486-1409	MIDPAC2A-S033/34DK/34DK2	017085	40.0	Box Dredge	TUCLZ	~12kg of thick crust on basalt.
6.311	-162.776	861	MIDPAC2A-S033/27GTV/27GTV1	017073	-	TV Grab	TUCLZ	
6.315 6.313	-162.790 -162.786	861-859	MIDPAC2A-S033/26MS/26MS	017072	-	Multisonde	TUCLZ	Oxygen minimum zone between 160-220 dbars.
6.503 6.499	-162.370 -162.375	2572-2347	MIDPAC2A-S033/25DS/25DS6	017071	5.0	Chainbag Dredge	TUCLZ	Thin veneer of crust on tuffaceous material.
6.516 6.500	-162.408 -162.388	2349-1766	MIDPAC2A-S033/24DS/24DS	017070	-	Chainbag Dredge	TUCLZ	Oyster shells and corals.
6.541 6.499	-162.442 -162.373	3474-2015	MIDPAC2A-S033/23FE/23FE	017069	-	Photo Sled	TUCLZ	Lost camera sled.
6.571	-162.441	-	MIDPAC2A-S033/22KH/22KH	017068	-	Box Core	TUCLZ	Foramineferal ooze.
8.186 8.178	-161.919 -161.919	3890	KK790808/STA112/RD33	017005	-	Dredge	HIG	20mm crust fragments, some pillow basalt fragments-substrate unknown.
8.186 8.183	-164.202 -164.200	1800	SPLEE L583HW/050/D32-52	017021	2.0	Chainbag Dredge	USGS-WH	Basalt breccia with thin layers of Mn crust to 7mm.
8.194	-164.200	1600-1450	SPLEE L583HW/049/D31-50 SPLEE L583HW/049/D31-51	017019 017020	5.0 45.0	Chainbag Dredge	USGS-WH	Massive coal-like crust fragment with knobby surface; crust on breccia with calcite cement and some phosphorite between crust and substrate.
8.235	-164.207	1300	SPLEE L583HW/048/D30	017018	-	Chainbag Dredge	USGS-WH	One boulder of fresh pumice; no manganese recovered.

NORTH PACIFIC AREA A-2

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
8.297 8.312	-164.369 -164.351	1700	SPLEE L583HW/047/D29-49	017017	2.0	Chainbag Dredge	USGS-WH	Boulder of white calcareous "sediment" with Mn crust and phosphorite on 2 or 3 sides; white-brn calcareous "sediment" and yellow-brn pebbly coarse-grained "sediment".
8.308 8.311	-164.346 -164.374	1400	SPLEE L583HW/046/D28-46 SPLEE L583HW/046/D28-4	017014 017015	- 3.0	Chainbag Dredge	USGS-WH	Large boulders (>50lbs) with knobby to botryoidal Mn crust; many isolated crustfragments to 4cm thick (porous on outside).
8.330	-164.362	1519	7-TOW/130-D	017004	-	Dredge	SIO	Fresh basalt with 2-10mm Mn crust.
8.353	-164.317	1150-1125	SPLEE L583HW/045/D27-44 SPLEE L583HW/045/D27-45	017012 017013	7.0 15.0	Chainbag Dredge	USGS-WH	Mn crust 0.5-3cm with botryoidal to smooth surface on highly altered basaltic breccia; large boulder(200 lbs) with 1.5cm massive crust which appears to be badly abraded.
8.389 8.392	-164.294 -164.292	1600	SPLEE L583HW/042/D25-43	017011	-	Chainbag Dredge	USGS-WH	Mn crust 1mm to 1.5cm on volcaniclastic breccia; basalt with thin crust all around.
8.398	-164.359	2400	SPLEE L583HW/041/D24-41 SPLEE L583HW/041/D24-42	017009 017010	30.0 20.0	Chainbag Dredge	USGS-WH	Mn crust to 4cm on mudstone and Mn crust up to 2cm on pyroclastic or volcaniclastic rocks.
8.414 8.417	-164.289 -164.301	1850-1900	SPLEE L583HW/040/D23-38 SPLEE L583HW/040/D23-39 SPLEE L583HW/040/D23-40	017006 017007 017008	38.0 3.0 20.0	Chainbag Dredge	USGS-WH	Mn crust 2-40mm volcaniclastic-pyroclastic tuffaceous rock, crust is porous and knobby to botryoidal or smooth; fractured basalt and some fresh basalt.
8.930	-164.555	4939	MIDPAC1-SO18/GBHF 13/CKB-3	017022	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
8.941	-164.567	4922	MIDPAC1-SO18/GBHF 14/CKB-4	017023	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
8.942	-164.581	4930	MIDPAC1-SO18/KH 19/CKB-8	017027	-	Box Core	TUCLZ	Mn crust.
8.953	-164.581	4880	MIDPAC1-SO18/GBHF 15/CKB-5	017024	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
8.964	-164.593	4892	MIDPAC1-SO18/GBHF 16/CKB-6	017025	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
8.978	-164.605	4810	MIDPAC1-SO18/GBHF 17/CKB-7	017026	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
9.081	-164.727	4301	MIDPAC1-S018/DK 30/CKB-10	017029	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-S018/DK 30/CKB-11	017030				
			MIDPAC1-S018/DK 30/CKB-12	017031				
			MIDPAC1-S018/DK 30/CKB-13	017032				
			MIDPAC1-S018/DK 30/CKB-14	017033				
9.140	-164.789	2638-1872	MIDPAC2A-S033/41DK/41DK2	017090	-	Box Dredge	TUCLZ	
9.163	-164.794							
9.142	-164.784	2465	MIDPAC1-S018/DK 32/CKB-23	017040	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-S018/DK 32/CKB-24	017041				
			MIDPAC1-S018/DK 32/CKB-25	017042				
			MIDPAC1-S018/DK 32/CKB-26	017043				
9.148	-164.808	2600	MIDPAC1-S018/DK 31/CKB-17	017034	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-S018/DK 31/CKB-18	017035				
			MIDPAC1-S018/DK 31/CKB-19	017036				
			MIDPAC1-S018/DK 31/CKB-20	017037				
			MIDPAC1-S018/DK 31/CKB-21	017038				
			MIDPAC1-S018/DK 31/CKB-22	017039				
9.159	-164.758	2294	MIDPAC2A-S033/45GTV/45GTV	017094	-	Box Dredge	TUCLZ	Calcareous "sediment" with low phosphate.
9.164	-164.842	2291-2348	MIDPAC2A-S033/37DK/37DK1	017086	2.5	Box Dredge	TUCLZ	~1kg crust with breccia and basalt.
9.163	-164.842							
9.166	-164.798	1427-1093	MIDPAC2A-S033/40DK/40DK2	017089	-	Box Dredge	TUCLZ	1kg crust.
9.218	-164.833							
9.170	-164.778	1872-1320	MIDPAC2A-S033/42DK/42DK	017091	-	Box Dredge	TUCLZ	1 large boulder ~200kg and fragments of variable size.
9.189	-164.778							
9.172	-164.826	1853-1361	MIDPAC2A-S033/38DK/38DK1	017087	-	Box Dredge	TUCLZ	5kg crust on breccia and basalt of hydrothermal origin, phosphorite.
9.178	-164.823							
9.179	-164.830	1263-1158	MIDPAC2A-S033/39DK/39DK2	017088	-	Box Dredge	TUCLZ	3kg crust on vesicular basalt.
9.201	-164.842							
9.194	-164.770	1677-1320	MIDPAC2A-S033/43DK/43DK	017092	-	Box Dredge	TUCLZ	Basalt with thin veneer crust.
9.202	-164.774							
9.200	-164.929		MIDPAC2A-S033/49DK/49DK3	017099	10.0	Box Dredge	TUCLZ	5kg crust, basalt, breccia.
9.209	-164.929							

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
9.201	-164.825	1200	MIDPAC1-SO18/SR 25W/CKB-9	017028	-	Gravity Core	TUCLZ	Mn crust.
9.223 9.184	-164.858 -164.871	1420-1350	MIDPAC2A-5033/47DK/47DK-AM	017102	-	Box Dredge	TUCLZ	
9.225 9.229	-164.780 -164.780	1456-1539	MIDPAC2A-SO33/44DK/44DK2	017093	-	Box Dredge	TUCLZ	15kg crust, basalt, breccia, phosphorite.
9.247 9.265	-164.846 -164.838		MIDPAC2A-SO33/48DK/48DK1 MIDPAC2A-SO33/48DK/48DK2 MIDPAC2A-SO33/48DK/48DK3 MIDPAC2A-SO33/48DK/48DK4	017095 017096 017097 017098	-	Box Dredge	TUCLZ	33kg crust on basalt, "sediment".
9.292	-158.638	2121	7-TOW/D-128	016004	-	-	SIO	Basalt fragments with Mn stain.
9.333	-163.167	1563	7-TOW/D-129	017003	-	-	SIO	Two nodules.
9.640 9.807	-162.186 -162.086	3322-3522	MIDPAC2A-SO33/7FE/7FE	017046	30.0	Photo Sled	TUCLZ	Good tv coverage, no black and white photos.
9.669 9.672	-162.202 -162.201	3356-3301	MIDPAC2A-SO33/20MS/20MS	017066	-	Multisonde	TUCLZ	
9.670 9.686	-162.170 -162.177	2696-2434	MIDPAC2A-SO33/21FE/21FE	017067	-	Photo Sled	TUCLZ	
9.681 9.767	-162.182 -162.139	2650-1236	MIDPAC2A-SO33/16FE/16FE	017061	-	Photo Sled	TUCLZ	
9.682 9.696	-162.184 -162.175	2706-2003	MIDPAC2A-SO33/17DK/17DK2	017062	-	Box Dredge	TUCLZ	5 kg crust on highly altered basalt.
9.693 9.690	-162.203 -162.195	2773-2796	MIDPAC2A-SO33/14KH/14KH	017058	-	Box Core	TUCLZ	No recovery.
9.694 9.695	-162.208 -162.209	2929-2903	MIDPAC2A-SO33/13MS/13MS	017057	-	Multisonde	TUCLZ	Oxygen minimum zone at 220 dbars; unreliable.
9.694 9.705	-162.178 -162.177	1993-1829	MIDPAC2A-SO33/8DK/8DK1 MIDPAC2A-SO33/8DK/8DK6 MIDPAC2A-SO33/8DK/8DK7 MIDPAC2A-SO33/8DK/8DK8	017047 017048 017049 017050	7.5	Box Dredge	TUCLZ	Thin Mn crust on basalt.
9.696 9.720	-162.181 -162.176	1927-1481	MIDPAC2A-SO33/9DK/9DK1 MIDPAC2A-SO33/9DK/9DK2 MIDPAC2A-SO33/9DK/9DK3	017051 017052 017053	10.0	Box Dredge	TUCLZ	Mn crust on freshly altered basalt.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
9.702	-162.195	2231	MIDPAC2A-SO33/10GTV/10GTV	017054	-	TV Grab	TUCLZ	No recovery.
9.705	-162.184	1940-1316	MIDPAC2A-SO33/18DK/18DK	017063	-	Box Dredge	TUCLZ	2 kg crust.
9.737	-162.164		MIDPAC2A-SO33/18DK/18DK1	017064				
9.716	-162.167	1602-1294	MIDPAC2A-SO33/15DK/15DK1	017059	-	Box Dredge	TUCLZ	Mn crust.
9.734	-162.163		MIDPAC2A-SO33/15DK/15DK2	017060				
			MIDPAC2A-SO33/15DK/15DK4M	017101				
9.724	-162.173	1623-1229	MIDPAC2A-SO33/19GTV/19GTV	017065	-	TV Grab	TUCLZ	No recovery.
9.754	-162.168							
9.758	-162.147	1226-1225	MIDPAC2A-SO33/12KH/12KH	017056	-	Box Core	TUCLZ	No recovery.
9.759	-162.149							
9.760	-162.133	2129-5139	MIDPAC2A-SO33/11MS/11MS	017055	-	Multisonde	TUCLZ	Oxygen minimum zone at 200 dbars.
9.759	-162.134							
10.293	-165.995	1790	7-TOW/D-134	053006	-	Dredge	SIO	Altered basalt pebbles with 0-15mm Mn crust.
10.813	-165.544	1325-1150	KK7910/STA136/RD-58	053010	-	Dredge	HIG	Up to 30mm (average 25mm) Mn crust on breccia.
*10.817	-165.550	1150-1325	KK790808/058/1/2	053051	10.0	Dredge	HIG	Angular basaltic breccias with clasts
			KK790808	053052	30.0			of <1cm sandstone and basalt pebbles
			KK790808/058/2/2B/058/2/2A	053053	30.0			cemented with pale green clay rich
								matrix; Mn coating <1cm in thickness.
12.517	-167.050	3000-3750	KK790808/059/7/7	053054	5.0	Dredge	HIG	Sub-angular basalt fragments of 10-25% vesicular basalt and massive Mn free basalts; angular basaltic sandstones with thin (2cm) and patchy Mn coating.
12.987	-164.958	2055	MIDPAC1-SO18/DK 44/CKB-35	053044	-	Dredge	TUCLZ	Mn crust.
13.001	-164.968	3040	MIDPAC1-SO18/DK-43/CKB-31	053040	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-SO18/DK-43/CKB-32	053041				
			MIDPAC1-SO18/DK-43/CKB-33	053042				
			MIDPAC1-SO18/DK-43/CKB-34	053043				
13.036	-165.126	5240	MIDPAC1-SO18/KH42/CKB-30	053039	-	Box Core	TUCLZ	Mn crust.
13.115	-165.552	4774	MIDPAC1-SO18/GBHF50/CKB-28	053037	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
13.138	-165.559	4710	MIDPAC1-SO18/KH49/CKB-27	053036	-	Box Core	TUCLZ	Mn crust.
13.140	-165.517	4083	MIDPAC1-SO18/DK 56/CKB-36	053045	-	Dredge	TUCLZ	Mn crust.
13.149	-165.520	3998	MIDPAC1-SO18/GBHF55/CKB-29	053038	-	Freefall Grab	TUCLZ	Small Mn nodules 1-2cm in diameter.
13.151	-165.485	4150	MIDPAC1-SO18/DK 57/CKB-37	053046	-	Dredge	TUCLZ	Mn crust.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
13.200	-165.462	1508	MIDPAC1-SO18/DK 58/CKB-38	053047	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-SO18/DK 58/CKB-39	053048				
			MIDPAC1-SO18/DK 58/CKB-40	053049				
13.462	-165.419	3850	KK7910/STA138/RD-60	053011	-	Dredge	HIG	Volcaniclastic sediment with up to 40mm Mn crust.
*13.467	-165.417	3850	KK790808/060/2/4A	053055	20.0	Dredge	HIG	Angular to sub-rounded pillow basalt
			KK790808/060/2/4B	053056	10.0			fragments and massive salts with thin
			KK790808/060/3/4	053057	8.0			(<1cm) Mn crust.
			KK790808/060/4/4	053058	13.0			
14.417	-145.867	4618	VEMA 20/RD-4	051003	15.0	Dredge	LDGO	Nodule fragments with nucleii resembling phosphatized carbonate.
14.456	-169.003	1770-1612	MIDPAC2B-SO37/10DK/10DK1	053104	15.0	Box Dredge	TUCLZ	
14.455	-168.992		MIDPAC2B-SO37/10DK/10DK2	053129	15.0			
			MIDPAC2B-SO37/10DK/	053140	-			
			10DK-SEM-63					
14.458	-168.978	1750	7-TOW/137-D	053007	-	Dredge	SIO	Mn encrusted (15mm) on altered basaltic boulder or conglomerate.
14.462	-169.017	2110-1780	MIDPAC2B-SO37/9DK/9DK5	053103	7.5	Box Dredge	TUCLZ	60% talus-40% broken from outcrop.
14.457	-169.001		MIDPAC2B-SO37/9DK/9DK6	053128				
14.982	-166.448	2800	KK7910/STA139/RD61	053012	-	Dredge	HIG	Volcanoclastic sediment with 10-15mm Mn crust.
*14.983	-166.100	2800	KK790808/061/2/5A	053059	20.0	Dredge	HIG	Rounded basaltic sandstones with thin
			KK790808/061/2/5B	053060	15.0			<1cm Mn coating; vesicular basalts and
			KK790808/061/4/5A	053061	25.0			sub rounded pillow basalts with thin
			KK790808/061/4/5B1	053062	35.0			<1cm Mn coating.
			KK790808/061/4/5B2	053063	35.0			
			KK790808/061/4/5B3	053064	35.0			
*15.150	-168.100	2700	KK790808/062/1/3A	053065	70.0	Dredge	HIG	Massive altered basalts with 2-6cm Mn
			KK790808/062/1/3B	053066	70.0			coating; basaltic sandstone with 2-6cm
			KK790808/062/1/3C	053067	70.0			Mn coating; both phases are 5-20cm
			KK790808/062/1/3D	053068	70.0			in length.
			KK790808/062/1/3E	053069	70.0			
			KK790808/062/1/3F	053070	70.0			
			KK790808/062/3/3A	053071	62.0			
			KK790808/062/3/3E	053072	62.0			
			KK790808/062/3/3F	053073	62.0			
15.156	-168.102	2700	KK7910/STA140/RD62	053013	-	Dredge	HIG	Up to 50mm Mn crust over limestone (mostly replaced).

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
15.492 15.503	-169.248 -169.257	2929-2700	MIDPAC2A-S033/63DK/63DK	053101	15.0	Box Dredge	TUCLZ	20 kg crust.
15.492 15.507	-169.236 -169.246	2468-1654	MIDPAC2A-S033/64DK/64DK	053102	3.0	Box Dredge	TUCLZ	5kg of thin crust veneer.
15.520	-169.209	2025	MIDPAC2B-S037/32MS/32MS	053105	-	Multisonde	TUCLZ	Multisonde data.
15.531 15.538 15.550	-169.213 -162.228 -162.250	940 1552-1765	MIDPAC2B-S037/42MS/42MS MIDPAC2A-S033/62DK/62DK	053115 053100	- 30.0	Multisonde Box Dredge	TUCLZ TUCLZ	Multisonde data.
15.538	-169.234	-	MIDPAC2A-S033/53GTV/1	053091	1.0	TV Grab	TUCLZ	Thin crust on altered trachyte clasts cemented with phosphorite.
15.544 15.536	-169.238 -169.233	1769-1562	MIDPAC2B-S037/43DS/43DS1 MIDPAC2B-S037/43DS/43DS2 MIDPAC2B-S037/43DS/43DS6	053116 053131 053132	2.0	Chainbag Dredge	TUCLZ	300kg substrate, hyaloclastite and volcanic breccia)- 100kg crust.
15.559	-169.219	1655	MIDPAC2B-S037/33GK/33GK	053106	-	Spade Core	TUCLZ	Foram ooze.
15.563 15.551	-169.224 -169.212	1651-1802	MIDPAC2B-S037/37DS/37DS3	053110	5.0	Chainbag Dredge	TUCLZ	133kg substrate of alkaline olivine hyaloclastite and volcanic breccia, 2kg "sediment", 5kg nodules, 30kg thin crust.
15.568	-169.215	-	MIDPAC2A-S033/61KH/1/ 61KH/1	053098	-	Box Core		No recovery.
15.570	-169.217	1630	MIDPAC2B-S037/34GK/34GK	053107	-	Spade Core	TUCLZ	
15.576	-169.220	1635	MIDPAC2B-S037/35GK/35GK	053108	-	Spade Core	TUCLZ	
15.582	-169.208	-	MIDPAC2A-S033/55DK/55DK	053093	-	Box Dredge	TUCLZ	Crust on basalt.
15.584 15.589	-169.205 -169.192	1605-1263	MIDPAC2B-S037/46DS/46DS3	053118	10.0	Chainbag Dredge	TUCLZ	220kg substrate, hyaloclastite)-30kg crust.
15.587	-169.223	-	MIDPAC2A-S033/61KH/2	053099	-	Box Core		No recovery.
15.588	-169.218	1585	MIDPAC2A-S033/60GK/60GK	053097	-	Spade Core	TUCLZ	Small (10cm * 8cm) piece of crust-encrusted hyaloclastite.
15.590	-169.207	-	MIDPAC2A-S033/58DK/58DK	053096	40.0	Box Dredge	TUCLZ	Crust on basalt.
15.591	-169.202	-	MIDPAC2A-S033/56DK/56DK	053094	60.0	Box Dredge	TUCLZ	
15.591	-169.208	-	MIDPAC2A-S033/54GTV/1	053092	20.0	TV Grab	TUCLZ	Hyaloclastite encrusted with crust.
15.591	-169.208	-	MIDPAC2A-S033/57DK/57DK	053095	-	Box Dredge	TUCLZ	Crust on basalt.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
15.594	-170.405	3010	MIDPAC2B-S037/31MS/31MS	054035	-	Multisonde	TUCLZ	Multisonde data.
15.595	-169.204	-	MIDPAC2A-S033/52GTV/1	053090	-	TV Grab	TUCLZ	22kg/m2 density of Mn nodules 3-6cm in diameter.
15.597	-169.232	1630-1575	MIDPAC2B-S037/36DS/36DS1	053109	30.0	Chainbag	TUCLZ	160kg substrate(hyaloclastite and
15.604	-169.244		MIDPAC2B-S037/36DS/36DS6	053130		Dredge		phosphorite and chalk breccia), 10kg nodules, 30kg crust.
15.604	-169.162	1680-1562	MIDPAC2B-S037/45DS/45DS	053134	-	Chainbag	TUCLZ	No recovery.
15.609	-169.139					Dredge		
15.615	-169.227	1498-1388	MIDPAC2B-S037/44DS/44DS1	053117	35.0	Chainbag	TUCLZ	170kg substrate, hyaloclastite and
15.620	-169.210		MIDPAC2B-S037/44DS/44DS6	053133		Dredge		volcanic breccia) -30kg crust.
15.628	-169.239	1552-1399	MIDPAC2B-S037/47DS/47DS2	053119	30.0	Chainbag	TUCLZ	385kg substrate, hyaloclastite and
15.628	-169.222		MIDPAC2B-S037/47DS/47DS3	053135		Dredge		volcanic breccia and chalk and
			MIDPAC2B-S037/47DS/47DS6	053136				phosphorite)-65kg crust.
			MIDPAC2B-S037/47DS/47DS9	053137				
15.630	-169.115	2130-2050	MIDPAC2B-S037/39DS/39DS	053112	-	Chainbag	TUCLZ	25kg substrate of hyaloclastite and
15.623	-169.121					Dredge		volcanic breccia, chalk and phosphorite.
15.631	-170.402	2200-1322	MIDPAC2B-S037/27DS/27DS2	054031	-	Chainbag	TUCLZ	50kg substrate of chalk and basaltic
15.649	-170.377					Dredge		breccia, 18kg "sediment", 2kg crust.
15.637	-170.406	1770-1417	MIDPAC2B-S037/28DS/28DS4	054032	20.0	Chainbag	TUCLZ	400kg substrate, 100kg crust.
15.659	-170.363		MIDPAC2B-S037/28DS/28DS5	054043		Dredge		
15.638	-169.107	2567-2038	MIDPAC2B-S037/41DS/41DS	053114	-	Chainbag	TUCLZ	68kg substrate, 2kg crust.
15.642	-169.113					Dredge		
15.638	-169.103	2983	MIDPAC2B-S037/38MS/38MS	053111	-	Multisonde	TUCLZ	Multisonde data.
15.649	-170.413	2180-1796	MIDPAC2B-S037/18DS/18DS1	054022	40.0	Chainbag	TUCLZ	90kg of talus with Mn crust, organic
15.652	-170.399		MIDPAC2B-S037/18DS/18DS4	054038		Dredge		encrustations on about 10%.
15.658	-170.385	1186-1122	MIDPAC2B-S037/29DS/29DS1	054033	20.0	Chainbag	TUCLZ	50 kg substrate of hyaloclastite,
15.653	-170.391		MIDPAC2B-S037/29DS/29DS3	054044		Dredge		chalky phosphorite and volcanic breccia, 30 kg crust, no nodules.
15.659	-170.381	1120	MIDPAC2B-S037/11MS/11MS	054016	-	Multisonde	TUCLZ	Multisonde data.
15.664	-170.397	1433-1114	MIDPAC2B-S037/20DS/20DS1	054024	70.0	Chainbag	TUCLZ	100% Mn encrusted hyaloclastites-50% of
	15.667	-170.388	MIDPAC2B-S037/20DS/20DS4	054042		Dredge		these encrusted with organics-no nodules.
15.665	-170.386	1520-1224	MIDPAC2B-S037/30DS/30DS1	054034	20.0	Chainbag	TUCLZ	90 kg substrate of chalk, phosphorite
15.663	-170.381		MIDPAC2B-S037/30DS/30DS2	054045		Dredge		and volcanic breccia, 30kg crust.
			MIDPAC2B-S037/30DS/30DS5	054046				

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
15.666	-169.289	1585	MIDPAC2B-S037/50DS/50DS	053122	-	Chainbag	TUCLZ	No recovery. volcanoclastic substrate with 4cm layer of Mn crust.
15.671 15.688	-170.413 -170.396	1815-1460	MIDPAC2B-S037/19DS/19DS2 MIDPAC2B-S037/19DS/19DS3 MIDPAC2B-S037/19DS/19DS5 MIDPAC2B-S037/19DS/19DS5	054023 054039 054040 054041	25.0	Chainbag Dredge	TUCLZ	65kg crusts, 135kg substrate of hyaloclastite chalky phosphorite volcanic breccia, organic encrustations on 20%, no nodules.
15.673 15.675 15.641	-170.381 -169.124 -169.098	1117 3443-2479	MIDPAC2B-S037/21GK/21GK MIDPAC2B-S037/40DS/40DS	054025 053113	40.0 4.0	Spade Core Chainbag Dredge	TUCLZ TUCLZ	75g of foram sand with Mn crust fragments, one large rock of 33kg substrate, 2kg crust.
15.679	-170.331	2685	MIDPAC2B-S037/13FE/13FE	054018	-	TV Sled	TUCLZ	Tv sled photo coverage.
15.680 15.688	-170.358 -170.355	1710-1878	MIDPAC2B-S037/16DK/16DK	054020	-	Box Dredge	TUCLZ	Dredge empty except for 4 pebbles and 1 crust.
15.683	-170.359	1628-1180	MIDPAC2B-S037/17DS/17DS1 MIDPAC2B-S037/17DS/17DS -SEM-64	054021 054049	7.0	Chainbag Dredge	TUCLZ	95% encrusted substrates of hyaloclastite basalt and volcanigenic breccia.
15.691	-169.208	1709	MIDPAC2B-S037/49CG/49CG	053121	-	Gravity Core	TUCLZ	No recovery.
15.696 15.682	-170.344 -170.358	2260-1175	MIDPAC2B-S037/15DS/15DS1 MIDPAC2B-S037/15DS/15DS4	054019 054036	5.0	Chainbag Dredge	TUCLZ	175kg substrate, 20kg crust, 5kg nodules.
15.701	-169.206	1726	MIDPAC2B-S037/48GK/48GK	053120	-	Spade Core	TUCLZ	10cm of ???.
15.744	-170.488	1779	MIDPAC2B-S037/26CG/26CG	054030	-	Gravity Core	TUCLZ	Calcareous "sediment".
15.745	-170.515	1773	MIDPAC2B-S037/22GK/22GK	054026	-	Spade Core	TUCLZ	Foram-nanno fossil ooze.
15.745	-170.515	1842	MIDPAC2B-S037/23CG/23CG	054027	-	Gravity Core	TUCLZ	Foram-nanno fossil ooze.
15.746	-170.496	1749	MIDPAC2B-S037/25KH/25KH	054029	-	Box Core	TUCLZ	
15.746	-170.509	1772	MIDPAC2B-S037/24CG/24CG	054028	-	Gravity Core	TUCLZ	Foram-nanno fossil ooze.
15.833	-170.312	3100	MIDPAC2B-S037/12MS/12MS	054017	-	Multisonde	TUCLZ	Multisonde data.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
*16.433	-168.150	2325	KK790808/063/1/9	053074	10.0	Dredge	HIG	5-20cm angular fragments of vesicular basalt with 1-6cm Mn coating, limestone; 5-20cm fragments with 2cm of patchy Mn coating.
			KK790808/063/2/9A	053075	25.0			
			KK790808/063/2/9B	053076	25.0			
			KK790808/063/2/9C	053077	25.0			
			KK790808/063/5/9A	053078	2.0			
			KK790808/063/5/9B	053079	1.0			
			KK790808/063/6/9A	053080	20.0			
			KK790808/063/6/9B	053081	5.0			
			KK790808/063/8/9	053082	20.0			
*16.433	-168.150	2400	KK790808/064/2/7	053083	30.0	Dredge	HIG	Altered basalts with 1-3cm of Mn coating; basaltic sandstone.
			KK790808/064/4/7A	053084	15.0			
			KK790808/064/4/7B	053085	15.0			
			KK790808/064/5/7A	053086	12.0			
			KK790808/064/5/7B	053087	15.0			
			KK790808/064/7/7A	053088	15.0			
			KK790808/064/7/7B	053089	3.0			
16.436	-168.114	2325	KK79-10-29/STA141/RD63	053014	-	Dredge	HIG	Sediment with Mn encrustation 20-50mm thick.
16.678	-169.359	1400	SPLEE L583HW/034/D19-53	053035	-	Chainbag Dredge	USGS-WH	Breccia with organic (carbonate) clasts; basaltic clasts in a manganese or phosphate cement.
16.681	-169.357							
18.135	-169.067	2139	7-TOW/D-142	053008	-	Dredge	SIO	Assorted nodular and basaltic pebbles with light Mn crust.
18.300	-161.767	3111	DODO/D-9-2	053001	-	-	SIO	Mn coated altered basalt or "sediment".
18.350	-158.450	1317	DODO/D-8	052001	-	-	SIO	Altered vesicular basalt with thin(1-4mm) Mn crust.
18.584	-158.352	3541	MIDPAC2A-S033/5MS/5MS	052014	-	Multisonde	TUCLZ	O_2 min. zone@ 650 dbar.
18.637	-158.313	2002-1663	MIDPAC2A-S033/3DK/3DK1	052009	30.0	Box Dredge	TUCLZ	10% crusts on trachyte, small nods.
18.646	-158.309		MIDPAC2A-S033/3DK/3DK3	052010				
			MIDPAC2A-S033/3DK/3DK4	052011				
			MIDPAC2A-S033/3DK/3DK5	052012				
			MIDPAC2A-S033/3DK/3DK2M	052023				
18.643	-158.295	1924-1883	MIDPAC2A-S033/2DK/2DK1	052005	50.0	Box Dredge	TUCLZ	Thick Mn crust on altered basalt.
18.643	-158.300		MIDPAC2A-S033/2DK/2DK3	052006				
			MIDPAC2A-S033/2DK/2DK10	052007				
			MIDPAC2A-S033/2DK/2DK11	052008				
18.659	-158.342	2439-2349	MIDPAC2A-S033/4GTV/4GTV	052013	-	TV Grab	TUCLZ	No recovery.
18.659	-158.341							
18.683	-158.314	1047-486	MIDPAC2A-S033/6DK/6DK2	052015	30.0	Box Dredge	TUCLZ	Thin Mn crust on basalt.
18.686	-158.300		MIDPAC2A-S033/6DK/6DK3	052016				
			MIDPAC2A-S033/6DK/6DK4	052017				

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
18.699 18.678	-158.380 -158.388	3261-3544	MIDPAC2A-S033/1DK/1DK6 MIDPAC2A-S033/1DK/1DK7 MIDPAC2A-S033/1DK/1DK2	052002 052003 052004	5.0	Box Dredge	TUCLZ	~10% encrusted material 10% basalt rubble 80% "sediment".
18.783	-162.050	3147	DODO/D-13	053003	-	-	SIO	Small Mn nodules, crusts with punky substrates.
18.783	-162.050	4629	DODO/D-11	053002	-	-	SIO	Mn encrusted altered basalt and "sediment" with palagonite rind, Mn crust up to 5mm thick.
19.117	-169.733	1805	7-TOW/D-143	053009	-	Dredge	SIO	Mn nodules of variable size.
19.236	-157.172	3000-2600	KK84-04-28-05/76/RD45-306	052020	75.0	Rock Dredge	HIG	500 lbs of basaltic pillow fragments moderately to highly altered (somewhat vesicular) with Mn crust <1mm-10cm; 1 piece limestone.
19.243	-179.668	3224	ARIES-V/D-7	054001	-	Dredge	SIO	Extremely altered clayey basaltic substrate with 5mm crust of material which makes a strong brown streak.
19.317	-176.745	1861	ARIES V/D-10	055002	-	Dredge	SIO	Large cobbles (150mm diam) of heavily altered basalt with palagonite rind and up to 5mm Mn crust.
19.318	-168.651	4411	SPLEE L583HW/015/PC5	053015	-	Piston Core	USGS-WH	Mostly soft brown mud with three pebble layers-one at the surface and two below; some of the subsurface pebbles have Mn stain or thin crust; mud is mostly volcaniclastic.
19.335 19.358	-168.665 -168.698	3791-3700	SPLEE L583HW/018/D11A-20	053017	3.0	Chainbag Dredge	USGS-WH	Breccia and basaltic rocks with thin (2-4mm) Mn crust on at least one side. Crust surfacesknobby and botryoidal with secondary smoothing on some pieces.
19.338	-168.705	2450	SPLEE L583HW/017/PC7	053050	-	Piston Core	USGS-WH	Marl and zeolite.
19.347	-168.658	3622	SPLEE L583HW/016/PC6	053016	-	Piston Core	USGS-WH	Brown mud with gravel; some large pieces of relatively fresh basalt have Mn varnish.
19.350	-162.167	4209	DODO/D-15-3/D-15	053005	-	-	SIO	Altered brecciated rock with some crust 5-10mm thick.
19.355	-168.963	1500	L5-84-CP/23/GC8-GC9	053127	-	Gravity Core	USGS	2 cores of nannoplankton ooze (220cm and 285cm).
19.355	176.780	3672	ARIES V/D-9	055001	-	Dredge	SIO	Miscellaneous cobbles of chalky white altered basalt with glassy rind and 1-2mm Mn crust.
19.361	-171.064	2010	MIDPAC1-S018/DK 75/CKB-44 MIDPAC1-S018/DK 75/CKB-45	054004 054005	-	Dredge	TUCLZ	Mn crust.
19.367	-162.317	4868	DODO/D-14	053004	-	-	SIO	Mn nodules with core (200-300mm diameter) resembling phosphatized carbonate.
19.369	-168.695	2000	SPLEE L583HW/019/D12A-21 SPLEE L583HW/019/D12A-22	053018 053019	3.0 5.0	Chainbag Dredge	USGS-WH	Mn crust to 4mm on basaltic rocks and breccia, crust is botryoidal to smooth; both porous and massive types.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
19.373	-170.991	1190	MIDPAC1-SO18/DK 76/CKB-46	054006	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-SO18/DK 76/CKB-47	054007				
			MIDPAC1-SO18/DK 76/CKB-48	054008				
19.382	-168.887	1532	L5-84-CP/22/GC6-GC7	053126	-	Gravity Core	USGS	2 cores of nannoplankton ooze (286cm and 220cm).
19.392	-168.853	1564	L5-84-CP/21/GC4-GC5	053125	-	Gravity Core	USGS	2 cores of nannoplankton ooze (271cm and 330cm).
19.402	-171.173	2856	MIDPAC1-SO18/DK 73/CKB-41	054002	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-SO18/DK 73/CKB-42	054003				
19.408	-157.080	3050-2800	KK84-04-28-05/77/RD46-309	052021	30.0	Rock Dredge	HIG	200 lbs moderately to highly altered vesicular basalt pillow fragments with Mn crust 0-several cm; hyaloclastic breccia cemented with Mn crust or calcareous mudstone or phosphorite.
			KK84-04-28-05/77/RD46-311	052022	15.0			
19.408	-171.391	1925	MIDPAC1-SO18/DK 78/CKB-49	054009	-	Dredge	TUCLZ	Mn crust.
			MIDPAC1-SO18/DK 78/CKB-50	054010				
			MIDPAC1-SO18/DK 78/CKB-51	054011				
			MIDPAC1-SO18/DK 78/CKB-52	054012				
			MIDPAC1-SO18/DK 78/CKB-53	054013				
			MIDPAC1-SO18/DK 78/CKB-54	054014				
19.413	-168.848	1607	L5-84-CP/20	053124	-	Gravity Core	USGS	No recovery.
19.447	-168.808	1665	L5-84-CP/19/GC2-GC3	053123	-	Gravity Core	USGS	2 cores of nannoplankton foram ooze (260cm and 196cm).
19.481	-157.054	2750-2500	KK84-04-28-05/77/RD47-109	052019	9.0	Rock Dredge	HIG	300 lbs altered palagonite tuff, hyaloclastite breccia and pillow basalt with Mn crusts (<1mm-4cm); hyaloclastite breccia cement with Mn crust or calcite.
19.511	-168.835	1800-1750	SPLEE L583HW/021/D14A-23	053020	10.0	Chainbag	USGS-WH	Cobbles and boulders with Mn crust; surfaces mostly porous.
19.503	-168.828		SPLEE L583HW/021/D14A-24	053021	10.0	Dredge		
			SPLEE L583HW/021/D14A-25	053022	20.0			
			SPLEE L583HW/021/D14A-26	053023	10.0			
			SPLEE L583HW/021/D14A-28	053025	30.0			
			SPLEE L583HW/021/D14A-27	053024	20.0			
19.515	-168.855	1790	SPLEE L583HW/026/D18-32	053029	35.0	Chainbag	USGS-WH	Volcanic rocks with Mn crust to 4cm on at least one side; most have crust on all sides; surfaces subtley botryoidal.
19.495	-168.865		SPLEE L583HW/026/D18-33	053030	15.0	Dredge		
			SPLEE L583HW/026/D18-34	053031	5.0			
			SPLEE L583HW/026/D18-35	053032	10.0			
			SPLEE L583HW/026/D18-36	053033	10.0			
			SPLEE L583HW/026/D18-37	053034	15.0			
19.553	-168.832	2400	SPLEE L583HW/024/D17A-30	053027	10.0	Chainbag Dredge	USGS-WH	Mn crust to 1.5cm on altered basaltic rock (conglomerate-like).

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
19.695 19.676	-168.995 -168.984	4500-4300	SPLEE L583HW/022/D15B-29	053026	-	Chainbag Dredge	USGS-WH	F at pancake nodules, 3 pieces completely covered with Mn, smooth bottom surfaces and knobby top surfaces; substrate appears to be claystone.
20.078	-170.642	1332	MIDPAC1-S018/DK 111/CKB-55 MIDPAC1-S018/DK 111/CKB-56 MIDPAC1-S018/DK 111/CKB-57 MIDPAC1-S018/DK 111/CKB-58 MIDPAC1-S018/DK 111/CKB-59	090004 090005 090006 090007 090008	-	Dredge	TUCLZ	Mn crust.
20.133 20.134	-170.681 -170.680	1476-1463	MIDPAC2A-S033/69DK/69DK1 MIDPAC2A-S033/69DK/69DK2	090011 090012	-	Box Dredge	TUCLZ	
20.209 20.198	-169.506 -169.519	4500-4800	SPLEE L583HW/012/D8A-13 SPLEE L583HW/012/D8B-14 SPLEE L583HW/012/D8B-15 SPLEE L583HW/012/D8C-16	089025 089026 089027 089028	40.0 30.0 30.0 -	Chainbag Dredge	USGS-WH	Thick crusts to 4.5cm (massive and porous) on volcaniclastic silty mud stone; nodules type 1.
20.212	-170.588	1313	MIDPAC2A-S033/73GTV/73GTV	090017	-	TV Grab	TUCLZ	
20.218 20.217	-170.589 -170.586	1480-1404	MIDPAC2A-S033/72DK/72DK1 MIDPAC2A-S033/72DK/72DK2	090015 090016	25.0	Box Dredge	TUCLZ	40 kg crust-high phosphorite.
20.220	-170.568	2573	MIDPAC1-S018/DK 113/CKB-60 MIDPAC1-S018/DK 113/CKB-61	090009 090010	-	Dredge	TUCLZ	Mn crust.
20.222	-170.600		MIDPAC2A-S033/71DK MIDPAC2A-S033/71DK	090013 090014	-	Box Dredge	TUCLZ	
20.335 20.331	-169.575 -169.572	2400	SPLEE L583HW/014/D10-17 SPLEE L583HW/014/D10-18 SPLEE L583HW/014/D10-19	089029 089030 089031	7.0 30.0 10.0	Chainbag Dredge	USGS-WH	
21.670	-167.953	1690	7-TOW/144-D	089001	-	Dredge	SIO	Mn nodules.
21.718 21.722	-167.578 -167.587	2400-2100	SPLEE L583HW/009/D6AY-6 SPLEE L583HW/009/D6AY-7 SPLEE L583HW/009/D6AX-8 SPLEE L583HW/009/D6AX-9	089017 089018 089019 089020	40.0 40.0 4.0 4.0	Chainbag Dredge	USGS-WH	Mn crust on altered basalt and basaltic breccia; whitish phosphorite? and sedimentary rock; very few nodules.
21.796 21.800	-167.624 -167.615	2100	SPLEE L583HW/010/D7AX-10 SPLEE L583HW/010/D7FX-11 SPLEE L583HW/010/D7FX-12	089021 089022 089023	25.0 40.0 5.0	Chainbag Dredge	USGS-WH	Massive crusts on altered basaltic rocks and breccia.
21.841	-167.666	4123	SPLEE L583HW/011/PC4	089024	-	Piston Core	USGS-WH	Brown soft clayey mud with two layers of rubbly claystone with altered basaltic rocks; some small Mn covered pebbles.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
22.181 22.203	-166.810 -166.785	3950-4200	SPLEE L583HW/001/D1A-1	089011	1.0	Chainbag Dredge	USGS-WH	1-3mm crusts on altered basalt gray-brown to black with phenocrysts; 3-4mm crusts on brown indurated "sediment" scrofulous on top.
22.181	-166.861	3403	SPLEE L583HW/004/PC1	089012	-	Piston Core	USGS-WH	White-brown nannofossil mud, stiff in part and darker brown near surface.
22.208	-166.882	2402	SPLEE L583HW/005/PC2A-2	089013	4.0	Piston Core	USGS-WH	Mn nodules and crusts on phosphorite strata with foram sand.
22.256	-166.854	1970	SPLEE L583HW/006/PC3A-3	089014	20.0	Piston Core	USGS-WH	Botryoidal crust on clay and foram sand.
22.316 22.305	-166.899 -166.902	2350-2100	SPLEE L583HW/008/D5BX-4 SPLEE L583HW/008/D5CX-5	089015 089016	28.0 3.0	Chainbag Dredge	USGS-WH	Haul dominated by Mn crusts on altered pillow basalt and basaltic breccia; nodules recovered as well.
23.112 23.116	-162.480 -162.464	1650-2080	KK7601MN/STA9/D11	089003	-	Dredge	HIG	15mm Mn crust over altered conglomerate.
23.172	-162.434	1849-2200	KK76-01-MN/STA9/RD-10	089035	-	Dredge	HIG	Mn coated boulder.
23.317	-158.317	3000-2400	KK8007/RD25	088001	-	Dredge	HIG	10mm Mn crust over vesicuular basalt.
23.672	-164.891	1650-1000	KK84-04-28-05/94/RD75-1 KK84-04-28-05/94/RD75-212 KK84-04-28-05/94/RD75-214 KK84-04-28-05/94/RD75-220	089041 089086 089087 089091	5.0 7.0 8.5 8.0	Rock Dredge	HIG	Altered h yaloclastite breccia with mod-altered basalt clasts to grey-brown indurated calcareous clay(bioturbation) Mn crust 2mm to 1cm.
23.711 23.717	-165.602 -165.608	1325-1340	KK7601MN/STA8/RD9	089002	-	Dredge	HIG	Mn crust up to 2.5cm thick with substrate of altered basaltic breccia.
23.817	-164.420	870	KK720702 MIDWAY/D-47	089033	50.0	Dredge	HIG	Flat slab of Mn crust with botryoidal surface about 50mm thick.
23.915	-164.408	800-600	KK84-04-28-05/90/RD68-10	089061	7.5	Rock Dredge	HIG	Red-brown beachrock, indurated calcareous silt-sandstone, minor Mn crust <1mm to 2cm.
23.956	-164.414	1300-950	KK84-04-28-05/90/RD67-104	089073	7.0	Rock Dredge	HIG	Highly altered basalt, altered hyaloclastite breccia, Mn crust and calcareous indurated sediment breccia and indurated calcareous "sediment", Mn crust <1mm to 2.5cm.
23.961	-164.276	2650-2000	KK84-04-28-05/90/RD65-103	08907213.0		Rock Dredge	HIG	Indurated brown calcareous sediment with evidence of bioturbation, some volcaniclastic conglomerate with cobbles of altered vesicular basalt, Mn crust 2-13mm.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
23.979	-164.363	2200-1750	KK84-04-28-05/90/RD64-308	089097	3.5	Rock Dredge	HIG	Indurated brown calcareous sediment with evidence of bioturbation, Mn crust<1mm to 1cm on all 9 samples.
			KK84-04-28-05/90/RD64-310	089098	4.5			
23.988	-164.485	2100-1900	KK84-04-28-05/89/RD63-7	089057	12.5	Rock Dredge	HIG	Indurated calcareous sediment, homogeneous brown calcareous "sediment", 2, layered with darker calcareous "sediment" Mn crust <1mm thick.
24.322	-168.083	1225-1180	KK84-04-28-05/73/PD18-11	089038	-	Pipe Dredge	HIG	Primarily Mn encrusted mudstones and Mn crust fragments.
			KK84-04-28-05/73/PD18-63	089052	-			
			KK84-04-28-05/73/PD18-68	089056	-			
			KK84-04-28-05/73/PD18-61	089067	2.0			
			KK84-04-28-05/73/PD18-62	089068	3.5			
24.883	-157.117	3000-2200	KK8007/RD-20	088002	-	Dredge	HIG	Large Mn nodules.
25.094	-161.728	2800-2500	KK84-04-28-05/86/RD62-107	089075	6.0	Rock Dredge	HIG	Highly altered volcanic breccia to altered hyaloclastite breccia to indurated calcareous phosphatic hyaloclastite sandstone to altered and highly altered vesicular basalt Mn crust <1mm-2cm.
			KK84-04-28-05/86/RD62-108	089076	12.5			
			KK84-04-28-05/86/RD62-315	089100	3.0			
25.133	-161.950	3600-2700	KK8007/RD-38	089010	-	Dredge	HIG	5-8mm brittle Mn crust over calcareous "sediment".
25.135	-162.010	2175-2175	KK84-04-28-05/84/RC8-312	089099	-	Rock Core	HIG	5 Mn nodules 7mm-3cm in diameter, 0-7cm white indurated calcareous "sediment" with >=5mm Mn crust, 7-12cm semi-consolidated brown calcareous "sediment" with pebble debris and chert chips.
25.135	-162.027	2800-2300	KK84-04-28-05/81/RD55-9	089060	4.0	Rock Dredge	HIG	30 lbs moderately to highly altered relatively massive basalt, some calcite cemented hyaloclastite conglomerated by Mn crust, Mn crust 4mm-2cm.
			KK84-04-28-05/81/RD55-3	089043	16.5			
			KK84-04-28-05/81/RD55-217	089089	2.5			
25.183	-161.600	2600-1800	KK8007/RD-37	089009	-	Dredge	HIG	Patchy Mn crust up to 15mm thick over fresh vesicular basalt.
25.260	-162.046	2300-2100	KK84-04-28-05/85/RD60-6	089046	6.0	Rock Dredge	HIG	Slightly altered basalt, altered vesicular basalt, altered hyaloclastite breccia with coral debris and carbonate coralline Mn crust .5-3cm cement mixed pelagic "sediment", Mn crust breccia and indurated.
			KK84-04-28-05/85/RD60-105	089074	22.5			
			KK84-04-28-05/85/RD60-202	089077	41.5			
			KK84-04-28-05/85/RD60-204	089078	55.0			
			KK84-04-28-05/85/RD60-216	089088	30.0			
			KK84-04-28-05/85/RD60-222	089093	6.5			

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
25.276	-162.068	3000-2300	KK84-04-28-05/82/RD58-4	089044	6.5	Rock Dredge	HIG	50 lbs slightly altered vesicular and massive basalt, altered hyaloclastite breccia, altered hyaloclatite basalt conglomerate altered tuff breccia, brown calcareous mudstone all with Mn crust 1mm-1.5cm.
			KK84-04-28-05/82/RD58-205	089079	42.5			
			KK84-04-28-05/82/RD58-211	089085	4.5			
			KK84-04-28-05/82/RD58-219	089090	10.0			
			KK84-04-28-05/82/RD58-221	089092	19.0			
			KK84-04-28-05/82/RD58-224	089095	12.5			
25.303	-162.094	3500-3200	KK84-04-28-05/82/RD57-223	089094	3.0	Rock Dredge	HIG	75 lbs altered vesicular pillow basalt fragments to altered hyaloclastite breccia and basalt conglomerate to highly burrowed mudstone most with Mn crust 1mm-2.5cm.
			KK84-04-28-05/82/RD57-225	089096	6.5			
25.454	-168.683	1115-1080	KK84-04-28-05/71/PD12-67	089055	-	Pipe Dredge	HIG	Nodular concentric slabs with boytroidal Mn crust-stained limestone calcareous concretions.
				KK84-04-28-05/71/PD12-56			089048	
25.489	-168.672	1200-1150	KK84-04-28-05/71/PD11-57	089049	10.0	Pipe Dredge	HIG	Boytroidal crust fragments 2cm thick on one centimeter of substrate.
			KK84-04-28-05/71/PD11-65	089053	10.0			
			KK84 04-28-05/71/PD11-66	089054	10.0			
			KK84 04-28-05/71/PD11-71	089058	10.0			
			KK84 04-28-05/71/PD11-72	089059	10.0			
			KK84-04-28-05/71/PD11-64	089069	22.0			
			KK84-04-28-05/71/PD11-73	089070	12.0			
25.675	-168.697	1510	KK720702 MIDWAY/D-32	089034	50.0	Dredge	HIG	Cow-pie nodule, round 250mm diameter and 50mm thick.
25.685	-160.180	3000-2600	KK84-04-28-05/80/RD54-2	089042	2.5	Rock Dredge	HIG	50 lbs altered fine-grained basalt to altered hyaloclastite sandstone all with Mn crust <1mm to 2.5cm 100% crust coverage.
			KK84-04-28-05/80/RD54-101	089071	1.5			
25.728	-160.201	2600-2200	KK84-04-28-05/80/RD53-5	089045	-	Rock Dredge	HIG	150 lbs altered hyaloclastite breccia with few altered basalt fragments Mn crust <1mm-1cm|
25.783	-167.733	1600-1300	KK84 04-28-05/69/PD10-42	089039	-	Pipe Dredge	HIG	Three limestone fragments stained with Mn and two basalt specimens with botryoidal crust.
			KK84 04-28-05/69/PD10-41	089047	-			
			KK84-04-28-05/69/PD10-58	089050	-			
			KK84-04-28-05/69/PD10-60	089051	-			
			KK84-04-28-05/69/PD10-55	089065	5.0			
			KK84-04-28-05/69/PD10-59	089066	80.0			
25.900	-162.050	3200-2500	KK8007/RD-39	089036	50.0	Dredge	HIG	50mm Mn crust on altered vesicular pillow basalt and phosphorite.
25.926	-167.710	3250-2900	KK84-04-28-05/67/RD39-53	089063	6.0	Rock Dredge	HIG	Large altered very vesicular basalt fragments with Mn crust ~2cm, 2 tuffaceous and volcanic fragments with Mn crust .5-1cm, fresh basalt stained or coated with little Mn.
			KK84-04-28-05/67/RD39-54	089064	4.0			

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
25.929	-167.755	2500-2075	KK84-04-28-05/67/RD40-51 KK84-04-28-05/67/RD40-52	089062 089040	17.5 17.5	Rock Dredge	HIG	Basalt fragments with Mn crust from .5 to 3cm thick, some uncoated or stained samples also.
25.944	-159.878	2600-2250	KK84-04-28-05/79/RD50-102 KK84-04-28-05/79/RD50-201 KK84-04-28-05/79/RD50-203 KK84-04-28-05/79/RD50-213	088012 088014 088015 088016	3.0 5.0 7.0 6.5	Rock Dredge	HIG	150 lbs altered hyaloclastite breccia and 2 samples altered basalt all with Mn crust 5-1cm on exposed surfaces.
25.946	-159.903	3000-2700	KK84-04-28-05/79/RD52-8	088011	17.5	Rock Dredge	HIG	250 lbs altered palagonite tuff breccia to alterd vesicular basalt with Mn crust <1mm-3 .5cm; 7 altered tuffaceous sandstone with little crust
25.951	-159.914	3600-3200	KK84-04-28-05/79/RD51-106 KK84-04-28-05/79/RD51-218	088013 088018	- 16.0	Rock Dredge	HIG	3 samples (10 lbs):1 altered hyaloclastite breccia; 2 altered basalt all with Mn crust .5-2cm thick
25.980	-164.379	1800-1300	KK84-04-28-05/90/RD66-206 KK84-04-28-05/90/RD66-208 KK84-04-28-05/90/RD66-209 KK84-04-28-05/90/RD66-210	089080 089082 089083 089084	37.5 32.5 37.5 16.0	Rock Dredge	HIG	Alt. basalt breccia with fe oxide staining to volcaniclastic breccia with clasts of vesicular basalt and matrix of Mn crust to indurated brown calcareous clay Mn crust 1mm-3.3cm
26.000	-158.967	4070-3500	KK8007/RD28	088004	-	Dredge	HIG	Huge nodules(400mm diam) or crusts -can't really tell which it is
26.067	-158.200	4750-4000	KK8007/RD29	088005	-	Dredge	HIG	Weathered sedimentary rock with thin spotty Mn crust 2-3mm thick
26.150	-162.067	2450-2000	KK8007/RD35	089008	-	Dredge	HIG	Large pieces of nodules (200mm diameter)
26.583	-158.833	3525-3430	KK8007/RD27	088003	-	Dredge	HIG	Large Mn nodules
26.633	-161.200	3000-2000	KK8007/RD33	089006	-	Dredge	HIG	Lightly encrusted vesicular altered basaltic rock
26.917	-160.050	3000-2000	KK8007/RD32	089005	-	Dredge	HIG	Mn nodules
27.317	-161.650	3500-2900	KK8007/RD34	089007	-	Dredge	HIG	30mm Mn crust over orange altered substrate
27.417	-159.867	3400-3000	KK8004/RD31	088007	-	Dredge	HIG	Huge slabs of Mn crusts or nodules up to 50mm thick on calcareous "sediment"
27.550	-158.550	4850-4100	KK8007/RD30	088006	-	Dredge	HIG	20-25mm Mn crust over altered "sediment" or possibly ultramafic rock
27.868	-177.883	3443	TSDY 8/1-D	090001	-	Chainbag Dredge	SIO	"Sediment" coated with up to 10mm Mn crust
27.917 27.913	-171.062 -171.063	06847-821 -821	KK7608/STA34/D18	090003	-	Dredge	HIG	Thick broken nodules and/or crusts no coherent samples in dredging bag

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
28.739	-178.783	3000-2675	KK84-04-28-05/60/RD33-32	090039	9.0	Rock Dredge	HIG	4 basalt fragments coral/ls stained with iron oxide with Mn deposits on top
28.881	-179.745	2000-1725	KK84-04-28-05/59/RD32-22	090036	2.0	Rock Dredge	HIG	Large cobbles with little or no Mn
			KK84-04-28-05/59/RD32-313	090048	7.0			coating, altered basaltic material, green lithified ash with .7cm of Mn crust
28.895	-178.868	1280-1000	KK84-04-28-05/59/RD30-27	090018	5.0	Rock Dredge	HIG	Basalt fragments with minimal Mn crust,
			KK84-04-28-05/59/RD30-28	090019	5.0			some highly altered basalt with 1.5-2cm
			KK84-04-28-05/59/RD30-16	090025	10.0			of crust
			KK84-04-28-05/59/RD30-23	090026	10.0			
			KK84-04-28-05/59/RD30-14	090035	11.0			
			KK84-04-28-05/59/RD30-23	090037	-			
			KK84-04-28-05/59/RD30-29	090038	5.0			
			KK84-04-28-05/59/RD30-314	090049	4.0			
28.965	-162.022	2820-3270	KK8007/RD23	089004	-	Dredge	HIG	10mm Mn encrusted altered rock (basaltic ?)
29.062	-174.022	1150-1150	KK84-04-28-05/65/RC4-50	090033	100.0	Rock Core	HIG	Mn crust10-11cm thick
29.106	-173.948	1850-1300	KK84 04-28-05/61/RD34-30	090020	15.0	Rock Dredge	HIG	Fresh basalt, volcaniclastics and
			KK84 04-28-05/61/RD34-33	090022	15.0			altered basalt with Mn crust up to 3cm
			KK84-04-28-05/61/RD34-35	090040	7.0			thick.
			KK84-04-28-05/61/RD34-302	090044	19.0			
			KK84-04-28-05/61/RD34-303	090045	16.5			
			KK84-04-28-05/61/RD34-304	090046	4.0			
			KK84-04-28-05/61/RD34-305	090047	6.0			
29.106	-174.020	1475-1100	KK84-04-28-05/64/PD8-43	090041	-	Pipe Dredge	HIG	1 basalt f ragment with botryoidal Mn coating 1-1.5cm thick, 1 volcaniclastic with .5-1cm thick botryoidal Mn crust
29.167	-174.067	1425-1100	KK84-04-28-05/62/PD6-31	090021	-	Pipe Dredge	HIG	Mn crust fragments to 4.5cm thick-
			KK84 04-28-05/62/PD6-34	090023	-			basalts and volcaniclastics with 0-3cm
			KK84 04-28-05/62/PD6-37	090027	-			crust
			KK84 04-28-05/62/PD6-39	090028	-			
			KK84 04-28-05/62/PD6-40	090029	-			
			KK84-04-28-05/62/PD6-47	090032	20.0			
			KK84-04-28-05/62/PD6-45	090042	22.5			
			KK84-04-28-05/62/PD6-48	090043	22.5			
29.185	-174.010	985-810	KK84 04-28-05/63/PD7-44	090030	-	Pipe Dredge	HIG	Basalt fragments, one piece of volcaniclastic material-one Mn coated rnd cobble
29.208	-174.112	2200-1800	KK84-04-28-05/62/RD35-36	090024	15.0	Rock Dredge	HIG	Large slab of altered basalt with 2-3cm
			KK84-04-28-05/62/RD35-46	090031	15.0			crust, small fragments with up to 3cm
			KK84-04-28-05/62/RD35-49	090034	15.0			

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
29.555	-163.372	2496	ARIES 5/58-D	089037	-	Dredge	SIO	Conglomerate mess with some basalt glassy palagonite and small amount of glassy Mn crust
29.634	179.288	1865-1585	KK84-04-28-05/57/RD27-15 KK84-04-28-05/57/RD27-19 KK84-04-28-05/57/RD27-25 KK84-04-28-05/57/RD27-26	091010 091015 091017 091018	10.0 10.0 11.5 8.5	Rock Dredge	HIG	Two generations of crust on altered basalt; the first being a few mm thick, the second being 1.5-2cm thick-Also several stained limestones.
29.641	179.282	1300-1150	KK84-04-28-05/57/RD29-38 KK84-04-28-05/57/RD29-18	091011 091014	- -	Rock Dredge	HIG	Fairly fresh basalt with thin coating of Mn crust
29.643	179.282	1300-1150	KK84-04-28-05/57/RD28-24	091006	10.0	Rock Dredge	HIG	Large cobbles and pillow basalt fragments. w.Mn crust
29.813	179.043	989	TSDY 8/3-D	091004	-	Dredge	SIO	Mn coated breccia (basalt?) up to 10mm
29.820	179.103	1700-1375	KK84-04-28-05/56/RD25-20 KK84-04-28-05/56RD25-301	091013 091021	65.0 -	Rock Dredge	HIG	Several large slabs of botryoidal Mn crust on volcaniclastic substrate, Mn encrusted and stained basalt cobbles, pumice
29.835	-177.883	3443	TSDY 8/2-D	090002	-	Dredge	SIO	2-10mm botryoidal Mn crust over-lying orange-weathered vesicular substrate
29.839	179.065	2100-1900	KK84-04-28-05/55/RD24-12 KK84-04-28-05/55/RD24-13 KK84-04-28-05/55RD24-21	091008 091009 091016	- - 2.0	Rock Dredge	HIG	Large altered volcaniclastic slab with 1-2cm crust, small fragments of altered basalt
29.857	179.083	2250-2150	KK84-04-28-05/55/RD23-17 KK84-04-28-05/55/RD23-69 KK84-04-28-05/55/RD23-70	091005 091007 091019	15.0 15.0 2.0	Rock Dredge	HIG	Basalt fragments with 8-30mm crust, volcaniclastic(yellow beach rock) with up to 30mm crust - some basalt fragments with palagonite rinds and some with iron oxide stains
29.869	179.098	2900-2300	KK84-04-28-05/55/RD22-74 KK84-04-28-05/55/RD22-75	091012 091020	15.0 9.0	Rock Dredge	HIG	Large slab(150cmx100cmx20cm) with several cm of crust on top and bottom, Mn coated volcaniclastics around phosphate zeolites, yellow-brown clay and fe oxides on slab, Mn crust on striated beach rock, Mn crust on basaltic core
30.350	-163.853	2362	ARIES 5/57-D	125012	-	Dredge	SIO	Vesicular basalt fairly fresh with only a Mn staining-no appreciable Mn
30.978 30.998	175.878 175.868	1920-1220	L-8-82/4/D-4-42	127015	12.0	Chainbag Dredge	USGS-MENLO	
31.020	175.873	598	ARIES 5/56-D	127008	2.5	Dredge	SIO	Mn cobbles with up to 5mm Mn as well as fresh cobbles with only Mn stain
31.660	-163.017	2350-2550	KK8004/RD9	125008	-	Dredge	HIG	Mn slabs and broken nodule fragments
31.802	-165.843	2500-2525	KK8004/RD8	125007	-	Dredge	HIG	Large nodules

SOUTH PACIFIC AREA A-3

Latitude	Longitude	Depth interval (m)	Sample number	Seq-uence number	Th. (mm)	Sample device	Inst.	Description
-.184	-176.069	5020	MIDPAC2B-SO37/7MS/7MS	317012	-	Multisonde	TUCLZ	Multisonde data
-.196	-176.054	4955	MIDPAC2B-SO37/8MS/8MS	317013	-	Multisonde	TUCLZ	Multisonde data
-.342	-176.099	1070	MIDPAC2B-SO37/3KH/3KH	317008	-	Box Core	TUCLZ	
-.343	-176.093	1080	MIDPAC2B-SO37/4KH/4KH	317009	-	Box Core	TUCLZ	
-.345	-176.088	1200	MIDPAC2B-SO37/1MS/1MS	317006	-	Multisonde	TUCLZ	Multisonde data
-.346	-176.098	1080	MIDPAC2B-SO37/2GK/2GK	317007	-	Spade Core	TUCLZ	
-.388	-176.073	2107	MIDPAC2B-SO37/5DK/5DK1	317010		3.0 Box Dredge	TUCLZ	20kg crust, 150kg volcanic breccia, 60kg "sediment", 20kg phosphatic material
-.399	-176.116	1551	MIDPAC2B-SO37/6DK/6DK1	317011	5.0	Box Dredge	TUCLZ	70kg crust, 30kg substrate of volcanic breccia and phosphorite
-.383	-176.128	1377	MIDPAC2B-SO37/6DK/6DK-SEM-62	317014				
-1.158	-168.003	7117	ERDC/1-D	316003	-	Dredge	SIO	Fresh basalt with <1mm Mn crust
-1.300	-168.388	6890	ERDC/7-D	316002	-	Dredge	SIO	Basalt pebbles and a few fragments of Mn crust
-7.583	-151.550	1880-2100	KK790808/044/2/2	315003	5.0	Dredge	HIG	Massive non-vesicular brownish grey clasts of basalt in a sandy matrix. patchy Mn crust., 4cm thick Mn encrusted finegrained yellow to reddish-brown breccia
-7.588	-151.543	1800-2100	KK790808/STA124/RD44	315001	-	Dredge	HIG	Breccia boulder encrusted with 20-40mm Mn

NORTH PACIFIC AREA A-2

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
31.935	-162.240	2460-3150	KK8004/RD16	125009	-	Dredge	HIG	Nodule fragments
32.468	-165.800	3150-2900	KK8004/RD5	125005	-	Dredge	HIG	Huge Mn nodules 300mm diameter
33.217	-162.338	2160-3660	KK8007/RD22	125011	-	Dredge	HIG	Large Mn nodule or broken crust fragment overlying altered conglomerate
33.473 33.475	-178.012 -178.007	5063-4843	KK7608/STA21/RD9	126001	-	Dredge	HIG	Up to 15mm Mn crust over altered substrate(possibly a broken nodule)
33.490	-166.535	3220-3800	KK8004/RD1	125001	-	Dredge	HIG	Variety of large and small nodules
33.627	-165.098	2740-2700	KK8004/RD7	125006	-	Dredge	HIG	Nodule fragments
33.693	177.552	1558	ARIES 5/51-D	127003	13.5	Dredge	SIO	Altered yellow-orange vesicular basalt with onion skin smooth 10-15mm Mn crust
33.828	-166.993	3050-3060	KK80-4/RD4 KK80-4/RD4	125004 125014	- -	Dredge	HIG	Mn slabs 20-30mm thick some thin Mn crusts(2-5mm)
33.863	-166.515	3410-3495	KK8004/RD3	125003	-	Dredge	HIG	Large Mn nodules
33.928	-162.095	2550-2310	KK8004/RD20	125010	-	Dredge	HIG	Mn nodule and fragments
34.077	-166.502	4400-4565	KK8004/RD2	125002	-	Dredge	HIG	Broken up dredge material 40mm Mn crust over altered rock(possibly nodules

SOUTH PACIFIC AREA A-3

Latitude	Longitude	Depth interval (m)	Sample number	Seq-uence number	Th. (mm)	Sample device	Inst.	Description
-.184	-176.069	5020	MIDPAC2B-SO37/7MS/7MS	317012	-	Multisonde	TUCLZ	Multisonde data
-.196	-176.054	4955	MIDPAC2B-SO37/8MS/8MS	317013	-	Multisonde	TUCLZ	Multisonde data
-.342	-176.099	1070	MIDPAC2B-SO37/3KH/3KH	317008	-	Box Core	TUCLZ	
-.343	-176.093	1080	MIDPAC2B-SO37/4KH/4KH	317009	-	Box Core	TUCLZ	
-.345	-176.088	1200	MIDPAC2B-SO37/1MS/1MS	317006	-	Multisonde	TUCLZ	Multisonde data
-.346	-176.098	1080	MIDPAC2B-SO37/2GK/2GK	317007	-	Spade Core	TUCLZ	
-.388	-176.073	2107	MIDPAC2B-SO37/5DK/5DK1	317010		3.0 Box Dredge	TUCLZ	20kg crust, 150kg volcanic breccia, 60kg "sediment", 20kg phosphatic material
-.399	-176.116	1551	MIDPAC2B-SO37/6DK/6DK1	317011	5.0	Box Dredge	TUCLZ	70kg crust, 30kg substrate of volcanic breccia and phosphorite
-.383	-176.128	1377	MIDPAC2B-SO37/6DK/6DK-SEM-62	317014				
-1.158	-168.003	7117	ERDC/1-D	316003	-	Dredge	SIO	Fresh basalt with <1mm Mn crust
-1.300	-168.388	6890	ERDC/7-D	316002	-	Dredge	SIO	Basalt pebbles and a few fragments of Mn crust
-7.583	-151.550	1880-2100	KK790808/044/2/2	315003	5.0	Dredge	HIG	Massive non-vesicular brownish grey clasts of basalt in a sandy matrix. patchy Mn crust., 4cm thick Mn encrusted finegrained yellow to reddish-brown breccia
-7.588	-151.543	1800-2100	KK790808/STA124/RD44	315001	-	Dredge	HIG	Breccia boulder encrusted with 20-40mm Mn

-7.588	-151.543	1800-2100	KK8106/STA 124/RD-44	315002	10.0	Dredge	HIG	10-15mm Mn coatings on sediments
-9.067	-150.700	1300-1450	KK790808/045/6/13A KK790808/045/6/13B	315004 315005	22.0	Dredge	HIG	Volcanic breccia, 10cm long basalt clasts in altered glass matrix, 1-5cm Mn crust
-9.990	-164.222	4430	50TW-11/70-D	316001	-	Dredge	SIO	Mn nodules
-10.030	-152.362	2500	KK8106/STA 127/RD-48	351003	-	Dredge	HIG	Altered volcanics wth thin Mn crust
-11.050	-150.100	4250-4400	KK790808/050/4/6A KK790808/050/4/6B	351007 351008	30.0	Dredge	HIG	Volcaniclastic sandstones, Mn crusted (1mm-10mm) graded sandstone containg bands of opaques glass fragments olivine and plagioclase grains, some poorly preserved radiolarians and forams
-11.051	-152.097	4250-4400	KK790808/STA129/RD50	351001	-	Dredge	HIG	Volcaniclastic breccia with 50mm Mn crust
-11.052	-152.097	4250-4400	KK8106/STA 129/RD-50	351004	-	Dredge	HIG	
-12.425	-158.317	5200-5240	VEMA 18/FO 120	351005	12.0		LDGO	Small fragments of nodules and/or crusts on altered phosphatic carbonate substrate, 15mm crust
-12.874	-150.773	3200-3000	KK790808/STA130/RD51	351002	-	Dredge	HIG	Up to 70mm Mn crust on altered breccia
-12.875	-150.762							
-12.883	-150.767	3000-3200	KK790808/051/2/7 KK790808/051/3/7A KK790808/051/2/7B KK790808/051/5/7A KK790808/051/5/7B KK790808/051/5/7C KK790808/051/6/7A	351009 351010 351011 351012 351013 351014 351015	2.0 12.0 12.0 30.0 30.0 30.0 15.0	Dredge	HIG	Volcanic breccia, 20cm long basalt clasts in a clay-carbonate matrix, abundant early eocene planktonic forams

SOUTH PACIFIC AREA A-3

-13.033	-147.933	4700	KK790808/053/1/1A KK790808/053/1/1B KK790808/053/1/1C KK790808/053/1/1D	350008 350009 350010 350011	6.0 6.0 6.0 6.0	Dredge	HIG	1-20cm long tabular crusts with pockets infilled with clay, middle Pliocene, recent
-14.300	-149.533	1937-2087	VEMA 18/RD 32	350005	12.0	Dredge	LDGO	Botryoidal Mn nodules, very light weight, altered carbonate core
-14.342	-149.625	2536-2657	VEMA 18/RD 33	350004	3.0	Dredge	LDGO	Up to 10mm Mn crust overlying altered phosphatized carbonate substrate
-14.483	-150.017	1082-1269	VEMA 18/RD 30	351006	15.0	Dredge	LDGO	10-15mm partially palagonized Mn crust overlying altered phosphatized carbonate substrate
-15.013	-149.038	3400	KK8106/STA 131/RD-51	350002	-	Dredge	HIG	Thin Mn crust on conglomerate, <1mm
-15.017	-149.033	3400	KK790808/052/4/7	350007	1.0	Dredge	HIG	Basalt, angular to sub-angular vesicular pillow fragments with glassy chill margin on a few pieces, volcanic sandstone - graded tuff boulder with interstitial clay
-15.018 -15.009	-149.032 -149.046	3350-3400	KK790808/STA131/RD52	350001	-	Dredge	HIG	Thin Mn coating on basalt, <1mm
-15.050	-172.183	2805	50TW-9/66-D	353003	-	Dredge	SIO	Vesicular basalt with no crust
-16.203	-176.257	1352	7-TOW/89-D	353001	-	Dredge	SIO	Mn encrusted fresh basalt core, some nodules
-16.338	-173.247	2340	ERDC/19-D	353006	-	Dredge	SIO	Phosphorite
-16.548	-178.442	1499	7-TOW/101-D	353002	-	Dredge	SIO	Boulder of porphyritic andesite with Mn crust up to 20mm

SOUTH PACIFIC AREA A-3

-16.923	-176.825	1960	7-TOW/86-D	353005	-	Dredge	SIO	Basalt with Mn stain
-17.867	-154.133	1994-1679	VEMA 19/RD1	351016	10.0	Dredge	LDGO	Flattened Mn nodule with ellipsoid carbonate core
-18.045	-176.020	2238	5OTW-9/64-D	353004	-	Dredge	SIO	600mm diameter basaltic boulder with little to no Mn crust
-18.733	-140.433	1474	AMPH/6-D	350003	-	Dredge	SIO	Encrusted sediment on altered basalt
-27.467	-174.362	3593	5OTW-9/52-D	389001	25.0	Dredge	SIO	Altered basalt with 20-30mm Mn crust

-7.588	-151.543	1800-2100	KK8106/STA 124/RD-44	315002	10.0	Dredge	HIG	10-15mm Mn coatings on sediments
-9.067	-150.700	1300-1450	KK790808/045/6/13A KK790808/045/6/13B	315004 315005	22.0	Dredge	HIG	Volcanic breccia, 10cm long basalt clasts in altered glass matrix, 1-5cm Mn crust
-9.990	-164.222	4430	50TW-11/70-D	316001	-	Dredge	SIO	Mn nodules
-10.030	-152.362	2500	KK8106/STA 127/RD-48	351003	-	Dredge	HIG	Altered volcanics wth thin Mn crust
-11.050	-150.100	4250-4400	KK790808/050/4/6A KK790808/050/4/6B	351007 351008	30.0	Dredge	HIG	Volcaniclastic sandstones, Mn crusted (1mm-10mm) graded sandstone containg bands of opaques glass fragments olivine and plagioclase grains, some poorly preserved radiolarians and forams
-11.051	-152.097	4250-4400	KK790808/STA129/RD50	351001	-	Dredge	HIG	Volcaniclastic breccia with 50mm Mn crust
-11.052	-152.097	4250-4400	KK8106/STA 129/RD-50	351004	-	Dredge	HIG	
-12.425	-158.317	5200-5240	VEMA 18/FO 120	351005	12.0		LDGO	Small fragments of nodules and/or crusts on altered phosphatic carbonate substrate, 15mm crust
-12.874	-150.773	3200-3000	KK790808/STA130/RD51	351002	-	Dredge	HIG	Up to 70mm Mn crust on altered breccia
-12.875	-150.762							
-12.883	-150.767	3000-3200	KK790808/051/2/7 KK790808/051/3/7A KK790808/051/2/7B KK790808/051/5/7A KK790808/051/5/7B KK790808/051/5/7C KK790808/051/6/7A	351009 351010 351011 351012 351013 351014 351015	2.0 12.0 12.0 30.0 30.0 30.0 15.0	Dredge	HIG	Volcanic breccia, 20cm long basalt clasts in a clay-carbonate matrix, abundant early eocene planktonic forams

-13.033	-147.933	4700	KK790808/053/1/1A KK790808/053/1/1B KK790808/053/1/1C KK790808/053/1/1D	350008 350009 350010 350011	6.0 6.0 6.0 6.0	Dredge	HIG	1-20cm long tabular crusts with pockets infilled with clay, middle Pliocene, recent
-14.300	-149.533	1937-2087	VEMA 18/RD 32	350005	12.0	Dredge	LDGO	Botryoidal Mn nodules, very light weight, altered carbonate core
-14.342	-149.625	2536-2657	VEMA 18/RD 33	350004	3.0	Dredge	LDGO	Up to 10mm Mn crust overlying altered phosphatized carbonate substrate
-14.483	-150.017	1082-1269	VEMA 18/RD 30	351006	15.0	Dredge	LDGO	10-15mm partially palagonized Mn crust overlying altered phosphatized carbonate substrate
-15.013	-149.038	3400	KK8106/STA 131/RD-51	350002	-	Dredge	HIG	Thin Mn crust on conglomerate, <1mm
-15.017	-149.033	3400	KK790808/052/4/7	350007	1.0	Dredge	HIG	Basalt, angular to sub-angular vesicular pillow fragments with glassy chill margin on a few pieces, volcanic sandstone - graded tuff boulder with interstitial clay
-15.018 -15.009	-149.032 -149.046	3350-3400	KK790808/STA131/RD52	350001	-	Dredge	HIG	Thin Mn coating on basalt, <1mm
-15.050	-172.183	2805	50TW-9/66-D	353003	-	Dredge	SIO	Vesicular basalt with no crust
-16.203	-176.257	1352	7-TOW/89-D	353001	-	Dredge	SIO	Mn encrusted fresh basalt core, some nodules
-16.338	-173.247	2340	ERDC/19-D	353006	-	Dredge	SIO	Phosphorite
-16.548	-178.442	1499	7-TOW/101-D	353002	-	Dredge	SIO	Boulder of porphyritic andesite with Mn crust up to 20mm

SOUTH PACIFIC AREA A-3

-16.923	-176.825	1960	7-TOW/86-D	353005	-	Dredge	SIO	Basalt with Mn stain
-17.867	-154.133	1994-1679	VEMA 19/RD1	351016	10.0	Dredge	LDGO	Flattened Mn nodule with ellipsoid carbonate core
-18.045	-176.020	2238	50TW-9/64-D	353004	-	Dredge	SIO	600mm diameter basaltic boulder with little to no Mn crust
-18.733	-140.433	1474	AMPH/6-D	350003	-	Dredge	SIO	Encrusted sediment on altered basalt
-27.467	-174.362	3593	50TW-9/52-D	389001	25.0	Dredge	SIO	Altered basalt with 20-30mm Mn crust

MARSHALL ISLANDS AREA A-1

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
6.667	172.417	1700	KK81-06-26/RD-9	019001	-	Dredge	HIG	Mn encrusted basaltic breccia and hyaloclastite both with some inclusions of calcareous materials.
7.235	171.005	1480-1500	L5-84-CP/2/D-2	019004	-	Chainbag Dredge	USGS	250 kg poorly indurated limestone with thin Mn crust oxide.
7.250	171.008	2250-2230	L5-84-CP/1/D1 L5-84-CP/1/D1-1 L5-84-CP/1/D1-3 L5-84-CP/1/D1-8	019003 019006 019007 019008	1.0	Chainbag Dredge	USGS USGS-MENLO USGS-MENLO USGS-MENLO	10 kg vocanic breccia with thin Mn oxide crust.
7.258	170.985	2000-3100	L5-84-CP/3/D-3	019005	-	Chainbag Dredge	USGS	1 kg basalt and limestone coquina.
7.333	172.333	1260	KK81-06-26/RD-10	019002	-	Dredge	HIG	Mn coated basalt breccia and hyaloclastite.
8.747	169.738	3550	L5-84-CP/4/D4 L5-84-CP/4/D4-3 L5-84-CP/4/D4-4	020001 020004 020005	3.0	Chainbag Dredge	USGS USGS-MENLO USGS-MENLO	4 kg basaltic breccia with phosphatized limestone matrix and rounded basalt cobbles.
8.755	169.792	2900	L5-84-CP/5/D6 L5-84-CP/5/D6-1 L5-84-CP/5/D6-2 L5-84-CP/5/D6-4 L5-84-CP/5/D6-6 L5-84-CP/5/D6-13	020002 020006 020007 020008 020009 020010	20.0	Chainbag Dredge	USGS USGS-MENLO USGS-MENLO USGS-MENLO USGS-MENLO USGS-MENLO	150 kg basalt breccia in phosphatized limestone matrix, angular fragments of basalt, fragments of Mn crust without substrate.
8.788	169.730	-	L5-84-CP/6	020003	-	Chainbag Dredge	USGS	No recovery.
10.037	169.568	-	L5-84-CP/9	056005	-	Pipe Dredge	USGS	No recovery.
10.088	169.530	-	L5-84-CP/7	056003	-	Chainbag Dredge	USGS	No recovery.
10.182	169.610	1000-1680	L5-84-CP/8/D10	056004	-	Pipe Dredge	USGS	2kg limestone with thin Mn coating.
10.458	160.900	1805-1749	VEMA34/D-6	056002	20.0	Dredge	LDGO	20-30mm slabs of Mn.
11.005	170.230	1800 1800	L5-84-CP/10/D14 L5-84-CP/10/D14-1	055007 055011	10.0	Chainbag Dredge	USGS USGS-MENLO	0.6 kg of Mn oxide crust, no substrate.
11.008	170.203	2000	L5-84-CP/10/D13 L5-84-CP/10/D13-1 L5-84-CP/10/D13-2	055006 055009 055010	20.0	Chainbag Dredge	USGS USGS-MENLO USGS-MENLO	1 kg of Mn oxide crust, no substrate.
11.020	170.177	1575-2000	L5-84-CP/10/D12 L5-84-CP/10/D12-1	055005 055008	25.0	Pipe Dredge	USGS USGS-MENLO	0.25 kg of Mn oxide crust-no substrate.
12.183	168.953	-	L5-84-CP/12/D16-GC1	056007	-	Chainbag Dredge and Gravity Core	USGS	No recovery.

MARSHALL ISLANDS AREA A-1

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
12.183	168.995	1300-1800	L5-84-CP/11/D15	056006	30.0	Chainbag Dredge	USGS	50 kg basalt breccia with phosphatized chalk substrate, loose basalt pebbles, Mn crust without substrate.
			L5-84-CP/11/D15-1e	056014			USGS-MENLO	
			L5-84-CP/11/D15-2	056015			USGS-MENLO	
			L5-84-CP/11/D15-3	056016			USGS-MENLO	
			L5-84-CP/11/D15-4	056017			USGS-MENLO	
			L5-84-CP/11/D15-9	056018			USGS-MENLO	
13.900	167.653	1600	L5-84-CP/14/D18	056009	30.0	Chainbag Dredge	USGS	50 kg basalt breccia with phosphatized chalk matrix with crust.
			L5-84-CP/14/D18-1	056021			USGS-MENLO	
			L5-84-CP/14/D18-3	056022			USGS-MENLO	
			L5-84-CP/14/D18-7	056023			USGS-MENLO	
			L5-84-CP/14/D18-10b	056024			USGS-MENLO	
			L5-84-CP/14/D18-11	056025			USGS-MENLO	
13.905	167.627	1600	L5-84-CP/13/D17	056008	20.0	Chainbag Dredge	USGS	3 kg chalk with Mn crust.
			L5-84-CP/13/D17-2	056019			USGS-MENLO	
			L5-84-CP/13/D17-6	056020			USGS-MENLO	
13.913	167.593	1395	L5-84-CP/17/BC3	056012	-	Box core/Camera	USGS	30 cm of penetration-nannoplankton foram ooze with photo.
13.922	167.532	-	L5-84-CP/15	056010	-	Chainbag Dredge	USGS	No recovery.
13.928	167.447	1380	L5-84-CP/16/BC1 and 2	056011	-	Box core/Camera	USGS	40 cm of penetration-nannoplankton foram ooze with photo.
14.542	169.003	1700-2000	L5-84-CP/18/D-20	056013	-	Chainbag Dredge	USGS	1.5 kg limestone coquina with thin Mn coating.
15.467	153.242	2385-2608	VEMA34/D-10/D-10	057003	25.0	Dredge	LDGO	Weathered carbonate substrate with no Mn crust and a few 25-30mm Mn crust slabs.
15.717	152.200	2423	VEMA34/D-11	057001	10.0	Dredge	LDGO	Weathered basalt with 10-30mm porous Mn crust.
16.458	148.958	2385	VEMA34/D-14	058006	20.0	Dredge	LDGO	25mm of Mn on altered basaltic substrate.
17.437	144.567	3971	TSDY8/D-14	058005	-	Dredge	SIO	Mn embedded with clayey "sediment".
17.683	143.933	4200	KK77-03-17/M11/RD11	058004	-	Dredge	HIG	Thick slabs of 30-40mm Mn (on pumice?).
17.827	143.983	4200	KK77-03-17/M09/RD09	058002	-	Dredge	HIG	Calcareous "sediment" encrusted with Mn.
17.883	144.695	3200	KK77-03-17/M01/RD01	058001	-	Dredge	HIG	Calcareous "sediment" encrusted with 5-20mm Mn crust.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
18.163	171.517	2000-1700	KK81-06-26/STA94/RD-68	055003	-	Dredge	HIG	Mn encrusted highly altered volcaniclastic breccia and pelagic limestone.
18.273	136.487	2757	VEMA35/D-4	059004	10.0	Dredge	LDGO	8-12mm Mn crust slabs.
18.300	135.250	3555	ANTP/D-8	059001	5.0	Dredge	SIO	Nodules-10mm Mn crust with white powdery calcareous "sediment" inside.
18.320	144.437	3600	KK77-03-17/M10/RD10	058003	-	Dredge	HIG	Possibly a large nodule fragment or 25-30mm Mn crust over calcareous "sediment".
18.362	139.413	2350	VEMA35/D-2	059003	8.0	Dredge	LDGO	8mm Mn over punky carbonate-looking substrate.
19.035	138.968	2600	VEMA35/D-7	059005	30.0	Dredge	LDGO	30mm Mn crust, altered basaltic substrate.
19.070	173.373	2100-1900	KK81-06-26/STA100/RD-75	055004	10.0	Dredge	HIG	Up to 10mm Mn encrusted calcarenites.
19.523	153.617	2158	VEMA32/D-4	057002	-	Dredge	LDGO	Massive Mn crust to 30mm thick overlying minimal quantities of altered substrate.
19.667	135.950	2741-693	VEMA28/D-12	059006	12.0	Dredge	LDGO	Mn slabs with some other iron mineral phases.
20.001	138.816	2519	VEMA35/D-5	095002	8.0	Dredge	LDGO	8mm Mn crust with chalky substrate.
20.750	173.667	3816	ARIESV/D-13	091002	-	Dredge	SIO	Extremely punky altered basalt cobbles with glassy rinds and 2-8mm Mn crust.
20.751	173.440	1623	ARIESV/D-12	091022	-	Dredge	SIO	Nodule.
20.752	173.440	1834	ARIESV/D-12	091001	-	Dredge	SIO	Altered basalt boulder ~300mm diam with 20mm palagonite rind and up to 15mm botryoidal Mn crust.
20.767	173.347	1337	ARIESV/D-15	091003	-	Dredge	SIO	Flat slabs 600x300x150mm thick primarily glassy palagonite with Mn botryoidal coating on all sides.
20.788	173.340	1278	ARIESV/D-15	091023	-	Dredge	SIO	Nodule.
20.912	142.532	3112	SCAN/D-35	094004	-	Dredge	SIO	Mn encrusted calcareous sediment and perfectly round nodules.

MARSHALL ISLANDS AREA A-1

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
20.938	138.033	2508	VEMA35/D-6	095003	12.0	Dredge	LDGO	12mm Mn crust on altered volcanic substrate.
21.145	163.397	1777	ARIESV/D-19	092001	-	Dredge	SIO	Boulder of lightly altered basalt with up to 8mm botryoidal Mn crust.
21.160	163.147	1468	ARIESV/D-20	092002	-	Dredge	SIO	Botryoidal Mn crust up to 10mm thick on glassy rind with some pockets of altered basalt.
21.350	153.333	3835-3135	VEMA33/D-76	093009	15.0	Dredge	LDGO	15mm thick Mn slabs.
21.367	153.287	2083	VEMA32/D-2	093007	20.0	Dredge	LDGO	Mn fragments, 20mm thick with plagonite.
21.480	159.248	1602	ARIESV/D-24	093002	-	Dredge	SIO	Slab 300x200x60mm of altered basalt with 20mm botryoidal Mn crust surface.
21.483	159.538	1273	ARIESV/D-23	093001	-	Dredge	SIO	Altered clayey basalt with Mn stain of 20mm.
21.678	161.870	1715	ARIESV/D-21	092003	-	Dredge	SIO	Cobbles of orange-yellow altered basalt with hard botryoidal Mn crust (up to 5mm).
23.703	159.547	2812	ARIESV/D-25	093003	-	Dredge	SIO	Very altered substrate covered by large (20mm diam) botryoids of Mn crust.
24.017	159.450	4079	ARIESV/D-27	093004	-	Dredge	SIO	Boulder(250mm) of altered basalt with smooth lustrous Mn crust.
25.223	143.928	1560-1345	D859	094014	15.0	Dredge	GSJ	Crusts.
25.272	144.082	2500-2200	D862	094015	18.5	Dredge	GSJ	Crusts.
25.314	143.913	1515-1345	D858	094013	57.5	Dredge	GSJ	Crusts.
25.751	147.992	1375-1245	D881	094020	25.0	Dredge	GSJ	Crusts.
25.793	146.783	1395-1370	D884	094022	6.5	Dredge	GSJ	Crusts.
25.797	146.747	1470-1440	D883	094021	6.5	Dredge	GSJ	Crusts.
25.846	147.798	1410-1415	D879	094019	14.0	Dredge	GSJ	Crusts.
25.934	144.275	1870-1650	D856	094012	4.0	Dredge	GSJ	Crusts.
25.987	143.499	2390-2280	D849	094008	6.0	Dredge	GSJ	Crusts and nodules.
26.081	144.352	955-780	D854	094011	3.5	Dredge	GSJ	Crusts.

MARSHALL ISLANDS AREA A-1

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
26.164	144.182	790-730	D853	094010	4.5	Dredge	GSJ	Crusts.
26.166	144.252	905-810	D851	094009	4.5	Dredge	GSJ	Crusts and nodules.
26.172	145.168	1250-1160	D866	094016	38.0	Dredge	GSJ	Crusts.
26.250	145.154	1100-1065	D867	094017	69.0	Dredge	GSJ	Crusts.
26.430	144.280	2780-2655	D845	094007	8.0	Dredge	GSJ	Crusts.
26.850	148.783	2234-2046	ZETES3/D-7	094003	2.5	Pipe Dredge	SIO	Mn botryoidal crust up to 5mm covering basalt and breccia.
26.902	145.507	1250-1260	D869	094018	23.5	Dredge	GSJ	Crusts and nodules.
27.050	148.683	1749-1341	VEMA33/D-75	094006	5.0	Dredge	LDGO	15mm Mn crust on carbonate substrate.
27.933	147.650	2728-2083	ZETES3/D-8	094001	-	Dredge	SIO	Vesticular Mn coated altered volcanic rock.
28.383	148.250	2423	ZETES3/D-5	094002	-	Dredge	SIO	Fairly large Mn nodular slab.
29.490	153.348	1991	ARIESV/D-29	093005	-	Dredge	SIO	Mn crust fragments on glass.
29.522	153.407	1825	ARIESV/D-30	093006	25.0	Dredge	SIO	50mm diameter nodules and larger slabs with up to 50mm Mn encrusting altered basalt.
31.557	151.222	1768	ARIESV/D-31	129002	10.0	Dredge	SIO	Very large slabs of Mn encrusted punky altered basalt up to 20mm Mn.
31.793 31.793	174.325 174.307	2130-1462	L-8-82/3/D3-5	127013	9.0	Chainbag Dredge	USGS-MENLO	
31.801 31.782	174.330 174.321	2130-2000	L-8-82/2/D-2-3	127014	9.0	Chainbag Dredge	USGS-MENLO	
32.018	149.273	1697	ARIESV/D-32	129003	-	Dredge	SIO	Irregularly shaped slabs and Mn nodules.
32.137	172.262	1360	ARIESV/D-55	127007	2.5	Dredge	SIO	Fairly fresh basaltic boulder with up to 5mm Mn crusts.
32.292	172.792	645	ARIESV/D-54	127006	-	Dredge	SIO	White punky altered basaltic cobbles with no Mn.
32.717	158.267	2562	ANTP/D-50	129001	25.0	Dredge	SIO	Huge Mn nodule slabs up to 50mm thick.

MARSHALL ISLANDS AREA A-1

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
32.720	172.202	947	ARIESV/D-53	127005	-	Dredge	SIO	Fairly fresh basalt pebbles with light Mn staining-no appreciable Mn.
32.758	148.225	2262	ARIESV/D-34	130002	-	Dredge	SIO	Unusual assortment of altered basalt cobbles with no Mn crust, Mn nodules.
33.666	171.602	1002	ARIESV/D-52	127004	7.5	Dredge	SIO	Large cobbles of altered orange punky basalt with 5-10mm Mn crust.
34.220	144.185	1830	ARIESV/D-37	130004	7.5	Dredge	SIO	Fairly fresh altered basalts some with up to 15mm Mn crust some with no encrustation.
34.253	143.853	1898	ARIESV/D-39	130005	2.5	Dredge	SIO	About 5mm Mn crust over slabs of white chalky altered substrates.
34.267	145.945	2046	ARIESV/D-36	130003	10.0	Dredge	SIO	Mn nodules with orangey altered basalt nucleii.
34.778	171.830	823	ARIESV/D-43	127001	-	Dredge	SIO	Fresh Mn stained basalt pebbles-no appreciable Mn.

WEST COAST EEZ AREA A-4

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
30.200	-117.667	1300	SOB/D-10	120003	10.0	Dredge	SIO	20mm or less Mn crust over very altered basalt or sed.
30.300	-117.667	1060	SOB/D-27	120006	18.0	Dredge	SIO	16-20mm good Mn crusto n top of altered basalt.
31.083	-118.167	1630	SOB/D-24	120005	-	Dredge	SIO	Mn stained fresh basalt.
31.250	-117.583	2120	SOB/D-5	120001	-	Dredge	SIO	Mn coated "sediment" and conglomerate.
31.283	-118.467	650	SOB/D-6	120002	-	Dredge	SIO	Vesicular basaltic boulder.
31.383	-118.050	1040	SOB/D-20	120004	-	Dredge	SIO	Mn coated "sediment" and a few nodules which were broken.
33.733	-120.750	1719	110675-1/110675-1	121002	25.0	Dredge	SMIT	Large dolomite boulder with 20-30mm crust.
34.600	-131.783	2932	ANTP/D-1	122001	-	Dredge	SIO	Calcareous sediment no Mn.
36.067	-122.000	2074	ANTP/D-10	121001	-	Dredge	SIO	
36.734 36.746	-125.380 -125.375	3650-3277	L-12-80/6/WF-6-1	121003	4.0	Chainbag Dredge	USGS/ MENLO	
44.000	-129.000	2302-2438	OCEANOGRAPHER/ 111247/39	157012	-	Dredge	SMIT	Small nodules and fragments.
44.000	-129.000	2616-2836	OCEANOGRAPHER/ 111246/48	157011	-	Dredge	SMIT	Small nodules.
44.667	-130.333	2195-2220	OCEANOGRAPHER 68 111240/145	158022	-	Dredge	SMIT	Glassy basalt with very thin Mn crust, crust scrapings may not be homogeneous.
44.750	-130.500	2995	OCEANOGRAPHER/ 111242/DR-9	158023	10.0	Dredge	SMIT	Semi-altered basalt with friable botryoidal crust to 20mm thick.
45.654	-130.075		TT 170/STA 40-D	158011	2.5	Dredge	UWASH	2-3mm Mn crust palagonized and overlying glassy rind.
45.733	-129.912		TT 170-43-17/43-17	157007	-	Dredge	UWASH	Glass and palagonite.
45.733	-129.928		TT 170/43-19B	157008	5.0	Dredge	UWASH	Poor palagonized 0-10mm crust.
45.821	-129.504		TT 170/56-20	157001	5.5	Dredge	UWASH	Fragments of Mn crusts and some glass fragments 1-10mm thick.
45.821	-129.504		TT 170/56-1	157002	15.0	Dredge	UWASH	10-20mm thick Mn fragments.
45.821	-129.504		TT 170/56-2	157003	9.0	Dredge	UWASH	8-10mm Mn crust over 5-7mm glassy rind layer.

WEST COAST EEZ AREA A-4

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
45.821	-129.504		TT 170/56-18	157004	9.0	Dredge	UWASH	Flat 8-10mm Mn crusts.
45.821	-129.504		TT 170/56-3	157005	20.0	Dredge	UWASH	Mn crust fragments 10-30mm some overlying glass.
45.821	-129.504		TT 170/56-12	157006	-	Dredge	UWASH	
45.821	-129.504		TT 170-56-33/56-33	157009	7.0	Dredge	UWASH	2-12mm of fairly good crust overlying glassy rind.
45.885	-129.409		TT 170/59-5	157010	-	Dredge	UWASH	No sample.
45.908	-130.050		TT 170/28-03	158019	3.5	Dredge	UWASH	Up to 5mm striated crust over glass.
45.953	-130.274		TT 170-36-6/36-6	158002	10.0	Dredge	UWASH	Up to 20mm Mn with some glass.
45.953	-130.274		TT 170/STA36D #14	158012	17.0	Dredge	UWASH	15-20mm botryoidal crust overlying 5mm glassy rind.
45.953	-130.274		TT 170/36-3	158013	17.0	Dredge	UWASH	15-20mm crust overlying glassy rind.
45.953	-130.274		TT 170/36-1	158014	7.5	Dredge	UWASH	Large slab of crust, 15mm thick.
46.041	-130.367		TT 170/21-10	158016	7.0	Dredge	UWASH	5-10mm botryoidal Mn crust.
46.041	-130.367		TT 170/21-14	158017	10.0	Dredge	UWASH	8-12mm Mn crust over glassy rind.
46.041	-130.367		TT 170/21-7	158018	5.0	Dredge	UWASH	2-8mm crust poor overlying glass.
46.069	-130.387		TT 170/23-18	158001	9.0	Dredge	UWASH	8-10mm good Mn crust.
46.069	-130.387		TT 170/23-14	158015	13.0	Dredge	UWASH	Good 10-15mm Mn crust.
46.125	-130.000		TT 29/DH 12-2	158005	7.5	Dredge	UWASH	5-10mm slightly palagonized Mn crust.
46.125	-130.000		TT 29/12	158006	9.5	Dredge	UWASH	5-12mm quasibotryoidal Mn crusts.
46.125	-130.000		TT 29/DH 12-7	158007	4.0	Dredge	UWASH	Mn crust fragments 2-6mm thick, poor quality.
46.125	-130.000		TT 29/DH12-1	158020	3.5	Dredge	UWASH	5mm crust over glassy palagonite.
46.153	-130.335		TT 170-3D/STA-3D	158003	11.0	Dredge	UWASH	10-12mm Mn crust with botryoidal surfaces.
46.153	-130.335		TT 170/3-D-2	158004	14.0	Dredge	UWASH	Botryoidal crust 10-18mm thick.
48.475	-133.133	1245	TT 080/DH 1-7	158008	9.5	Dredge	UWASH	5-14mm botryoidal Mn crust, dark brown to black.
48.475	-133.133	1245	TT 080/DH 1-3	158009	15.0	Dredge	UWASH	Botryoidal 10-20mm Mn crust.

WEST COAST EEZ AREA A-4

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
48.475	-133.133	1245	TT 80/DH 1-2	158010	10.5	Dredge	UWASH	6-15mm microbotryoidal Mn crust.
48.475	-133.133		TT 80/DH1 #10	158021	13.0	Dredge	UWASH	10-15mm Mn crust lustrous and very lithified look.

NEW ENGLAND SEAMOUNT AREA A-7

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
33.567	-62.433	1542	A-260/7PD	115004	-	Dredge	WHOI	Red shale and granite, flat pavement pieces with pebble-like indentation, hard lithified rock.
33.947	-65.783	4892	CHAIN 58/100	115005	-	Dredge	WHOI	Typical round to ellipsoid nodules with white buff cratered micronodular surface.
34.810	-57.223	3310	KNORR-42/161	114006	-	Dredge	WHOI	Nodular Mn crust on impregnated whitish sediment material with 30-40% impurities.
35.605	-58.690	4227	KNORR-42/166	114005	-	Dredge	WHOI	Clayey carbonate porous material with 1-4mm rough rubbly crust; brownish black with low density.
36.667	-67.942		CHAIN 21/D-2	115006	-	Dredge	WHOI	12cm nodule with mud concentric center, also 6cm nodule.
37.483	-59.783	1298	A-280/D-12	114003	-	Dredge	WHOI	Mn coated corals, hard black Mn crust, possible phosphorite.
37.510	-59.870	1523	KNORR-42/171	114004	-	Dredge	WHOI	Massive crust of impregnated layered oxide with minor whitish country rock inclusions remaining smaller better layered slabs pure oxide with no white residual ma.
37.550	-59.783	1295	A-280/D-13	114002	-	Dredge	WHOI	Encrusted coral and cobble coated with Mn (erratic)?.
37.550	-59.800	1295	A-280/D-13	114001	-	Dredge	WHOI	Gneissic erratic pebble 4*3cm cut section.
38.050	-69.150	1954	A-280/D-14	115001	-	Dredge	WHOI	Impregnated black and orange round punky rock impure 3*5*4cm, also coated coral.
38.067	-60.217	3007	VEMA 19/RD 11	115015	15.0	Dredge	LDGO	Baseball-size nodules with grey core; possibly altered volcanic material-fairly dense.
38.188	-60.943	3777	KNORR-42/174	115010	-		WHOI	Glacial erratic very thin Mn skin.
38.217	-60.433	1785	A-280/D-10-9	115002	-	Dredge	WHOI	Heavily coated corals and pebbles crusts 2cm, 3-4cm fragments available.
38.900	-61.017	1298	A-280/D-3PD	115003	-	Dredge	WHOI	Heavily manganized limestone, rock chips, pebbles, stained coral.
39.383	-67.233	3040	KNORR 42/182	115007	-	Dredge	WHOI	Glacial erratic and 4cm botryoidal nodule yellow-brown character.
39.450	-65.455	2240	KNORR 42/178	115009	-	Dredge	WHOI	Undulating brown-yellow black crust large ampling 112 pieces.

NEW ENGLAND SEAMOUNT AREA A-7

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
39.517	-65.350	3382	ATL 296/D-3-2	115012	-	Dredge	WHOI	Massive pavement black smooth sand-grainy surface with adhering white material.
39.837	-66.210	2354	KNORR 42/180	115008	-	Dredge	WHOI	Dark coated cobble like physalia without significant Mn crust.
39.850	-66.880	2825	KNORR-42/181	115011	-	Dredge	WHOI	Greenstone? with very thin oxidized layer.

SOUTHEASTERN ATLANTIC AREA A-6

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
20.267	-65.683	7002	CHAIN 34/D-3	079002	-	-	WHOI	Fragment thick orange stained black smooth Mn crust homogeneous but light assume high Mn content may be hydrothermal in origin.
20.817	-66.917	4878	RC-8/D-8	079004	1.5	Dredge	LDGO	Nodules and micronodules, caryn seamount.
21.833	-70.573	5416	GS/7103/10	080008	-	-	UMIAMI	Botroidal Mn slabs 15mm thick.
22.317	-72.080	3363	GS/7308/D-10	080008	-	-	UMIAMI	Partly encrusted calcareous "sediment" with Mn encrusted up to 5mm where present.
22.333	-72.085	2250	GS/7308/D-11	080002	-	-	UMIAMI	Thick botryoidal crust over calcareous "sediment".
22.570	-72.375	3420	GS/7308/D-12	080003	-	-	UMIAMI	Calc "sediment" with thick Mn crust up to 20mm.
22.642	-72.850	2390	GS/7308/D-13	080004	-	-	UMIAMI	Thick Mn crust with calcareous material.
23.157	-73.752	3126	GS/7308/D-14	080005	-	-	UMIAMI	Mn encrusted upon coral and calcareous "sediment". Mn crust is 0-10mm thick.
23.183	-73.973	1315	GS/7308/D-15	080006	-	-	UMIAMI	Massive botryoidal Mn crust slabs up to 50mm thick.
23.487	-74.200	2910-2062	GS/7308/D-16	080007	-	-	UMIAMI	Massive slabs (50mm thick) of botryoidal Mn crust (inside somewhat more Fe stained).
24.277	-68.107	5668	BIOLOGICAL/NEW	079001	-	-	UMIAMI	Heavily encrusted Mn (up to 15mm) on calcareous "sediment"; substrate is dark brown botryoidal slab of Mn crust.
30.798	-78.160	840	NONE/111493/6	116008	-	-	NOAA	80mm diam hard nodule.
30.798	-78.160	840	NONE/111499/5	116009	-	-	NOAA	Classic nodule 70mm diam.
30.798	-78.495	860	NONE/111498/17	116010	-	-	NOAA	Flattened disc shaped nodule 35mm diam.
30.798	-78.495	860	NONE/111411/139	116021	-	-	NOAA	Slab hard Mn shaped and cracked in some places, unique two layer shape.
30.798	-78.495	860	NONE/111411/146	116022	-		NOAA	Mn nodule.
30.798	-78.495	860	NONE/111411/81	116024	-		NOAA	Classic small nodule 50mm.
30.798	-78.495		NONE/111411/14	116023	-		NOAA	Classic small nodule 50mm.
30.800	-78.767	805	PROSPECTOR 6A/6A-1	116038	-	Chainbag Dredge		Round and flat nodules.

BLAKE PLATEAU A-5

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
30.883	-78.783	836	A-266/D-40	116003	-	Dredge	WHOI	Mn nodules and slabs, all Mn no phosphorite; black, coaly, dull.
30.908	-78.717	843	GOS-74/2384/G-39	116051	-	Chainbag Dredge and Small pipe	WHOI	Glob sand-frags and well rounded Mn nodule.
30.967	-78.500	810	ATL266/45/45	116042	-	Chainbag Dredge	WHOI	Slabs-sponges.
30.970	-78.818	794	NONE/111520/1	116014	-	-	NOAA	Small nodule highly veined with carbonate.
30.975	-78.500	823	ATL266/46/46	116043	-	Chainbag Dredge	WHOI	Slabs-ooze.
30.975	-78.500	833	A-266/R-45	116001	-	Dredge	WHOI	Mn slab 20cm diameter 3.5cm max thickness with $CaCO_3$ phosphate, orange-white veins.
30.983	-78.216	834	A-266/D-42	116002	-	Dredge	WHOI	Flattish slab and pebbles with heavy sponge encrustations.
30.983	-78.217	903	A-266/D-41	116004	15.0	Dredge	WHOI	Mn flat slabs and nodules 1-4cm plus lithified carbonate bored encrusted.
30.983	-78.350	823	PROSPECTOR 7A/7A-20	116039	-	Chainbag Dredge		
30.990	-78.522	780	NONE/111410/10	116018	-	-	NOAA	Irregular shaped Mn slab with organic debris on faces, 10-15mm thick.
30.990	-78.522	780	NONE/111410/71	116019	-	-	NOAA	Large slab, irregular shape with organic debris on surface.
30.990	-78.522	780	NONE/111410/2	116029	-	-	NOAA	Hard fairly dense slab organic debris on faces.
30.997	-78.355	840	GYRE82-G-11/D-11/ 9P3-4-83	116047	-	Chainbag Dredge	USGS	Nodule, slabs, carbonate, sand and gravel.
31.000	-77.525	930	GOS-74/2342/G-37-A	116037	-	Chainbag Dredge and Small Pipe	WHOI	Mud, sand, Mn nodules.
31.008	-78.993	777	GYRE82-G-11/D-15/ 12P3-4-83	116049	-	Chainbag Dredge	USGS	Mn slabs, carbonate, coral.
31.022	-78.387	796	GYRE82-G-11/D-9/ 7P3-4-83	116046	-	Chainbag Dredge	USGS	Mn nodules and slabs.

BLAKE PLATEAU A-5

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
31.033	-78.350		PROSPECTOR 7A/7A-20-F	116040	-	Chainbag Dredge		
31.050	-78.400		PROSPECTOR 7A/7A-20-I	116041	-	Chainbag Dredge		
31.075	-78.172	817	NONE/111497/4	116011	-	-	NOAA	Heart shaped 80mm diameter nodule.
31.075	-78.172	817	NONE/111519/9	116015	-	-	NOAA	Very hard dense black nodule 50-60mm diam. Cut section shows concentric iron rich calcareous and black rings inside.
31.075	-78.172	817	NONE/111506/1	116016	-	-	NOAA	Small broken slab. Cut section black and iron stained sides separated by carbonate vein.
31.075	-78.172	817	NONE/111501/1	116020	-	-	NOAA	Hard black irregular shaped slab, possibly phosphorite coral remnants and white organic stringers on surface.
31.075	-78.172	817	NONE/111522/1	116025	-	-	NOAA	Phosphorous Mn slab irregularly shaped. Much organic debris on face which has sheen.
31.075	-78.172	817	NONE/111494/1	116026	-	-	NOAA	30mm diameter small hard nodule.
31.075	-78.172	817	NONE/111501-2/2	116028	-	-	NOAA	Slab with organic debris on bottom and top surface of Mn/P_2O_5.
31.105	-78.842	718	GYRE82-G-11/D-14/ 11P3-4-83	116048	-	Chainbag Dredge	USGS	Small $Mn-P_2O_5$ plates.
31.133	-79.125	649	GOS-74/2478/G-67	116035	-	Chainbag Dredge and Small Pipe	WHOI	Calcareous globigerina, small nodules and platy Mn slabs.
31.213	-78.483	648	GOS-74/2390	116030	-	Chainbag Dredge and Small Pipe	WHOI	Mn slabs 5-10 cm thick.
31.213	-78.483	648	GOS-74/2390A/G-53	116056	-	Chainbage Dredge and Small Pipe	WHOI	Mn slabs 5-10cm thick.
31.213	-78.483	648	GOS-74/2390	116057	-	Chainbag Dredge and Small pipe		Mn slabs.
31.253	-78.983	546	GOS-74/2387B/G-52	116052	-	Chainbag Dredge and Small pipe		Mn slabs 4-5cm thick.

BLAKE PLATEAU A-5

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
31.253	-78.983	546	GOS-74/2387	116053	-	Chainbag Dredge and Small pipe		Mn-slabs globigerina.
31.295	-78.172	690	NONE/111500/1	116027	-	-	NOAA	Slab broken piece, top and bottom have sheen similar to talc or graphite.
31.310	-77.307	1090	NONE/111429/224	116013	-	-	NOAA	Collection of small 10mm diameter angular Mn chips and fragments.
31.383	-78.667	512	GOS-74/2389/G-51	116054	-	Chainbag Dredge and Small pipe	WHOI	Mn P_2O_5 slabs.
31.383	-78.667	512	GOS-74/2389	116055	-	Chainbag Dredge and Small pipe	WHOI	Mn P_2O_5 slabs.
31.410	-78.510	635	GYRE82-G-11/D-8/ 6P3-4-83	116045	-	Chainbag Dredge	USGS	
31.483	-78.000	649	GOS-74/2392	116031	-	Pipe Dredge	WHOI	Mn plates, nodules, globigerina sand.
31.483	-78.000	649	GOS-74/2392/G-56	116032	-	Pipe Dredge	WHOI	Glob sand-pterpod shell
31.483	-78.000	649	GOS-74/2392B/G-36	116033	-	Chainbag Dredge and Small pipe	WHOI	Glob sand-pterpod shell fragments, plates, Mn nodules.
31.557	-77.370	952	GYRE82-G-11/D-5/ P53-4-83	116044	-	Chainbag Dredge	USGS	Phplates-cobs ooze Mn-pl. P_2O_5 plates, cobbles, ooze, Mn plates.
31.647	-77.780	610	GOS-74/2393B/G-80	116034	-	Pipe Dredge	WHOI	Medium to coarse globigerina sand and platy nodules.
31.680	-78.800	543	GOS-74/2481/G-70	116036	-	Pipe Dredge	WHOI	Large Mn-P_2O_5 slab, few coral fragments.
31.883	-77.453	815	A-266/D-5 (9-12)	116005	-	Dredge	WHOI	Mn-Fe replaced phosphorite slabs black dk brown to (dark brown) fractures with vertical and horizontal carbonate veins.
31.908	-77.413	775	GOS-74/2339B/G-38	116050	-	Chainbag Dredge and Small pipe	WHOI	Coral and Mn nodules.
31.967	-77.308	843	A-266/D-2-2	116006	-	Dredge	WHOI	Clayey carbonate with yellow, brown crust 0-3mm on dense chert-like material (.3mm) some thinner pieces have 6mm punky iron rich material.

BLAKE PLATEAU A-5

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
32.195	-77.460	690	NONE/111495/2	116012	-	-	NOAA	Hard nodule cut face shows original nucleii probably of phosphoric makeup.
32.632	-77.515	399	NONE/111502/2	116017	-	-	NOAA	Hard black slab nodule 400g with much organic debris.
33.947	-65.783	4892	CHAIN 58/100	115005	-	-	WHOI	Typical round to ellipsoid nodules with white buff cratered micronodular surface.

OTHER AREAS

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
.150 .167	17.317 17.300	3150-2750	AII60/STA19	002002	5.0	-	WHOI	Basaltic boulder with up to 10mm Mn crust with large and microbotryoidal surface textures.
.300 .330	-17.033 -17.067	2260-2150	AII60/STA22	002001	5.0	-	WHOI	Highly altered basalt, clayey with up to 10mm crust.
.535	-85.605	2340	CCTW/D-2	009003	-	Dredge	SIO	Nodules.
.542	2.483	2652	P/6707A/706	036001	-	-	UMIAMI	Mn nodule from seamount.
.705	-85.500	2523	USNM/113152/128 DR-1	009006	1.0		SMIT	Glassy basalt with 1mm Mn crust.
.818	-86.132	2473	50TW-7/D-17	009005	1.5	Dredge	SIO	Fresh basaltic pebbles with up to 3mm Mn crust.
1.385 1.392	-93.733 -93.740	2643-2559	KK78-12-30/STA78/RD2	010001	-	Dredge	HIG	0-3mm Mn crust over fairly fresh basaltic rocks.
1.817 1.817	-93.635 -93.647	2755-2531	KK78-12-30/STA80/RD4	010002	-	Dredge	HIG	Already separated crusts 10-15mm thick, no substrate.
1.875 1.900	-86.548 -86.555	2750-2395	KK78-12/STA107/RD29	009001	-	Dredge	HIG	Small nodules 50mm diameter.
2.335 2.350	-95.308 -95.312	2354-2305	KK78-12/STA88/RD-16	010007	-	Dredge	HIG	Fresh glassy basalt with some crust.
2.422	-95.407	2267	DESTIQEUR/113156-13/D-7	010010	3.5	-	SMIT	Altered basalt with 2-5mm microbotryoidal Mn crust.
2.633	-95.467	3000	CERES/D-21	010008	-	Dredge	SIO	Mn nodules and fragments of variable size.
2.640	-95.470	2650	KK78/115731/D-12	010011	2.0	-	SMIT	Fresh cut basalt slab with 2mm Mn crust.
2.653 2.662	-95.475 -95.477	2631-2609	KK78-12/STA 85/RD-12	010006	-	Dredge	HIG	Mn stained fresh volcanics.
2.698	-95.242	2596	DESTIQEUR/113155/66-65 DR-6	010009	10.0	-	SMIT	Basalt and Mn fragments crust to 20mm.
2.752 2.767	-95.245 -95.247	2768-2637	KK78-12-30/STA86/RD14	010003	-	Dredge	HIG	Fairly fresh volcanics with 0-5mm Mn crust.
3.020	-84.237	2293	50TW-7/D-9	009004	-	Dredge	SIO	Bag of Mn fragments.
3.350 3.375	-93.648 -93.642	2969-2765	KK78-12-30/STA96/RD27	010005	-	Dredge	HIG	Lightly encrusted basalt <1mm.

OTHER AREAS

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
3.525 3.538	-93.798 -93.817	2795-3079	KK78-12-30/STA94/RD25	010004	-	Dredge	HIG	20-30mm Mn crusts over altered substrate.
3.699	63.892	3748-3840	RESEARCHER'79/115294-1/DR-7	030001	-	-	SMIT	Basaltic boulder with smooth face ,other sides contain up to 2mm crust, however not enough to sample.
3.877	-81.687	2240	GS/7202/102	009002	-	-	UMIAMI	Up to 20mm Mn encrusted phosphatic carbonate "sediment".
8.257	-104.143	3139	CCTW/D-1	011001	5.0	Dredge	SIO	Up to 10mm Mn on fairly fresh basalt.
8.783	-104.550	1195	RIS3/D-4	011006	-	Dredge	SIO	Fresh basalt with Mn stain.
8.825	-103.917	1190	RIS3/D-3	011005	25.0	Dredge	SIO	Thick Mn crust up to 50mm.
9.617	-40.350	2388	LSDA/D-5	032001	-	Dredge	SIO	Fairly fresh basalt with thin Mn coating.
9.827 9.838	57.943 57.975	1680-1825	RESEARCHER '79/115291/ M79-3-1 DR-3	037001	2.0	-	SMIT	Large altered basaltic boulder with .5-3mm Mn crust
9.917	-104.483	1716-1711	QBR/D-22	011002	20.0	Dredge	SIO	Up to 40mm Mn crust on altered basalt with palagonite rind.
9.950	-108.800	1227	CARR/D-6	011003	-	Dredge	SIO	Altered basalt with thin Mn crust $\leq$ 1mm.
9.983	-108.800	448	CARR/D-7	011004	-	Dredge	SIO	Altered basalt with thin Mn coat $\leq$ 1mm.
10.367	-108.383	3140-3080	QBR/D-7	047001	7.5	Dredge	SIO	Up to 15mm Mn crust on basaltic substrate.
10.367	-108.400	3148-3032	QBR/D-7A	047002	4.0	Dredge	SIO	Up to 8mm of botryoidal Mn crust on fairly altered basaltic substrate.
10.400	-108.433	3843	QBR/D-8	047003	-	Dredge	SIO	Small assortment of Mn nodules about 30-40mm diameter.
10.600	-108.800	4592	CARR/D-9	047004	-	Dredge	SIO	Mn nodules.
10.895	-45.297	4640	P/7003/36	041001	-	-	UMIAMI	Thick Mn crust on altered basalt.
11.017	-140.142	4602	PLDS/D-8	051001	5.0	Dredge	SIO	10mm Mn crust over very altered basalt.
11.240	-101.125	3050	CERES/D-20	047031	-	Dredge	SIO	Nodules.
11.263	-101.088	3205	CERES/D-19	047030	-	Dredge	SIO	Mn nodules and botryoidal Mn fragments.
11.418	-101.625	3034	CERES/D-15	047028	-	Dredge	SIO	Assortment of nodules and basalts with Mn staining.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
11.458	-103.233	1408	RIS3/D-8	047007	-	Dredge	SIO	Botryoidal Mn crust over glassy basalt, up to 25mm Mn.
11.458	-103.300	1498	RIS3/D-6	047005	-	Dredge	SIO	Mn nodules with some glass.
11.483	-103.217	1235	RIS3/D-7	047006	5.0	Dredge	SIO	Fresh basalt with up to 10mm Mn.
11.963	-101.617	2900	CERES/D-18	047029	-	Dredge	SIO	Nodules.
12.037	-101.600	3070	CERES/D-14	047027	20.0	Dredge	SIO	Slab up to 40mm Mn crust over altered basalt.
12.260	-100.507	2600	CERES/D-12	047025	2.0	Dredge	SIO	Up to 4 mm Mn encrusted on altered basaltic pebbles.
12.550	-103.267	1240	RIS3/D-13	047008	-	Dredge	SIO	Friable botryoidal Mn crust on highly layered basalt.
12.567	-100.363	3317	CERES/D-13	047026	-	Dredge	SIO	Mn botryoidal fragments of variable thickness.
12.717	-102.583	1020	RIS3/D-20/1	047011	10.0	Dredge	SIO	Thick botryoidal Mn crusts 20mm thick on highly altered substrate.
12.717	-102.583	1020	RIS3/D-20/2	047012	-	Dredge	SIO	Mn nodule, 50mm diameter, and pieces with very altered basalt cores.
12.723	-102.513	2700	CERES/D-5	047021	-	Dredge	SIO	Nodules.
12.733	-102.583	1450	RIS3/D-19	047010	-	Dredge	SIO	Small Mn nodules some with palagonite in them.
12.745	-102.562	2202	CERES/D-6	047022	-	Dredge	SIO	Large Mn encrusted basalt boulder heavily altered.
12.942	-103.467	670	RIS3/D-17	047009	-	Dredge	SIO	Mn stained fresh basalt.
12.962	-100.900	3478	CERES/D-10	047024	-	Dredge	SIO	Mn fragments and nodules of variable thickness
12.983	-100.817	1342	RIS3/D-25	047016	30.0	Dredge	SIO	Large 60mm thick Mn crust in dredge with fairly fresh basalts.
13.012	-100.848	2381	CERES/D-9	047023	-	Dredge	SIO	Mn fragments and nodules of variable thickness.
13.022	-100.817	1340	RIS3/D-24	047015	-	Dredge	SIO	Nodules and Mn pieces.
13.042	-97.067	3888	RC-13/D-1	046001	25.0	Dredge	LDGO	25mm Mn crust, substrate undetermined, possibly altered basalt.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
13.358	-102.467	630	RIS3/D-23	047014	-	Dredge	SIO	Fairly fresh vesicular basalt with Mn stain.
13.400	-102.517	887	RIS3/D-21	047013	-	Dredge	SIO	Fairly fresh basalt with thin Mn stain.
13.447	-102.610	3424	CERES/D-1	047020	-	Dredge	SIO	Mn encrusted altered basaltic boulder.
13.767	-101.875	928	RIS3/D-27	047017	5.0	Dredge	SIO	Large altered volcaniclastic rock with up to 10mm Mn crust.
13.767	-101.872	990	RIS3/D-28	047018	-	Dredge	SIO	Mn concretion, 120mm diameter.
13.833	-104.183	1490	RIS3/D-30	047019	-	Dredge	SIO	Fresh basalt with glassy rind, no Mn.
15.340 15.352	-21.850 -21.880		KANE9(USNS)/115763/D-13	039001	15.0	Dredge	SMIT	Mn crust up to 30mm on highly altered substrates.
15.483	-64.083	1086	CHAIN75/3-1	043001	-	Dredge	WHOI	Specimen broken into almond size pieces, may have micronodular surface layer.
16.017	134.500	5085-4124	VEMA34/D-17	059002	12.0	Dredge	LDGO	10-15mm crust on altered basaltic substrate.
17.617	116.983	-	VEMA36/D-8	061001	10.0	Dredge	LDGO	10mm Mn crust on altered basaltic substrate.
20.673 20.728	-107.635 -107.596	-	LEE1-76-MX/44/44A	083006	50.0	Chainbag Dredge	USGS/ MENLO	Huge slab of Mn crust, no substrate material present in bag.
20.750	-112.783	1712	TRIPOD/D-2	084002	-	Dredge	SIO	Mn crusts and crust pieces.
20.750	-114.450	3840	TRIPOD/D-4	084004	-	Dredge	SIO	Mn nodules.
20.925 20.935	-109.040 -109.033	2655	LEE1-76-MX/10/10A	083005	15.0	Chainbag Dredge	USGS/ MENLO	Mixture of basaltic rocks with 1mm crust as well as thick 30mm botryoidal slabs of crust.
21.083	-119.367	2985	TRIPOD/D-9	084005	-	Dredge	SIO	Large Mn nodules.
21.300	-112.700	2497	TRIPOD/D-3	084003	-	Dredge	SIO	Nodules and nodule pieces.
21.502	-108.762	2807	HYPO/D-74	083002	-	Dredge	SIO	Fresh basalt with Mn stain.
21.517	-117.283	820-540	SOB/D-13	084006	5.0	Dredge	SIO	Vesicular basalt with 0-10mm Mn crust.
21.850	-56.150	4049	RC-5/D-1	078004	-	Dredge	LDGO	Up to 10mm Mn crust on carbonate and clayey substrate.

OTHER AREAS

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
22.870	-108.075	3127	GUAY/D-2 GUAY/D-5	083003 083004	4.0	Dredge	SIO	Large basaltic boulder with glassy rind and up to 8mm Mn crust.
23.612	-45.098	3682-2430	KNORR79/15/15-3	077001	-	Chainbag Dredge	WHOI	Cobbles and boulders of altered basalt with botryoidal Mn crust.
23.633	133.283	2630-2392	VEMA33/D-72	095001	-	Dredge	LDGO	Slabs of Mn, up to 55mm thick.
23.768	-46.617	3155	VEMA25/D-9	077009	1.0	Dredge	LDGO	1-24mm Mn encrusting basaltic pebble.
23.853	-46.223	4590-4010	G-104/35/21	077002	-	-	WHOI	Yellow, brick-red pure oxide cobble along with large cobbles and boulders of altered basalt with thin Mn stain.
24.775	-109.203	3038	HYPO/D-53	083001	-	Dredge	SIO	Thin Mn crust on fresh basalt.
24.778	-50.435	5726	VEMA25/D-13	078002	-	-	LDGO	Altered basalt with 1mm Mn, 3mm palagonite rind.
24.953	-51.752	5960	VEMA25/D-14	078003	25.0	Dredge	LDGO	Large nodule, ~30mm Mn surrounding altered oval carbonate core.
26.472	-110.718	2501	HYPO/D-60	084001	-	Dredge	SIO	Fresh basalt-no Mn.
26.983 27.000	-42.667 -42.600	3500-3390	AII-59/3/6-9	077006	7.5	-	WHOI	Thick friable Mn crust to 15mm on substrate of altered basalt with possible palagonite layer.
27.067	-60.467	5891-5725	RC-15/RD-23	079007	-	Dredge	LDGO	Mn coated basalt pebbles and some small (golf ball) size nodules.
27.200	-43.600 -43.550	3670-2885	AII-59/5/4-16	077005	3.5	-	WHOI	Fairly altered basalt boulder 0-7mm Mn crust in small botryoids.
27.250 27.250	-43.967 -43.917	2785-2140	AII-59/7/2-4	077004	2.2	-	WHOI	Fairly fresh cobble with 1-3.4mm Mn encrusting 90% of surface.
27.300 27.317	-44.550 -44.533	2860-2255	AII-59/10/4	077003	-	-	WHOI	Mn (<1mm) encrusted small basaltic cobble. Did not sample.
27.583	-60.400	5536-5631	RC-15/RD-25	079008	-	Dredge	LDGO	Huge Mn coated boulder.
27.600	-61.133	5706-5877	RC-15/RD-19	079005	2.0	Dredge	LDGO	1-3mm Mn (altered) over poor altered orange basaltic substrate.
27.700	-61.167	5390-5386	RC-15/RD-20	079012	5.0	Dredge	LDGO	40-50mm diam nodules with volcanic substrate, 1-10mm Mn crust around core.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
28.000	-61.067	5509-5160	RC-15/RD-27	079009	-	Dredge	LDGO	Assorted flat and round nodules composed largely of substrate.
28.033	-61.000	5028-5161	RC-15/RD-21	079006	4.0	Dredge	LDGO	Nodules, 2-5mm crust over yellow punky substrate.
28.033	-61.000	5105-5557	RC-15/RD-28	079010	-	Dredge	LDGO	Nodule, not much Mn.
28.757	-60.358	5338-5350	RC-16/RD-19	079011	-	Dredge	LDGO	Small nodules.
30.213	-39.358		CHAIN-115/146	112001	-	Dredge	WHOI	Neatly impregnated pumice, thick punky Mn rock with crude botryoidal internal structures, colored exterior pavement, 1.5cm clay piece of black vesicular basalt.
35.582	170.953	1896	ARIESV/44-D	127002	-	Dredge	SIO	Fresh basaltic pebbles with light Mn staining-no appreciable Mn.
36.602	-33.413	2137	KNORR-42/77	112006	.3	-	WHOI	Altered basalt with thin .2-.3mm Mn crust.
36.607	-33.488	2118	KNORR-42/129	112003	1.5	-	WHOI	Heavily altered basalt greenish-yellow with 0-3mm Mn crust.
36.843	-33.357	1763	KNORR-42/108	112005	-	-	WHOI	Moderately altered basalt with palagonite rind 2-2.5mm, occasional carbonate ooze glued to rim.
36.847	-33.388	2137	KNORR-42/68	112007	0.9	-	WHOI	.2-.3mm to 1.5mm Mn, sampled scraps and cut sections.
36.848	-33.542	1353	KNORR-42/137	112002	-	-	WHOI	Heavily stained coral.
36.887	-33.535	1727	KNORR-42/110	112004	3.5	-	WHOI	Vesicular basalt with 2-5mm Mn crust minibotryoidal modular surface, peels off easily.
37.267	162.400	1110-1295	ZETES3/D-2	128002	30.0	Dredge	SIO	Up to 60mm Mn encrustation on altered substrates.
37.762 37.767	170.280 170.277	1629-1476	KK76-08/STA26/D12	127012	-	Dredge	HIG	20mm Mn crust over altered ultramafic.
38.017	145.983	2785-3653	ZETES3/D-1	130001	-	Dredge	SIO	Mn pieces and altered basalt.
39.385 39.383	165.868 165.882	3537-3075	KK76-08/STA27/D13	128001	-	Dredge	HIG	Large Mn nodules.
40.267	170.333	2037-1664	ZETES3/D-3	163001	-	Dredge	SIO	Mn covered boulders.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
42.332	-27.005	3193-2884	VEMA27/D-11	147003	10.0	Dredge	LDGO	10mm average Mn overlying a mud-clay substrate.
42.622	-29.125	1845-1785	VEMA27/D-10	147004	-	Dredge	LDGO	Poor palagonite rind over fairly fresh basalt.
43.003	-28.220		AII-32/3/10	147001	-	Dredge	WHOI	Vesicular fairly altered basalt with hard .4mm crust where it is not broken.
43.613	-15.690	5740	VEMA27/D-7	146001	2.0	Dredge	LDGO	Basaltic pebble (fresh?) with 1-3mm Mn crust.
53.543	-144.373	2100	S-6-79/4/D-4-4(2)	195011	2.0	Chainbag Dredge	USGS/ MENLO	Black massive to laminated isotropic oxide crust on crystal rich substrate.
			S-6-79/4/D-4-4(1)	195012	30.0			
			S-6-79/4/4-13(1)	195013	40.0			Black vitreous oxide crust on basalt substrate.
			S-6-79/4/4-13(2)	195014	13.0			
			S-6-79/4/4-15(1)	195015	15.0			Thin massive crust overlaying crystal rich tuff.
			S-6-79/4/4-15(2)	195016	8.0			
			S-6-79/4/D-4	195017	20.0			Some vesicular volcanics with 5-10mm of Mn with one massive crust of 45mm.
54.662	-150.305	1400	S-6-79/9/9-1(1)	196002	30.0	Chainbag Dredge	USGS/ MENLO	Soft black laminated oxide crust on unknown substrate.
			S-6-79/9/9-1(2)	196003	9.0			
			S-6-79/9/9-9A(1)	196004	45.0			
			S-6-79/9/9-9A(2)	196005	40.0			
			S-6-79/9/9-9B(1)	196006	45.0			
			S-6-79/9/9-9B(2)	196007	24.0			
			S-6-79/9/9-11A(1)	196008	12.5			Thin irregular crust of black oxide on coarse volcanic breccia with clasts of massive vesicular and altered glassy volcanic rock.
			S-6-79/9/9-11A(2)	196009	10.0			
			S-6-79/9/9-11B(1)	196010	12.5			
			S-6-79/9/9-11B(2)	196011	3.0			
			S-6-79/9/D-9	196012	6.0			Altered conglomeritic rock with 0-5mm Mn and a bag of separate Mn crust.
55.107	-140.462	2200	S-6-79/1/D-1-4(4)	195002	40.0	Chainbag Dredge	USGS/ MENLO	Dark-brown earthy massive to laminated oxide crust on unknown substrate.
			S-6-79/1/D-1-4(2)	195003	30.0			
55.127	-140.423	1400	S-6-79/2/2-33(1)	195004	46.5	Chainbag Dredge	USGS/ MENLO	Black laminated oxide crust on unknown substrate.
		1400	S-6-79/2/2-33(2)	195005	2.0			
		1400	S-6-79/2/2-34B(1)	195006	46.5			
		1400	S-6-79/2/2-34B(2)	195007	22.0			
		1400	S-6-79/2/2-34C(1)	195008	46.5			
		1400	S-6-79/2/2-34C(2)	195009	42.0			
		1400	S-6-79/2/D-2	195010	8.0			Massive Mn crusts.
-2.177	-101.960	3108	NONE/113434/DR-1	310001	10.0		SMIT	Altered glassy basaltic boulder, 1-20mm botryoidal Mn crust over most surface.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-2.367	-22.767	3217	P/6707/30	302001	-	Dredge	UMIAMI	Mn stained basalt.
-4.100	-12.150	1640-1540	AII-42/1/20-60	301001	3.7	Dredge	WHOI	Fresh irregularly shaped basalt cobble with partial Mn coating up to 7.5mm.
-5.383	-97.483	4119-3558	DODO/D-232	335001	5.0	Dredge	SIO	Up to 10mm Mn over basalt and unspecified sediment.
-5.750	-11.350	2380	LSDA/D-3	334001	-	Dredge	SIO	Fresh basalt with thin Mn crust <1mm.
-6.245	-107.228	2980	Y-71-9-114/96/79-9-114	310002	-	-	OSU	Hard igneous rock with 0-2mm Mn, not enough to collect.
-9.383	109.267	1390	MSN/D-18	325001	-	Dredge	SIO	Small Mn nodules with palagonite nucleii.
-9.650	56.417	2800	DODO/D-125	330001	4.0	Dredge	SIO	Small basaltic fragments with up to 8mm Mn crust.
-9.960	-5.387	1561-1227	RC-13/D-5	300001	8.0	-	LDGO	Altered volcaniclastic with 5-15mm botryonite Mn crust.
-12.858	-14.037	2950-2760	RC-16/RD-1	337001	10.0	Dredge	LDGO	Nodules and Mn crust overlying basalt ~12mm Mn crust.
-12.933	-14.252	2544	RC-16/RD-2	337002	12.0	Dredge	LDGO	Very porous altered Mn crust (18mm) overlying thick palagonite rind.
-13.303	-15.528	3199	RC-16/RD-8	337003	8.0	Dredge	LDGO	8mm Mn crust on altered phosphatic carbonate rock.
-13.528	66.642	2154	ANTP/D-127	365005	-	Dredge	SIO	Calcareous sediment with thin Mn.
-13.560	-112.340	2750	5OTW-8/D-33	347002	-	Dredge	SIO	Basaltic fragments with glassy rinds, no Mn.
-14.088	-110.815	3778	5OTW-7/D-32	347001	4.0	Dredge	SIO	Altered basaltic boulder, glassy rind with up to 8mm Mn.
-16.010	-95.662	4240	5OTW-7/D-28	345001	1.5	Dredge	SIO	Fairly fresh basaltic pebbles with 1-2mm Mn crust.
-16.420	-101.332	3416	5OTW-7/D-31	346001	2.5	Dredge	SIO	Large, slightly altered basaltic boulder with 1-4mm Mn.
-17.583	65.650	2720	ANTP/D-86	365002	-	Dredge	SIO	Mn nodules 20mm diameter some broken up.
-17.633	65.817		ANTP/D-89	365003	-	Dredge	SIO	Fresh basalt, no Mn.
-17.712	65.497	3291	ANTP/D-97	365004	-	Dredge	SIO	Basalt with glassy rind, not much Mn.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-17.883	99.100	5588-5354	VEMA28/D-15	362001	2.5	Dredge	LDGO	1-5mm Mn crust over altered mud-carbonate matrix.
-18.033	65.617	1423	ANTP/D-82	365001	-	Dredge	SIO	Highly altered basalt with Mn stain.
-18.617	99.067	6030-5717	VEMA33/D-14	362002	20.0	Dredge	LDGO	Mn stained and coated rocks, some crust fragments 20mm thick.
-18.800	78.150	4934	VEMA20/RD-5	364003	15.0	Dredge	LDGO	15mm Mn crust on altered phosphatized carbonate sediment.
-19.562 -19.552	-70.425 -70.430	658-661	KK74-01/STA40/RD-12	343001	-	Dredge	HIG	Up to 15mm Mn crust over altered substrate.
-19.975	-80.042	3109	GS/7202/60	344001	-	-	UMIAMI	Nodules.
-20.567	-31.800	3715-3367	RC-15/RD-16	375002	7.0	Dredge	LDGO	7mm Mn and palagonite crust on altered volcanic substrate.
-20.967	-31.800	4141-4150	RC-15/RD-13	375001	-	Dredge	LDGO	Light porous Mn and palagonite fragments.
-21.017	-31.900	4331-4227	RC-15/RD-14	375003	-	Dredge	LDGO	Small nodules consisting of coarse volcanic clastic material.
-21.070	-81.913	2560	GS/7202/59	380003	-	-	UMIAMI	Mn encrusted slab of phosphatic carbonate sediment.
-21.253	-80.925	2300	GS/7202/D-57	380001	-	-	UMIAMI	20mm thick Mn crust and phosphatic carbonate sediment separated.
-21.283	-80.960	3282	GS/7202/58	380004	-	-	UMIAMI	400x300x300mm phosphatic carbonate sediment boulder with up to 20mm Mn crust.
-21.888 -21.887	-11.875 -11.907	1480-1100	AII-60/10/2-24	373002	0.8	-	WHOI	Basaltic boulder variably encrusted with Mn 0-1.5mm.
-22.100 -22.067	-11.450 -11.458	2300-2100	AII-60/12/32	373001	1.0	-	WHOI	Basalt cobbles 0-2mm with partial Mn crust and heavy Fe stain where not encrusted.
-22.278 -22.317	-12.072 -12.060	2000-1600	AII-60/4/2-8-32	373003	5.0	-	WHOI	Friable 2-8mm Mn crust overlying palagonite rind.
-22.683	-13.217	2910	LSDT/D-2	406001	-	Dredge	SIO	Small Mn nodules.
-22.710	-97.308	4026	Y-73-4/28-4	381002	4.0	-	OSU	Altered boulder with 3-5mm Mn crust.
			Y-73-4-28/4-28	381003	1.5	-	OSU	Took one piece with 0-3mm Mn crust.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-22.922 -22.947	-13.510 -13.540	1700-1200	AII-60/2/8-19	373004	1.0	-	WHOI	Irregular shaped basaltic boulder with 0-2mm Mn crust.
-23.033	169.600	1143-987	NOVA H/D-64	391001	-	-	SIO	Mn nodules about 25mm in diameter.
-23.267	74.983	4520	DODO/D-113	400001	-	Dredge	SIO	Mn coating on unspecified sediment.
-23.433	50.817	4993-4052	RC-14/D-4	402001	10.0	Dredge	LDGO	10mm Mn crust over phosphatic carbonate sediment nucleus.
-23.800	-78.483	392	CARR/D-1	379001	-	Dredge	SIO	Vesicular basalt with thin Mn coating.
-24.017	170.050	1175	NOVA H-4/D-63	390001	-	Dredge	SIO	Mn coated sandstone with foraminifera.
-25.443	-97.565	3721	GS/7202/69	381001	-	-	UMIAMI	Mn encrusted phosphatic carbonate sediment.
-25.643 -25.638	-83.522 -83.537	2067-1955	KK74-01/STA32/RD9	380002	-	Dredge	HIG	Up to 5mm Mn crust overlying altered basalt.
-26.200	-106.300	3003-2778	RC-15/RD-2	397002	-	Dredge	LDGO	Up to 1mm Mn overlying basalt pebble.
-26.498 -26.493	-110.337 -110.342	2446-2411	KK74-01/STA27/RD4	383001	-	Dredge	HIG	Up to 10mm Mn crust on basalt.
-27.983	60.800	5698	ANTP/D-109	401001	5.0	Dredge	SIO	Mn nodules, 10mm thick crust with phosphatic carbonate sediment nucleii.
-28.417	-40.750	4388	RC-16/RD-10/RD-10	376001	2.5	Dredge	LDGO	0-5mm Mn crust on altered phosphatic carbonate sediment substrate.
-29.300	60.617	4688	ANTP/D-115	401003	-	Dredge	SIO	Thick Mn encrustation.
-29.300	60.650	5699-5118	ANTP/D-113	401002	-	Dredge	SIO	Mn nodules with phosphatic carbonate sediment nucleii.
-30.433	-36.017	1522-1399	RC-16/RD-12	411003	-	Dredge	LDGO	Basalt pebbles with 0-3mm Mn crust.
-30.500	-35.933	1357-673	RC-15/RD-8	411001	-	Dredge	LDGO	12mm crust overlying altered basalt.
-31.833	-13.578	2984-2364	AII-107-7/25	409001	1.0	-	WHOI	Boulder with pillowed surface and feldspar phenocrysts in black mass, 0.5-1.5mm crust.
-32.567	36.583	4469-3652	RC-14/D-2	440001	-	Dredge	LDGO	Altered basalt with up to 1mm Mn crust.
-32.677	-14.018	2634-2087	AII-107-7/23	409008	5.0	-	WHOI	Basalt boulder with friable botryoidal Mn crust 1-10mm, palagonite rind under crust.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-32.967	-88.000	3640	E21-07/BT21-8	416003	2.5	-	FSU	Mn encrusted altered basalt, Mn up to 5mm.
-33.000	-85.900	3883	E21-06/BT21-7	416002	-	-	FSU	Crust on altered basalt.
-33.217	-89.450	3587	CARR/D-2	416001	10.0	Dredge	SIO	Basalts with 20mm thick Mn crust.
-33.713	-14.250	2283-1489	AII-107-7/20	409009	-	-	WHOI	Mn encrusted around basaltic pebble, porous crust.
-34.553	-15.147	2924-2464	AII-107-7/18	409002	.6	-	WHOI	Gray altered basalt with thin Mn crust .2-1mm.
-35.278	-15.735	3638-3135	AII-107-7/17	409004	3.2	-	WHOI	0.5-6mm Mn crust on basalt boulder, some crust botryoidal.
-35.967	-134.300	4727	E24-15/BT24-15	421001	-	-	FSU	Two Mn stained pebbles.
-36.073	-18.083	2623-2284	AII-107-7/16	409006	5.0	-	WHOI	Altered basalt boulder 2-8mm crust, pillow basalt with large phenocrysts -yellowish altered surface.
-36.558	-17.587	2683-2434	AII-107-7/15	409007	2.2	-	WHOI	Various basaltic rocks with 1-3mm Mn crust.
-36.750	44.767	2479-2050	RC-14/D-3	439001	20.0	Dredge	LDGO	About 20mm Mn crust on altered substrate.
-36.950	-169.833	775-1560	VEMA36/D-4	424002	35.0	Dredge	LDGO	35mm Mn crust, no substrate.
-37.057 -37.062	-7.188 -7.198	3019-3283	RC-12/D-4	408001	7.0	Dredge	LDGO	Small Mn fragments, no substrate, 7mm thick.
-37.187	-17.515	2454-2224	AII-107-7/14	409005	1.2	-	WHOI	Basaltic boulder with 0.5-2mm Mn crust, surface of small botryoids.
-37.550	18.100	3147	VEMA22/D-7	442001	15.0	Dredge	LDGO	Large slab-nodules, substrate consists of scoriaceous basalt, fairly fresh with carbonate covering crust averaging about 15mm.
-37.833	-17.142	2723-1885	AII-107-7/13-1	409003	2.5	-	WHOI	Fragments of pillow basalt 1-4mm crust on top surfaces.
-37.867	26.683	2942-2531	RC-14/D-1	441003	20.0	Dredge	LDGO	15-25mm Mn overlying altered basalt substrate.
-38.433	-36.017	1445-1714	RC-16/RD-11	411002	50.0	Dredge	LDGO	Assortment of Mn coated basalt-slabs and nodules up to 50mm thick.
-38.643	-167.885	1418	GEOSECS/D-1	424001	-	Dredge	SIO	Mn encrusted coral and Mn slab.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-38.967	-150.367	5066	E24-02/BT24-02	423001	-	-	FSU	Small nodules and assorted nodule fragments.
-39.121	24.054	4775-4546	VEMA34/D-25	441001	25.0	Dredge	LDGO	25mm Mn over very altered basalt.
-39.771 -39.773	24.755 24.772	2963-2853	VEMA34/D-28	441002	25.0	Dredge	LDGO	25mm Mn slab and altered volcanic substrate.
-39.850	-96.867	3639	E21-12A/BT21-11	417001	-	-	FSU	Small Mn pieces and a few larger nodules.
-40.133	-119.583	4252	E21-14/ET21-12	455001	-	-	FSU	Small nodules and very small pieces of Mn.
-40.438	-16.750	2627-2597	AII-107/7/9-13	445001	-	-	WHOI	Cobbles and fragments of ultrabasic rock, thin Mn stain.
-40.438	-16.750	2627-2597	AII-107/7/7-11	445002	-	-	WHOI	Basalt with altered fractured irregular surface coated with thin Mn layer.
-40.438	-16.750	2627-2597	AII-107/7/6-1	445003	-	-	WHOI	Slab gray-green spheroidal water-marked very hard ultra basic rock.
-40.438	-16.750	2627-2597	AII-107-7/7/18	445004	-	-	WHOI	Chunk of glassy basalt.
-40.438	-16.750	2627-2597	AII-107-7/7/7-15	445005	120.0	-	WHOI	Broken fragments of basalts encrusting large foraminefera and micromolluska.
-41.264 -41.247	28.314 28.314	4314-3895	VEMA34/D-26	477001	18.0	Dredge	LDGO	Up to 25mm Mn over altered volcaniclastic rock.
-42.083	-86.050	3054	E25-05/BT-25-1	452002	-	-	FSU	Nodule fragments.
-43.000	-139.933	5141	E24-08/BT 24-8	457001	-	-	FSU	Nodules and fragments.
-43.117	2.117	3967	VEMA29/D-3	479001	35.0	Dredge	LDGO	-
-44.350	-57.350	4605-4296	VEMA18/RD 14	449001	15.0	Dredge	LDGO	-
-47.933	-57.100	2620-2549	VEMA18/RD 6	449002	55.0	Dredge	LDGO	-
-47.967	-57.017	3338-3122	RC-15/RD-7/RD-7	449004	30.0	Dredge	LDGO	Nodule fragment of 20-40mm Mn overlying altered carbonate substrate.
-48.467	-55.233	2915-2394	RC-15/RD 5	449003	35.0	Dredge	LDGO	Crust slabs, up to 40mm thick with no substrate.
-49.567	-48.400	3929-3000	VEMA31/D-12	448001	20.0	Dredge	LDGO	Some 20mm slabs of Mn with basaltic pebbles and cobbles with 1-3mm Mn.
-49.600	-47.567	4080-2705	RC-15/RD-4	448002	25.0	Dredge	LDGO	Up to 25mm crust slabs.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-49.667	178.942	1344	E27-02B/BT27-3	462001	-	-	FSU	Nodule Mn fragments and Mn coated hard rock.
-49.950	-89.983	4390	E25-09/BT25-5	452001	-	-	FSU	Mn fragments.
-50.367	8.750	4686	VEMA29/D-4	515008	-	Dredge	LDGO	1-5mm Mn overlying volcanic substrate.
-50.483	-94.917	4664	E25-10/MT25-6	489002	-	-	FSU	Nodules, ~2cm in diameter.
-52.017	-99.950	2479	E20-24A/BT20-8	489004	-	Dredge	FSU	Mn fragments.
-52.167	10.483		VEMA29/D-5	514001	-	Dredge	LDGO	1-5mm Mn over phosphatized carbonate substrate.
-52.875	-33.858	2853	E0925A/T9-18	483004	-	-	FSU	Mn stained pebbles.
-53.058	-48.950	3041	E07-26A/RD7-17	484002	-	-	FSU	Mn encrusted on basalt.
-53.147 -53.152	9.192 9.167	2438-2214	AII-107-6/66	515001	6.5	-	WHOI	Altered basalt pebbles, cobbles, 3mm-10mm thick crust; matrix replaced by Mn oxide of 2cm thickness in some places to form puddingstone conglomerate
-53.238 -53.170	9.193 9.170	3670-2692	AII-107-6/65	515002	7.0	-	WHOI	3mm-20mm crust on altered basalt substrate, some cobbles gray porphoritic and fractured.
-53.418 -53.375	9.198 9.278	4418-4063	AII-107-6/61/67	515003	2.5	-	WHOI	1-4cm crust on feldspathic welded tuff altered basalt conglomerate breccia green and gray rounded clasts.
-53.428 -53.480	9.152 9.190	5349-4207	AII-107-6/60	515005	0.8	-	WHOI	Boulder of veined greenish-gray to yellow-brown altered basalt .5-1mm Mn crust.
-53.942	-55.917	1887	E06-098/BT6-2	485004	-	-	FSU	Mn encrusted phosphatized carbonate sediment.
-53.980 -53.955	7.340 7.355	2074-1316	AII-107-6/58	515004	0.2	-	WHOI	Gray hard altered basalt with indistinct coordinate boundries .1-.3mm crust concentrated in microbotryoidal patches.
-54.100	-119.317	3219	E21-17A/BT21-16	491001	-	-	FSU	Mn coated altered basaltic rocks.
-54.423 -54.420	1.570 1.528	3240-2724	AII-107-6/40	515006	2.0	-	WHOI	Cobbles highly altered basalt brown-green-yellow with .5-7mm crust.
-54.442 -54.428	1.622 1.607	4818-4436	AII-107-6/39(15)	515007	1.2	-	WHOI	.5-2mm Mn crust on altered basalt fragment.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-55.100	-55.833	2890	E06-10/RD6-10	485005	-	-	FSU	Mn encrusted altered basalt.
-55.300	-64.755	2149	E11-33B/BT 11-18	486001	-	-	FSU	Mn stained igneous rocks.
-55.902	-58.860	4023	E06-43/BT-6-15	485008	-	-	FSU	Nodules with basaltic nucleii and fragments of Mn coated basalt.
-56.170 -56.153	41.800 41.768	3709-3402	AII-107-6/1	511001	6.5	-	WHOI	Cobbles with 2-10mm crust heavily altered grayish crystalline nucleus.
-56.250	-58.333	4115	E06-05B/RD6-5	485009	-	-	FSU	Mn encrusted basalts.
-56.867	-99.417	4737	E18-03/BT 18-3	489006	-	Dredge	FSU	Stained basalts and some Mn fragments.
-56.995	-59.083	4023	E06-42/BT-6-14	485007	-	-	FSU	Nodules with basaltic nucleii.
-57.083	-70.983	3790	E05-26/RD5-16	487003	-	Dredge	FSU	Mn crusts and fragments.
-57.083	-70.983	3790	E05-27A/RD5-17	487004	-	-	FSU	Mn nodules slabs and pieces.
-57.117	-59.117	4115	E06/RD6	485001	-	-	FSU	Nodules Mn fragments and pieces.
-57.150	-119.550	4517	E15-15/BT15-8	491002	-	-	FSU	Small nodules and bits of basaltic rock, ~2cm in diameter.
-57.338	149.678	2000	E38-09/KG38-17	501001	-	-	FSU	Small nodules, ~2cm in diameter.
-57.737	-90.782	5093	E13-04/BT13-2	489001	-	-	FSU	Four nodules, ~2cm in diameter.
-57.767	-55.967	4084	E06-13A/RD6-13	485006	-	-	FSU	Small nodules and basalt pebbles with <1mm Mn crust.
-57.850	-108.420	4682	E15-13/MT15-7	490001	-	Dredge	FSU	Nodules some with partly phosphatized carbonate "sediment" nucleii.
-58.033	-45.067	2861	E7/480	484003	5.0	-	FSU	10mm or less Mn encrusted on calcareous substrate.
-58.100	-59.400	4358	E06-07A/RD6-7	485002	-	-	FSU	Mn stained fresh basalt.
-58.102	-82.872	4206	E10-04/RD-10-2	488001	-	Dredge	FSU	Mn nodules, ~2cm in diameter.
-58.150	-59.883	3917	E06-07B/MT6-4	485003	-	-	FSU	Nodules fragments and Mn coated basaltic fragments.
-58.293	-78.460	4938	E10-30/MT10-20	487005	-	Dredge	FSU	Small nodules, ~2cm in diameter.
-58.708	-33.500	3328	E09-19/T9-14	483003	-	-	FSU	Mn encrusted slab.
-58.875	-36.400	1783	E09-18B/T9-13	483002	-	-	FSU	Two stained pebbles.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-59.017	-48.992	3868	E07-21A/BT7-7	484001	-	-	FSU	Fairly fresh basalts some Mn coated botryoids.
-59.017	-70.750	3841	E05-25/RD5-15	487002	-	Dredge	FSU	Nodules, ~2cm in diameter.
-59.017	-99.593	4901	E15-04/BT15-3	489005	-	Dredge	FSU	Small Mn nodules, ~2cm in diameter.
-59.027	-74.633	4697	E10-20/BT10-13	487001	-	-	FSU	Small nodules and fragments, ~2cm in diameter.
-59.033	-67.300	3475	E05-07B/RD5-45	486002	-	-	FSU	Small nodules and pieces, ~2cm in diameter.
-59.417	-31.208	2396	E12-16A/BT12-13	483005	-	-	FSU	Rock slabs with <1mm Mn crust.
-59.473	-82.558	4956	E10-05/RD10-3	488002	-	Dredge	FSU	Two Mn stained pebbles.
-59.800	-144.750	3259	E20-11/BT20-3	494001	-	-	FSU	120mm diameter nodules; semi-round.
-59.867	-32.317	613	E12-16C/BT12-1059	483001	-	-	FSU	Mn stained pebble.
-60.093	-75.288	4590	E10-19/MT10-12	523004	-	-	FSU	Mn stained pebbles.
-60.400	-115.017	5040	E23-17/BT23-5	527001	-	-	FSU	Nodules and botryoidal slabs, variable sizes.
-60.610	-29.978	1079	E12-15/BT12-12	518001	-	-	FSU	Mn stained pebbles.
-61.033	-95.033	4993	E15-01/BT151	525002	-	-	FSU	Small nodule fragments.
-61.045	-75.063	4471	E10-18/BT10-11	523002	-	-	FSU	Nodules, ~2cm diameter.
-61.100	-104.967		E15-08/BT15-5	526002	-	-	FSU	Small nodules, ~2cm diameter.
-61.183	-120.333	4987	E21-20/BT21-20	528003	-	-	FSU	Small nodules, ~2cm diameter.
-61.233	-67.717	3804	E05-13/RD5-12 OR RD5-9	522001	-	Dredge	FSU	Fresh basalt, no Mn.
-61.400	-101.233	4911	E23-07/BT23-3	526001	-	-	FSU	Small nodules, ~2cm diameter.
-61.450	-94.967	4800	E23-03/BT23-2	525001	-	-	FSU	Nodules, ~2cm diameter.
-61.700	-99.867	4893	E19-03/BT19-3	525004	-	-	FSU	Basalt pebbles and angular Mn pieces, variable sizes.
-61.842	149.883		E38-08	537001	-	-	FSU	Small nodules, ~2cm diameter.
-61.963	-79.083	4700	E10-27/MT10-19	523003	-	-	FSU	Nodules, ~2cm diameter.
-62.037	-75.172	4389	E10-17/MT10-10	523001	-	-	FSU	Micro nodules, ~1cm diameter.

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Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Thickness (mm)	Sampling Device	Inst.	Description
-62.200	-94.767	4898	E17-29/BT17-101	525003	-	-	FSU	Small nodules, ~2cm diameter.
-63.608	-129.897	4819	E13-23/BT13-8	528001	-	-	FSU	White gray small nodule, ~2cm diameter.
-64.050	-135.000	-	E17-09/BT17-4	529001	-	-	FSU	Small nodules and lightly crusted basalts.
-65.617	-123.917	-	E13-20/BT13-7	528002	-	-	FSU	Mn nodules and small pieces.

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
APLIAC8501	8.550°S	167.000°W	3940	RC13/45		IMP COLLAGE U
BURNWC7705	2.286°N	101.018°W	3150	CRUISE14/1052		N.Y.-ST.-UNIV
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-1	Dredge	UNIV.ANGLIA/N
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-2	Dredge	UNIV.ANGLIA/N
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-3	Dredge	UNIV.ANGLIA/N
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-4	Dredge	UNIV.ANGLIA/N
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-5	Dredge	UNIV.ANGLIA/N
CANNJR7701	12.550°N	47.651°E	2550	DISC/6243-6	Dredge	UNIV.ANGLIA/N
CLARAL8501	13.000°N	164.984°W	3350	MIDPAC81/3		MMS
CLARAL8501	13.200°N	165.452°W	1510	MIDPAC81/9		MMS
CLARAL8501	19.350°N	170.984°W	1190	MIDPAC81/10		MMS
CLARAL8501	19.400°N	171.168°W	1190	MIDPAC81/5		MMS
CLARAL8501	20.069°N	170.635°W	1240	MIDPAC81/11		MMS
CLARAL8501	20.069°N	170.635°W	1240	MIDPAC81/6		MMS
CLARAL8501	9.083°N	160.733°W	3780	MIDPAC81/1		MMS
CLARAL8501	9.1347°N	164.783°W	1120	MIDPAC81/		MMS
CLARAL8501	9.1347°N	164.783°W	1120	MIDPAC81/8		MMS
CLARAL8501	9.1358°N	164.801°W	2100	MIDPAC81/2		MMS
CLARAL8501	9.1358°N	164.801°W	2100	MIDPAC81/7		MMS
CORLJB7801	.4167°N	86.100°W		LEG-1/DM-1	Dredge	OREGON.ST.UNI
CORLJB7801	.4167°N	86.100°W		LEG-1/DM-2	Dredge	OREGON.ST.UNI
CORLJB7801	.5833°N	86.100°W		LEG-1/A-2	Dredge	OREGON.ST.UNI
CORLJB7801	.5833°N	86.100°W		LEG-1/N-3	Dredge	OREGON.ST.UNI
CORLJB7801	.5833°N	86.100°W		LEG-1/N-4	Dredge	OREGON.ST.UNI
CORLJB7801	.5833°N	86.100°W		LEG-1/TB-3	Dredge	OREGON.ST.UNI
CORLJB7801	.5833°N	86.100°W		LEG-1/TB-7	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/A-1	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/N-1	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/N-2	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/N-5	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/TB-1	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/TB-2	Dredge	OREGON.ST.UNI
CORLJB7801	.6000°N	86.117°W		LEG-1/TB-5	Dredge	OREGON.ST.UNI
CORLJB7801	.6167°N	86.100°W		LEG-1/TB-4	Dredge	OREGON.ST.UNI
CORLJB7801	.6167°N	86.100°W		LEG-1/TB-6	Dredge	OREGON.ST.UNI
CRAIJD8201	20.134°N	156.253°W	1440	KK720702/3-5-22	Dredge	H.I.G.
CRAIJD8201	20.134°N	156.253°W	1440	KK720702/3-8-21A	Dredge	H.I.G.
CRAIJD8201	21.685°N	158.485°W	985	MW74-01/2-6-6	Dredge	H.I.G.
CRAIJD8201	21.718°N	158.285°W	795	MW74-01/2-4	Dredge	H.I.G.
CRAIJD8201	21.718°N	158.451°W	920	MW74-01/2-5-3A	Dredge	H.I.G.

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
CRAIJD8201	21.769°N	158.735°W	1120	KK720702/2-1214A	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-1-1	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-1-2A	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-2-4A	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-2-5A	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-2-6	Dredge	H.I.G.
CRAIJD8201	21.833°N	158.667°W	1295	KKMN7502/3-2-8A	Dredge	H.I.G.
CRAIJD8201	21.850°N	158.684°W	1340	KK720702/2-8-8A	Dredge	H.I.G.
CRAIJD8201	21.868°N	158.818°W	1150	KK720702/3-4-14	Dredge	H.I.G.
CRAIJD8201	21.868°N	158.818°W	1150	KK720702/3-4-15A	Dredge	H.I.G.
CRAIJD8201	21.868°N	158.818°W	1150	KK720702/3-4-17	Dredge	H.I.G.
CRAIJD8201	21.901°N	158.634°W	1840	KK720702/2-9-9A	Dredge	H.I.G.
CRAIJD8201	21.918°N	158.785°W	1945	KK720702/3-3-11	Dredge	H.I.G.
CRAIJD8201	21.953°N	158.602°W	1985	KK720702/2-1011A	Dredge	H.I.G.
CRAIJD8201	21.953°N	158.602°W	1985	KK720702/2-101A	Dredge	H.I.G.
CRAIJD8201	23.117°N	162.467°W	1865	KK760806/4-11	Dredge	H.I.G.
CRAIJD8201	23.168°N	162.433°W	2065	KK760806/4-10	Dredge	H.I.G.
CRAIJD8201	23.367°N	163.567°W	870	KK720702/1-49	Dredge	H.I.G.
CRAIJD8201	23.702°N	165.600°W	1330	KK760806/4-9	Dredge	H.I.G.
CRAIJD8201	23.817°N	164.417°W	870	KK720702/1-47-A	Dredge	H.I.G.
CRAIJD8201	24.235°N	166.068°W	1840	KK760806/4-8	Dredge	H.I.G.
CRAIJD8201	24.285°N	166.719°W	1115	KK720702/1-43	Dredge	H.I.G.
CRAIJD8201	25.484°N	168.651°W	1075	KK720702/1-33-A	Dredge	H.I.G.
CRAIJD8201	25.484°N	168.651°W	1075	KK720702/1-33-B	Dredge	H.I.G.
CRAIJD8201	25.500°N	168.235°W	1440	KK760806/4-5	Dredge	H.I.G.
CRAIJD8201	25.650°N	168.785°W	1860	KK760806/4-3	Dredge	H.I.G.
CRAIJD8201	25.668°N	168.686°W	1510	KK720702/1-32-A	Dredge	H.I.G.
CRAIJD8201	25.668°N	168.686°W	1510	KK720702/1-32-B	Dredge	H.I.G.
CRAIJD8201	25.668°N	168.686°W	1510	KK720702/1-32-C	Dredge	H.I.G.
CRAIJD8201	25.668°N	168.686°W	1510	KK720702/1-32-D	Dredge	H.I.G.
CRAIJD8201	25.683°N	167.686°W	1340	KK760806/4-7	Dredge	H.I.G.
CRAIJD8201	26.451°N	177.852°W	930	KKMN7601/5-8-B	Dredge	H.I.G.
CRAIJD8201	27.700°N	175.683°W	1090	KK720702/1-24	Dredge	H.I.G.
CRAIJD8201	27.751°N	175.636°W	850	KKMN7601/5-7-C	Dredge	H.I.G.
CRAIJD8201	27.751°N	175.636°W	850	KKMN7601/5-7-E	Dredge	H.I.G.
CRAIJD8201	28.785°N	178.801°W		KKMN7601/5-5-B	Dredge	H.I.G.
CRAIJD8201	28.785°N	178.801°W	880	KKMN7601/5-5-A	Dredge	H.I.G.
CRAIJD8201	28.817°N	178.950°W	980	KK720702/1-20-A	Dredge	H.I.G.
CRAIJD8201	37.752°N	170.285°E	1800	KKMN7601/5-12-A	Dredge	H.I.G.
CRAIJD8201	38.617°N	171.034°E	1104	KKMN7601/5-10	Dredge	H.I.G.

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
CRAIJD8201	40.218°N	170.367°E	2030	KKMN7601/5-11-A	Dredge	H.I.G.
CRONDS8201	26.933°S	177.617°W	1700	TANG-81/U23-1	Dredge	IMP-COL-LONDO
CRONDS8201	26.933°S	177.617°W	1700	TANG-81/U23-2	Dredge	IMP-COL-LONDO
DILLJG8201	19.500°N	168.900°W	1805	7 TOW/143 D-C		VPI
DILLJG8201	19.500°N	168.900°W	1805	7 TOW/143 D-E		VPI
DILLJG8201	38.600°S	167.900°W	1420	GEOSECS/1D		VPI
EHRLAM6803	1.6167°S	58.617°E	3940	CHN-43/11-1	Grab	M.I.T.
EHRLAM6803	25.517°S	85.233°W	920	DWHD-72/4	Grab	M.I.T.
EHRLAM6803	31.202°N	78.483°W	648	GOSN-74/2390-	Grab	M.I.T.
EHRLAM6803	31.934°N	77.250°W	787	ALAN-266/5-12A	Grab	M.I.T.
EHRLAM6803	35.583°N	67.917°W	3000	CHN-21/2-9	Dredge	M.I.T.
EHRLAM6803	9.0192°N	42.669°W	2300	CHN-43/113-10	Grab	M.I.T.
FRIEGH8001	9.3000°N	146.050°W	4830	VAL-1312/FMC-	Dredge	ACHEN-F.R.G.
GLASGP7202	55.151°S	150.050°E	3865	ELTAN-36/22139A		FLORIDA ST UN
GLASGP7202	55.151°S	150.050°E	3865	ELTAN-36/22139B		FLORIDA ST UN
GLASGP7202	55.151°S	150.050°E	3865	ELTAN-36/22139C		FLORIDA ST UN
GLASGP7202	55.151°S	150.050°E	3865	ELTAN-36/22139F		FLORIDA ST UN
GLASGP7402	2.7181°N	59.902°E	3998	DISC-67/6249	Dredge	IMP-COL-LON-E
GLASGP7402	2.7522°N	59.852°E	3833	DISC-67/6252	Dredge	IMP-COL-LON-E
GLASGP7402	2.7683°N	59.768°E	3516	DISC-67/6257	Dredge	IMP-COL-LON-E
GLASGP7402	2.8167°N	59.834°E	3579	DISC-67/6253	Dredge	IMP-COL-LON-E
GLASGP7402	2.8175°N	59.851°E	3472	DISC-67/6256	Dredge	IMP-COL-LON-E
GLASGP7402	2.9022°N	60.036°E	4189	DISC-67/6273	Dredge	IMP-COL-LON-E
GLASGP7504	21.684°S	159.950°W	3970	TANG-22/37DT-20	Pipe Dredge	N.Z.O.I.
GLASGP7504	22.535°S	160.117°W	4817	TANG-22/38DT-22	Pipe Dredge	N.Z.O.I.
GLASGP7504	32.668°S	160.002°W	5300	TANG-22/52DT-31	Pipe Dredge	N.Z.O.I.
GLASGP8202	10.000°S	134.000°W	5000	SONNE-06/137DK	Free-fall Grab	N.Z.O.I.
GLASGP8202	17.717°S	159.967°W	5186	SONNE-06/151-GB	Free-fall Grab	N.Z.O.I.
GLASGP8202	22.000°S	161.900°W	4433	SONNE-06/211-GB	Free-fall Grab	N.Z.O.I.
GLASGP8202	22.017°S	161.967°W	4473	SONNE-06/218-GB	Free-fall Grab	N.Z.O.I.
GLASGP8202	7.000°S	132.000°W	5000	SONNE-06/94-GB	Free-fall Grab	N.Z.O.I.
GLASGP8302	17.383°S	159.617°W	5148	SO-06/2/157GB	Free-fall Grab	HAWAII INST G
GLASGP8302	17.400°S	159.617°W	5112	SO-06/2/154-GB	Free-fall Grab	HAWAII INST G
GLASGP8302	17.417°S	159.600°W	5027	SO-06/2/153-GB	Grab	HAWAII INST G
GLASGP8302	18.967°S	161.633°W	4955	SO-06/2/171GB	Free-fall Grab	HAWAII INST G
GLASGP8302	18.983°S	161.633°W	4897	SO-06/2/170GB	Free-fall Grab	HAWAII INST G
GLASGP8302	18.983°S	161.650°W	4936	SO-06/2/168GB	Free-fall Grab	HAWAII INST G
GLASGP8302	18.983°S	161.683°W	4944	SO-06/2/172KG	Spade Core	HAWAII INST G
GLASGP8302	19.000°S	161.650°W	4925	SO-06/2/167GB	Free-fall Grab	HAWAII INST G
GLASGP8302	19.017°S	161.667°W	4990	SO-06/2/165GB	Free-fall Grab	HAWAII INST G

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
GLASGP8302	19.033°S	161.667°W	5088	SO-06/2/174KG	Spade Core	HAWAII INST G
GLASGP8302	19.350°S	162.267°W	4616	SO-06/2/179KG	Spade Core	HAWAII INST G
GLASGP8302	19.350°S	162.267°W	4616	SO-06/2/LOC-26	Spade Core	HAWAII INST G
GLASGP8302	19.917°S	162.000°W	4857	SO-06/2/193GB	Free-fall Grab	HAWAII INST G
GLASGP8302	19.917°S	162.000°W	4938	SO-06/2/194GB	Free-fall Grab	HAWAII INST G
GLASGP8302	19.933°S	162.000°W	4900	SO-06/2/192GB	Free-fall Grab	HAWAII INST G
GLASGP8302	19.933°S	162.000°W	4958	SO-06/2/191GB	Free-fall Grab	HAWAII INST G
GLASGP8302	20.467°S	161.233°W	4913	SO-06/2/197GB	Free-fall Grab	HAWAII INST G
GLASGP8302	20.483°S	161.217°W	4995	SO-06/2/198KG	Spade Core	HAWAII INST G
GLASGP8302	20.483°S	161.233°W	4907	SO-06/2/196GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.350°S	162.967°W	4944	SO-06/2/226GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.350°S	162.967°W	4964	SO-06/2/225GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.367°S	162.917°W	4861	SO-06/2/229GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.367°S	162.933°W	4861	SO-06/2/227GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.500°S	162.417°W	4913	SO-06/2/220GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.600°S	161.533°W	4433	SO-06/2/211GB	Free-fall Grab	HAWAII INST G
GLASGP8302	21.617°S	161.583°W	4473	SO-06/2/218GB	Box Core	HAWAII INST G
GLASGP8302	22.033°S	164.283°W	5211	SO-06/2/241KL	Piston Core	HAWAII INST G
GLASGP8302	22.317°S	164.250°W	5216	SO-06/2/240GB	Free-fall Grab	HAWAII INST G
HALBPA8301	13.150°N	165.484°W	3280	MIDPAC81/57DK2		IMMR GERMANY
HALBPA8301	19.350°N	170.983°W	1190	MIDPAC81/76DK		IMMR GERMANY
HALBPA8301	19.400°N	171.168°W	2860	MIDPAC81/73DK7		IMMR GERMANY
HALBPA8301	20.069°N	170.635°W	1240	MIDPAC81/111DK2		IMMR GERMANY
HALBPA8301	9.1358°N	164.801°W	2100	MIDPAC81/31DK5		IMMR GERMANY
HALBPA8301	9.4003°N	164.783°W	1120	MIDPAC81/32DK2		IMMR GERMANY
HANAKN8001	13.883°S	150.583°W	3620	UNKNOWN/2P-50		
HANAKN8001	16.483°S	145.550°W	1270	UNKNOWN/DWHD-16		
ISKOJM8201	13.067°S	24.683°W	440	V16SBT3		UNIV. HAWAII
ISKOJM8201	14.300°S	149.533°W	2000	V18-D32		UNIV. HAWAII
ISKOJM8201	24.950°N	51.750°W	5960	V25-D14		UNIV. HAWAII
ISKOJM8201	26.417°N	29.983°W	5080	V27-256		UNIV. HAWAII
ISKOJM8201	28.817°N	178.950°W	1090	MDH-20		UNIV. HAWAII
ISKOJM8201	36.750°S	44.767°E	2220	RC14-D3		UNIV. HAWAII
ISKOJM8201	37.050°S	7.183°W	3100	RC12-D4		UNIV. HAWAII
ISKOJM8201	48.467°S	55.233°W	2650	RC15-D5		UNIV. HAWAII
JONEHA8001	12.900°S	119.867°E	2100	VALDIVIA/KD13		BMR.AUST.
JONEHA8001	13.100°S	120.083°E	2300	VALDIVIA/KD3		BMR.AUST.
JONEHA8001	13.150°S	120.083°E	2100	VALDIVIA/KD4		BMR.AUST.
JONEHA8001	45.200°S	145.067°E	3968	ELTANIN/PC34-13		BMR.AUST.
JONEHA8001	51.983°S	119.633°E	3905	ELTANIN/PC44-28		BMR.AUST.

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
JONEHA8001	52.083°S	135.100°E	3367	ELTANIN/PC34-21		BMR.AUST.
JONEHA8001	53.017°S	150.000°E	3878	ELTANIN/PC36-18		BMR.AUST.
JONEHA8001	53.500°S	163.517°E	2689	ELTANIN/PC44-09		BMR.AUST.
JONEHA8001	56.583°S	150.283°E	3516	ELTANIN/PC36-15		BMR.AUST.
JONEHA8001	57.000°S	150.000°E	3291	ELTANIN/RD38-03		BMR.AUST.
JONEHA8001	57.467°S	150.467°E	3255	ELTANIN/PC38-10		BMR.AUST.
JONEHA8001	58.667°S	159.517°E	3876	ELTANIN/PC36-37		BMR.AUST.
JONEHA8001	61.883°S	149.283°E	3657	ELTANIN/RD38-02		BMR.AUST.
KOBAKA8401	25.500°N	142.533°E	2010	KH 84-1/8-51	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.083°N	144.317°E	1050	KH 84-1/3-607	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.117°N	144.317°E	1050	KH 84-1/3-606	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.200°N	144.183°E	890	KH 84-1/27-017	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.217°N	144.083°E	2430	KH 84-1/5-33	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.267°N	142.967°E	1430	KH 84-1/2-124	Chainbag Dredge	UNIV. OF TOKY
KOBAKA8401	26.267°N	142.967°E	1430	KH 84-1/2-306	Chainbag Dredge	UNIV. OF TOKY
KRAETA7401	33.050°S	82.050°W		E21-4	Core	UNIV-MIAMI-FL
KRAETA7401	35.967°S	134.833°W		E24-15C	Core	UNIV-MIAMI-FL
KRAETA7401	55.383°S	145.033°W		E15-13	Core	UNIV-MIAMI-FL
KRISSA7201	13.867°	150.583°W	3623	MULTIPLE/TF-2		TATA INST-IND
KRISSA7201	13.883°S	150.583°W	3695	MULTIPLE/2P-50		TATA INST-IND
KRISSA7201	20.750°N	112.783°W	3000	MULTIPLE/TRPD-2D		TATA INST-IND
KRISSA7201	40.267°N	170.333°E	3000	MULTIPLE/ZETES3D		TATA INST-IND
LAVRVM7301	33.500°N	29.933°W	2370	LOMONOSV/STN 363		USSR ACAD SCI
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/B-CRUST	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/DPSD3-C	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/DPSD3-N	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/DPSD4-N	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/DPSD5-C	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/NOD-A	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/NOD-B	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/SIQD4-C	Dredge	SCRIPPS
LONSPF8007	8.7006°N	103.886°W	1875	MELVILLE/SIQD4-N	Dredge	SCRIPPS
MCGOPJ7901	26.117°N	25.350°W	2600	TAG71-73/2B2	Dredge	UNIV.MELBOURN
MCGOPJ7901	26.117°N	25.350°W	2600	TAG71-73/2B8	Dredge	UNIV.MELBOURN
MCGOPJ7901	26.152°N	44.784°W	3148	TAG71-73/2A3-30	Dredge	UNIV.MELBOURN
MCGOPJ7901	26.152°N	44.784°W	3148	TAG71-73/2A3-31	Dredge	UNIV.MELBOURN
MCGOPJ7901	26.152°N	44.784°W	3148	TAG71-73/2A3-32	Dredge	UNIV.MELBOURN
MCGOPJ7901	26.152°N	44.784°W	3148	TAG71-73/2A4-30	Dredge	UNIV.MELBOURN
MEYLMA7801	15.134°S	166.900°W	5348	TANG-76/I-166	Pipe Dredge	NZOI
MEYLMA7801	21.684°S	159.950°W	3970	TANG-74/G-1001	Pipe Dredge	NZOI

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
MEYLMA7801	21.886°S	160.902°W	4817	TANG-74/G-996B	Peterson Grab	NZOI
MEYLMA7801	22.535°S	160.117°W	4817	TANG-74/G-1002	Pipe Dredge	NZOI
MEYLMA7801	22.934°S	162.069°W	4848	TANG-74/G-994	Pipe Dredge	NZOI
MEYLMA7801	23.534°S	162.900°W	4993	TANG-74/G-993E	Free-fall Grab	NZOI
MEYLMA7801	27.650°S	160.003°W	4982	TANG-74/G-1007	Pipe Dredge	NZOI
MIZUAA7501	10.052B	165.319°W	1340	GH74-5/111	Dredge	GEOL-SURV-JAP
MIZUAA7501	8.3350°N	164.385°W	1660	GH74-5/113	Dredge	GEOL-SURV-JAP
MIZUAA8101	10.555°N	168.003°W	1609	GH79-1/D315	Dredge	GEOL-SURV-JAP
MIZUAA8101	12.999°N	177.000°W	3957	GH79-1/GB916A	Box Core	GEOL-SURV-JAP
MIZUAA8201	1.5125°S	165.881°W	5537	GH80-1/P171	Piston Core	GEOL SURV JAP
MIZUAA8201	13.788°S	159.474°W	5147	GH80-1/FG219-2	Free-fall Grab	GEOL SURV JAP
MIZUAA8201	13.794°S	159.476°W	5162	GH80-1/B15	Box Core	GEOL SURV JAP
MIZUAA8201	16.169°N	179.339°W	5291	GH80-1/FG251-2	Free-fall Grab	GEOL SURV JAP
MOORWS7601	2.6853°N	95.235°W		D6	Dredge	U.S. NAV.OC.O
MOORWS7601	2.9525°N	95.167°W		D-9	Dredge	U.S. NAV.OC.O
MOORWS8101	11.117°N	140.083°W	4722	MN7601/20-2	Box Core	UNIV. SO. CAR
MOORWS8401	11.000°N	140.000°W		MK79-05/91	Box Core	UNIV S CAROLI
MORITA8105	12.985°N	179.983°E	5053	GH78-1/G622	Box Core	GEOL-SURV-JAP
MORITA8105	12.986°N	179.986°E	4762	GH78-1/FG91-2	Free-fall Grab	GEOL-SURV-JAP
NOAKLC7501	45.184°S	145.052°E	3969	UNKNOWN/ELTAN08		AUS BUR MIN R
NOAKLC7501	51.969°S	119.619°E	3905	UNKNOWN/ELTAN13		AUS BUR MIN R
NOAKLC7501	52.069°S	135.100°E	3367	UNKNOWN/ELTAN14		AUS BUR MIN R
NOAKLC7501	53.017°S	150.000°E	3878	UNKNOWN/ELTAN15		AUS BUR MIN R
NOAKLC7501	53.500°S	163.517°E	2689	UNKNOWN/ELTAN16		AUS BUR MIN R
NOHAMA7601	20.383°S	148.017°W	4618	HAKUHO M/15		GEOL SURV JAP
NOHAMA7601	23.817°N	148.767°E	1250	HAKUHO M/13		GEOL SURV JAP
NOHAMA7601	28.083°N	131.633°E	1260	HAKUHO M/17		GEOL SURV JAP
NOHAMA7601	36.067°N	143.533°E	3350	HAKUHO M/11		GEOL SURV JAP
NOHAMA7601	37.117°N	145.300°E	2630	HAKUHO M/12		GEOL SURV JAP
NOHAMA7601	37.117°N	162.650°E	2920	HAKUHO M/07		GEOL SURV JAP
NOHAMA7601	38.000°S	169.967°W	5070	HAKUHO M/08		GEOL SURV JAP
NOHAMA7601	38.983°N	146.000°E	3450	HAKUHO M/10		GEOL SURV JAP
NOHAMA7601	44.500°N	170.417°E	1290	HAKUHO M/06		GEOL SURV JAP
NOHAMA7601	44.550°N	170.283°E	1232	HAKUHO M/05		GEOL SURV JAP
NOHAMA7601	44.617°N	170.300°E	1365	HAKUHO M/04		GEOL SURV JAP
NOHAMA7601	44.617°N	170.333°E	1385	HAKUHO M/03		GEOL SURV JAP
RONAPA8403	26.134°N	26.768°W	2896	ALVIN/1244-1	Manipulator	
RONAPA8403	26.134°N	44.769°W	2951	ALVIN/1247-2	Manipulator	
RONAPA8403	26.134°N	44.769°W	2958	ALVIN/1247-1	Manipulator	
RONAPA8403	28.134°N	44.769°W	2944	ALVIN/1243-1	Manipulator	

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
ROONGS8001	11.017°N	147.635°W	5308	VA-04/109	Dredge	GERMANY
SCOTMR7401	26.117°N	25.350°W		148-2B	Dredge	NOAA
SCOTMR7401	26.133°N	44.750°W		253-13	Dredge	NOAA
SCOTMR7401	26.269°N	45.101°W		255-19	Dredge	NOAA
SCOTMR7401	26.553°N	44.500°W		254-15	Dredge	NOAA
SCOTMR7401	30.133°N	42.483°W		160-10G	Dredge	NOAA
SIEGMD8101	10.950°N	140.163°W	4223	MN 75-03/019-1	Free-fall Grab	HAWAII INST G
SKORNS7501	22.733°S	160.817°W	3180	6298-9		USSR
SKORNS7501	22.733°S	160.817°W	4530	6298-13		USSR
SKORNS7501	22.733°S	160.817°W	4530	6298-53		USSR
STOFPA8101	21.983°S	161.900°W	447	SONNE-06/215KG	Spade Core	UNIV-HEIDELBE
SUESEA7701	54.767°N	10.083°E	25	UNKNOWN		FED.REP.GERMA
TAKENA7901	17.269°N	176.301°W	4400	06-N4		INTPCHEMRES-J
TAKENA7901	44.500°N	170.417°E	1280	01-K1		INTPCHEMRES-J
TAKENA7901	50.101°N	123.785°W	350	12		INTPCHEMRES-J
TAKENA7901	50.101°N	123.785°W	350	13		INTPCHEMRES-J
THIJAA8101	10.149°S	134.000°W	4453	SO-06/137-DK	Free-fall Grab	U.ANTWERP-BEL
THIJAA8101	21.300°S	162.951°W	4944	SO-06/226-GB	Free-fall Grab	U.ANTWERP-BEL
UCHITA7601	44.617°N	170.300°E	1365	KH-63-3/9-7	Chainbag Dredge	UNIV TOKYO
VANDCH7602	16.483°S	145.550°W	1270	SEVERAL/01		UNIV UTRECHT
VANDCH7602	38.067°N	60.217°W	3200	SEVERAL/04		UNIV UTRECHT
VoNSUA7801	12.910°S	119.882°E	2100	VA 77/KD13-1	Dredge	BUN GEo & RoH
VoNSUA8401	9.300°N	146.050°W	4830	VA-13/2/237KD		BGR
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D41	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D42-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D42-1-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D42F	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D43B	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D46-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D46-1-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D48-1-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D48A	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D49A	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D4B1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D53	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D53-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D53-1-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D53B	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7-1-1	Chainbag Dredge	PETRoBRAS

A9 - STATION DATA FOR SAMPLES COLLECTED FROM NGDC ARCHIVES (abbreviations in columns follow NGDC format).

MMBIB #	Latitude	Longitude	Depth (m)	Sample	Sampling Device	Inst.
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7B1-1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7B1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7C	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7CPL2	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7CPL1	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	34.000°W		CHAIN115/D7D	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	37.000°W	260	CHAIN115/P81	Chainbag Dredge	PETRoBRAS
XAVIAA8201	8.000°S	37.000°W	260	CHAIN115/P90A	Chainbag Dredge	PETRoBRAS

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
31.000	-77.525	930	GOS-74/2342/W-210096	116058	Chainbag Dredge and Small Pipe	WHOI	Mud-and-Mn nodules
31.253	-78.983	546	GOS-74/2387B/W-210097	116059	Chainbag Dredge and Small pipe	WHOI	Mn slabs 4-5cm thick
31.213	-78.483	648	GOS-74/2390/W-210098	116060	Chainbag Dredge and Small Pipe	WHOI	Mn slabs
31.483	-78.000	649	GOS-74/2392/W-210099	116061	Pipe Dredge	WHOI	Mn plates, nodules, glob sand
31.647	-77.780	610	GOS-74/2393B/W-210100	116062	Pipe Dredge	WHOI	Med-coarse glob sand-platy nodules
31.680	-78.800	543	GOS-74/2481/W-210101	116063	Pipe Dredge	WHOI	Large Mn(phosphate) slab-few coral fragments
31.908	-77.413	775	GOS-74/2339/W-210104	116064	Chainbag Dredge and Small pipe	WHOI	Coral and Mn nodules
31.253	-78.983	546	GOS-74/2387/W-210107	116065	Chainbag Dredge and Small pipe	WHOI	Mn slabs 4-5cm thick
31.383	-78.667	512	GOS-74/2389/W-210109	116066	Chainbag Dredge and Small pipe	WHOI	Mn-p2o5 plates
31.647	-77.780	610	GOS-74/2393/W-210110	116067	Pipe Dredge	WHOI	Med-coarse glob sand-platy nodules
31.133	-79.125	649	GOS-74/2478/W-210113	116068	Chainbag Dredge and Small Pipe	WHOI	Calc glob with small nodules and platy Mn slabs
18.635	-158.320	2760	MW-85-13/STN7/RD01-4	052024	Dredge	HIG	Ferromanganese crust
			MW-85-13/STN7/RD01-11	052025			
18.792	-158.229	2013	MW-85-13/STN12/RD02-1	052026	Dredge	HIG	Ferromanganese crust
			MW-85-13/STN12/RD02-4	052027			
			MW-85-13/STN12/RD02-5	052028			
			MW-85-13/STN12/RD02-8	052029			
			MW-85-13/STN12/RD02-9	052030			
			MW-85-13/STN12/RD02-10	052031			
			MW-85-13/STN12/RD02-11	052032			
			MW-85-13/STN12/RD02-12	052033			
			MW-85-13/STN12/RD02-14	052034			
			MW-85-13/STN12/RD02-18	052035			
			MW-85-13/STN12/RD02-20	052036			
			MW-85-13/STN12/RD02-22	052037			
			MW-85-13/STN12/RD02-24	052038			
			MW-85-13/STN12/RD02-26	052039			
			MW-85-13/STN12/RD02-28	052040			
			MW-85-13/STN12/RD02-29	052041			
			MW-85-13/STN12/RD02-30	052042			
			MW-85-13/STN12/RD02-31	052043			
			MW-85-13/STN12/RD02-32	052044			
			MW-85-13/STN12/RD02-34	052045			
			MW-85-13/STN12/RD02-35B	052046			
18.724	-158.312	1350	MW-85-13/RD06-7	052047	Dredge	HIG	Ferromanganese crust
			MW-85-13/RD06-11	052048			
			MW-85-13/RD06-12	052049			
			MW-85-13/RD06-16	052050			
			MW-85-13/RD06-17	052051			
			MW-85-13/RD06-18	052052			
			MW-85-13/RD06-21	052053			
			MW-85-13/RD06-23	052054			
			MW-85-13/RD06-25	052055			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
18.752	-158.330	2100	MW-85-13/STN 35/RD09-1	052056	Dredge	HIG	Ferromanganese crust
			MW-85-13/STN 35/RD09-2	052057			
			MW-85-13/STN 35/RD09-3	052058			
			MW-85-13/STN 35/RD09-4	052059			
			MW-85-13/STN 35/RD09-5	052060			
			MW-85-13/STN 35/RD09-6	052061			
			MW-85-13/STN 35/RD09-7	052062			
			MW-85-13/STN 35/RD09-8	052063			
			MW-85-13/STN 35/RD09-9	052064			
			MW-85-13/STN 35/RD09-11	052065			
			MW-85-13/STN 35/RD09-12	052066			
			MW-85-13/STN 35/RD09-13	052067			
			MW-85-13/STN 35/RD09-14	052068			
			MW-85-13/STN 35/RD09-15	052069			
			MW-85-13/STN 35/RD09-16	052070			
			MW-85-13/STN 35/RD09-17	052071			
			MW-85-13/STN 35/RD09-19	052072			
			MW-85-13/STN 35/RD09-20	052073			
			MW-85-13/STN 35/RD09-21	052074			
			MW-85-13/STN 35/RD09-22	052075			
			MW-85-13/STN 35/RD09-23	052076			
			MW-85-13/STN 35/RD09-24	052077			
			MW-85-13/STN 35/RD09-25	052078			
			MW-85-13/STN 35/RD09-26	052079			
			MW-85-13/STN 35/RD09-27	052080			
			MW-85-13/STN 35/RD09-28	052081			
			MW-85-13/STN 35/RD09-29	052082			
			MW-85-13/STN 35/RD09-30	052083			
			MW-85-13/STN 35/RD09-31	052084			
			MW-85-13/STN 35/RD09-32	052085			
			MW-85-13/STN 35/RD09-33	052086			
			MW-85-13/STN 35/RD09-34	052087			
12.050	165.000	2090	MIDPAC-43B	053164	Dredge	REF	
-16.483	-145.550	1270	DWHD-16	350006	Pipe Dredge	REF	
-13.883	-150.583	3695	MERO-2P-50	351017	Dredge	REF	

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
-22.583	-150.800	807	AMPH-9D	387002	Chainbag Dredge	REF	
6.6583	-92.8416	3450	PLUTO 11/PL11-2/MP9842	010012	Dredge	MANOP-SITE H	Crusts
			PLUTO 11 /PL11-4/MP9843	010013			
			PLUTO 11 /PL11-5/MP9844	010014			
-14.137	-171.1200	3100	WS-79(1)-10	353007	Freefall Grab		Ferromanganese encrusted volcanic rock
-22.7664	-175.8040	800-850	Tongan RV Lee 82/ 1-2	389002	Dredge	USGS-MENLO	Ferromanganese crusts on sandstone substrate
-22.7681	-175.6285	700-850	Tongan RV Lee 82/ 3-9	389003	Dredge	USGS-MENLO	Ferromanganese crusts on sandstone substrate
-23.025	-175.9572	650-800	Tongan RV Lee 82/ 5-10	389004	Dredge	USGS-MENLO	Ferromanganese crusts on sandstone substrate
-21.8495	-175.0769	750-600	Tongan RV Lee 82/ 8-5	389005	Dredge	USGS-MENLO	Ferromanganese crusts on sandstone substrate
-7.4506	179.0240	1230	MW86-02/4MD-001/S01	318001	Dredge	HIG	Crusts signified by Vernadite/Carbonate-fluoroapatite mineralogy
			MW86-02/4MD-001/S02	318002			
-7.4078	179.0460	1690	MW86-02/4RD-007/01	318003	Rock dredge	HIG	Crusts signified by Vernadite/Carbonate-fluoroapatite mineralogy
			MW86-02/4RD-007/02	318004			
			MW86-02/4RD-007/03	318005			
			MW86-02/4RD-007/04	318006			
			MW86-02/4RD-007/05	318007			
			MW86-02/4RD-007/07	318008			
			MW86-02/4RD-007/09	318009			
			MW86-02/4RD-007/09	318010			
			MW86-02/4RD-007/11	318011			
			MW86-02/4RD-007/12	318012			
			MW86-02/4RD-007/13	318013			
			MW86-02/4RD-007/14	318014			
			MW86-02/4RD-007/15	318015			
			MW86-02/4RD-007/16	318016			
			MW86-02/4RD-007/17	318017			
			MW86-02/4RD-007/18	318018			
-3.8371	-173.3290	2265	MW86-02/6RD-008/01	317015	Rock dredge	HIG	Crusts signified by Vernadite/Carbonate-fluoroapatite mineralogy
			MW86-02/6RD-008/02	317016			
			MW86-02/6RD-008/03	317017			
			MW86-02/6RD-008/04	317018			
			MW86-02/6RD-008/05	317019			
			MW86-02/6RD-008/06	317020			
			MW86-02/6RD-008/08	317021			
			MW86-02/6RD-008/S8	317022			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
-3.8043	-173.4901	4800	MW86-02/6RD-009/01A	317023	Rock dredge	HIG	Crusts signified by Vernedite w/trace of Carbonate-fluoroapatite and smectite mineralogy
			MW86-02/6RD-009/1AF	317024			
			MW86-02/6RD-009/02	317025			
			MW86-02/6RD-009/03	317026			
			MW86-02/6RD-009/04	317027			
			MW86-02/6RD-009/05	317028			
			MW86-02/6RD-009/06	317029			
-2.9920	-171.3803	1465	MW86-02/7RD-011/X	317030	Rock dredge	HIG	Crusts signified by Vernadite w/trace of Carbonate-fluoroapatite and smectite mineralogy; one sample 03 has todorokite as major mineral phase
			MW86-02/7RD-011/01	317031			
			MW86-02/7RD-011/02	317032			
			MW86-02/7RD-011/03	317033			
			MW86-02/7RD-011/04	317034			
			MW86-02/7RD-011/05	317035			
			MW86-02/7RD-011/06	317036			
			MW86-02/7RD-011/07	317037			
			MW86-02/7RD-011/08	317038			
			MW86-02/7RD-011/10	317039			
			MW86-02/7RD-011/11	317040			
			MW86-02/7RD-011/12	317041			
			MW86-02/7RD-011/13	317042			
			MW86-02/7RD-011/14	317043			
			MW86-02/7RD-011/15	317044			
-3.0160	-171.4463	3130	MW86-02/7RD-012/1A	317045	Rock dredge	HIG	Crusts signified by Vernadite
			MW86-02/7RD-012/1B	317046			
25.926	-167.710	3250	KK84-04-28-05/67/RD39-(2)	089101	Rock dredge	HIG	Large altered very vesicular basalt fragments with Mn crust ~2cm, two tuffaceous and volcanic fragments with Mn crust .5-1cm, fresh basalt stained or coated with little Mn
25.929	-167.755	2500	KK84-04-28-05/67/RD40-(1)	089102	Rock dredge	HIG	Basalt fragments with Mn crust from .5 to 3cm thick, some uncoated or stained samples also
			KK84-04-28-05/67/RD40-(2)	089103			
25.783	-167.733	1600	KK84 04-28-05/69/PD10-(3)	089104	Pipe dredge	HIG	3 ls fragments with Mn stain, 2 basalt specimens with botryoidal crust
25.489	-168.672	1200	KK84-04-28-05/71/PD11-(2)	089105	Pipe dredge	HIG	Botryoidal crust fragments 2cm thick fragments on 1cm substrate
			KK84-04-28-05/71/PD11-(7)	089106			
28.9041	-178.9566	1500	KK84-04-28-05/59/RD29-(1)	090050	Rock dredge	HIG	Fairly fresh basalt with thin coating of Mn crust
			KK84-04-28-05/59/RD29-(2)	090051			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
28.895	-178.868	1280	KK84-04-28-05/59/RD30-(7)	090052	Rock dredge	HIG	Mn encrusted basalt;fragments altered basalts
			KK84-04-28-05/59/RD30-(8)	090053			
			KK84-04-28-05/59/RD30-(12)	090054			
			KK84-04-28-05/59/RD30-(15)	090055			
28.739	-178.783	3000	KK84-04-28-05/60/RD33-(2)	090056	Rock dredge	HIG	4 basalt fragments coral/ls stained with iron oxide with Mn deposits on top
29.106	-173.948	1850	KK84 04-28-05/61/RD34-(5)	090057	Rock dredge	HIG	Fresh basalt-volcanoclastics and altered basalt with Mn crust up to 3cm thick
			KK84 04-28-05/61/RD34-(6)	090058			
29.167	-174.067	1425	KK84-04-28-05/62/PD6-(5)	090059	Pipe dredge	HIG	Mn crust fragments with up to 4.5cm thick-basalts and volcanoclastics with 0-3cm crust
			KK84-04-28-05/62/PD6-(6)	090060			
			KK84 04-28-05/62/PD6-(7)	090061			
			KK84 04-28-05/62/PD6-(9)	090062			
			KK84 04-28-05/62/PD6-(10)	090063			
			KK84 04-28-05/62/PD6-(11)	090064			
			KK84-04-28-05/62/PD6-(12)	090065			
29.208	-174.112	2200	KK84-04-28-05/62/RD35-(10)	090066	Rock dredge	HIG	Large slab of altered basalt with 2-3cm crust small fragments with up to 3cm
			KK84-04-28-05/62/RD35-(11)	090067			
29.185	-174.010	985	KK84 04-28-05/63/PD7-(1)	090068	Pipe dredge	HIG	Basalt fragments,one piece of volcaniclastic material-one Mn coated rnd cobble
			KK84 04-28-05/63/PD7-(3)	090069			
29.866	179.083	2250	KK84-04-28-05/55/RD23-(4)	091024	Rock dredge	HIG	Basalt fragments with 8-30mm crust, volcaniclastic(yellow beach rock) with up to 30mm crust
29.839	179.065	2100	KK84-04-28-05/55/RD24-(4)	091025	Rock dredge	HIG	Lg altered volcaniclastic slab with 1-2cm crust-sm fragments of altered basalt
29.820	179.103	1700	KK84-04-28-05/56/RD25-(7)	091026	Rock dredge	HIG	Several lg slabs on volcaniclastic substrate
29.643	179.282	1300	KK84-04-28-05/57/RD28-(5)	091027	Rock dredge	HIG	Large cobbles and pillow basalt fragments w/ Mn crust
9.08100	-164.727	4301	MIDPAC1-SO18/DK 30/30-B	017105	*See descriptions for MIDPAC1-SO18 in beginning of Appendix A - North Pacific Area A2.		
			MIDPAC1-SO18/DK 30/30-H	017106			
			MIDPAC1-SO18/DK 30/30-I	017107			
			MIDPAC1-SO18/DK 30/30-K	017108			
			MIDPAC1-SO18/DK 30/30-L	017109			
			MIDPAC1-SO18/DK 30/30-M	017110			
			MIDPAC1-SO18/DK 30/30-N	017111			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
9.14800	-164.808	2600	MIDPAC1-SO18/DK 31/31-E1	017112	*See descriptions for MIDPAC1-SO18 in beginning of Appendix A - North Pacific Area A2.		
			MIDPAC1-SO18/DK 31/31-E2	017113			
			MIDPAC1-SO18/DK 31/31-F	017114			
			MIDPAC1-SO18/DK 31/31-G	017115			
			MIDPAC1-SO18/DK 31/31-H	017116			
			MIDPAC1-SO18/DK 31/31-I	017117			
			MIDPAC1-SO18/DK 31/31-K	017118			
			MIDPAC1-SO18/DK 31/31-L	017119			
			MIDPAC1-SO18/DK 31/31-M	017120			
			MIDPAC1-SO18/DK 31/31-N	017121			
			MIDPAC1-SO18/DK 31/31-O	017122			
9.14200	-164.784	2465	MIDPAC1-SO18/DK 32/32-B	017123			
			MIDPAC1-SO18/DK 32/32-D	017124			
13.001	-164.968	3040	MIDPAC1-SO18/DK-43/43-A	053141			
			MIDPAC1-SO18/DK-43/43-B1	053142			
			MIDPAC1-SO18/DK-43/43-B2	053143			
			MIDPAC1-SO18/DK-43/43-C	053144			
			MIDPAC1-SO18/DK-43/43-D	053145			
			MIDPAC1-SO18/DK-43/43-E	053146			
			MIDPAC1-SO18/DK-43/43-F	053147			
12.987	-164.958	2055	MIDPAC1-SO18/DK 44/44-A	053148			
			MIDPAC1-SO18/DK 44/44-B	053149			
			MIDPAC1-SO18/DK 44/44-E	053150			
			MIDPAC1-SO18/DK 44/44-I	053151			
13.151	-165.485	4150	MIDPAC1-SO18/DK 57/57-A	053152			
			MIDPAC1-SO18/DK 57/57-C	053153			
			MIDPAC1-SO18/DK 57/57-D	053154			
13.200	-165.462	1508	MIDPAC1-SO18/DK 58/58-A1	053155			
			MIDPAC1-SO18/DK 58/58-A2	053156			
			MIDPAC1-SO18/DK 58/58-B	053157			
			MIDPAC1-SO18/DK 58/58-C	053158			
			MIDPAC1-SO18/DK 58/58-D	053159			
			MIDPAC1-SO18/DK 58/58-E1	053160			
			MIDPAC1-SO18/DK 58/58-F	053161			
			MIDPAC1-SO18/DK 58/58-G	053162			
			MIDPAC1-SO18/DK 58/58-X	053163			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
19.402	-171.173	2856	MIDPAC1-SO18/DK 73/73-A	054050	*See descriptions for MIDPAC1-SO18 in beginning of Appendix A - North Pacific Area A2.		
			MIDPAC1-SO18/DK 73/73-B	054051			
			MIDPAC1-SO18/DK 73/73-C	054052			
			MIDPAC1-SO18/DK 73/73-E	054053			
			MIDPAC1-SO18/DK 73/73-F	054054			
			MIDPAC1-SO18/DK 73/73-G	054055			
			MIDPAC1-SO18/DK 73/73-H	054056			
19.361	-171.064	2010	MIDPAC1-SO18/DK 75/75-A	054057			
			MIDPAC1-SO18/DK 75/75-B	054058			
			MIDPAC1-SO18/DK 75/75-C	054059			
			MIDPAC1-SO18/DK 75/75-D	054060			
			MIDPAC1-SO18/DK 75/75-E	054061			
			MIDPAC1-SO18/DK 75/75-G	054062			
19.373	-170.991	1190	MIDPAC1-SO18/DK 76/76-A	054063			
			MIDPAC1-SO18/DK 76/76-B	054064			
			MIDPAC1-SO18/DK 76/76-D	054065			
			MIDPAC1-SO18/DK 76/76-E	054066			
			MIDPAC1-SO18/DK 76/76-F	054067			
			MIDPAC1-SO18/DK 76/76-G	054068			
			MIDPAC1-SO18/DK 76/76-H	054069			
19.408	-171.391	1925	MIDPAC1-SO18/DK 78/78-A	054070			
			MIDPAC1-SO18/DK 78/78-B	054071			
			MIDPAC1-SO18/DK 78/78-C	054072			
			MIDPAC1-SO18/DK 78/78-D	054073			
			MIDPAC1-SO18/DK 78/78-E	054074			
			MIDPAC1-SO18/DK 78/78-F	054075			
			MIDPAC1-SO18/DK 78/78-G	054076			
			MIDPAC1-SO18/DK 78/78-H	054077			
			MIDPAC1-SO18/DK 78/78-I	054078			
			MIDPAC1-SO18/DK 78/78-L	054079			
			MIDPAC1-SO18/DK 78/78-M	054080			
			MIDPAC1-SO18/DK 78/78-N	054081			
20.078	-170.642	1332	MIDPAC1-SO18/DK 111/111-B	090070			
			MIDPAC1-SO18/DK 111/111-F	090071			
			MIDPAC1-SO18/DK 111/111-G	090072			
			MIDPAC1-SO18/DK 111/111-H1	090073			
			MIDPAC1-SO18/DK 111/111-H2	090074			
			MIDPAC1-SO18/DK 111/111-I	090075			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
20.220	-170.568	2573	MIDPAC1-SO18/DK 113/113-A	090076	*See descriptions for MIDPAC1-SO18 in beginning of Appendix A - North Pacific Area A2		
			MIDPAC1-SO18/DK 113/113-B	090077			
			MIDPAC1-SO18/DK 113/113-C	090078			
			MIDPAC1-SO18/DK 113/113-D	090079			
			MIDPAC1-SO18/DK 113/113-E	090080			
			MIDPAC1-SO18/DK 113/113-F	090081			
17.1483	145.6567	2975	TT-192-Marianas/D3/D3-3	059007	Dredge	USGS-MENLO	Fragments of hydrothermal cobbles and pebbles;black granular and pourous to submetallic w/ encrusting forams;red-orange brown mud
19.1495	145.4983	2880	TT-192-Marianas/D8/D8-5	058009	Dredge	USGS-MENLO	50% of dredge FeMn crusts on volcaniclastic sandstone w/ coarse granular to porous texture;botryoidal crusts on volcanic breccia
			TT-192-Marianas/D8/D8-12	058010			
			TT-192-Marianas/D8/D8-20	058011			
17.9363	145.5033	1940	TT-192-Marianas/D6/D6-1	058008	Dredge	USGS-MENLO	15% of rocks w/ crust 1mm thick(avg=.6mm)dominant substrate and site
19.4550	145.4906	1380	TT-192-Marianas/D-11/D-11-1A	058012	Dredge	USGS-MENLO	30% of rocks w/ <1mm thick patina
20.0253	145.2228	172	TT-192-Marianas/D12/D12-2	094023	Dredge	USGS-MENLO	Thin crusts (<2mm) on volcanic rocks and patina on coral
20.1120	145.0460	1650	TT-192-Marianas/D13/D13-1-A	094024	Dredge	USGS-MENLO	Cement for Sandstone slabs <5mm thick
20.3960	144.9771	1930	TT-192-Marianas/D15/D15-1-A	094025	Dredge	USGS-MENLO	Patina on volcanic breccia; 1 breccia cemmented w/ oxide; breccia with 8 mm crust on topand 1-4mm massive metallic layer on bottom
20.6118	144.6528	1640	TT-192-Marianas/D20/D20-1-A	094026	Dredge	USGS-MENLO	10% of dredge is volcanoclastic rocks w/ crusts up to 8mm. Thick"submettalic slabs some breccias and sandstones impregnated with oxides."
20.6481	144.4493	2200	TT-192-Marianas/D21/D21-1-A	094062	Dredge	USGS-MENLO	Seven pieces of pumice with crusts to 24mm (avg 13mm) thick;black patina on (<2mm) on volcanic rocks
21.0515	143.8321	2290	TT-192-Marianas/D27B/D27-1-A	094027	Dredge	USGS-MENLO	"Crust 6-16mm (avg 12mm) thick botryoidal"
21.1411	143.9041	1715	TT-192-Marianas/D-28/D28-3-A	094028	Dredge	USGS-MENLO	All rocks have patina with up to 2mm thick;1% have crusts to 19mm (avg 10mm)
			TT-192-Marianas/D-28/D28-4-A	094029			
			TT-192-Marianas/D-28/D28-6-A	094030			
			TT-192-Marianas/D-28/D28-7-A	094031			

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
21.7645	143.7196	1170	TT-192-Marianas/D33/D33-2-3-A	094032	Dredge	USGS-MENLO	95% rocks w/ patina;10% of rocks are volcanic breccia with clasts altered to orange-browniron oxides cemented and veined w/ submetallic oxides
22.0816	143.4000	1950	TT-192-Marianas/D36/D36-2-A(B) TT-192-Marianas/D36/D36-4	094033 094034	Dredge	USGS-MENLO	Crusts on volcanic breccia with clay matrix 5%; rare crusts to 30mm thick on volcanic rocks; encrusting forams and worm bes
22.2928	143.2256	1572	TT-192-Marianas/D37/D37-1 TT-192-Marianas/D37/D37-4 TT-192-Marianas/D37/D37-5	094035 094036 094037	Dredge	USGS-MENLO	Crusts to 37mm (avg 22mm) on volcanic breccia and andesite; botryoidal texture - encrusting forams
22.4616	142.9991	1230	TT-192-Marianas/D41/D41-2B-A	094038	Dredge	USGS-MENLO	Patina on most rocks- cement for breccia and pebble conglomerates; clasts coated and cemented by oxides;cobbles and pebbles dense
22.8295	142.5851	2450	TT-192-Marianas/D42/D42-1	094039	Dredge	USGS-MENLO	Patina on most rocks; some crusts to 20mm thick- interclasted with siltstone
22.9223	142.5261	2000	TT-192-Marianas/D44/D44-1	094040	Dredge	USGS-MENLO	Cement for breccia and sandstone ;massive-dense-submetallic cobbles and pebbles
23.5866	141.8250	1400	TT-192-Marianas/D51/D51-1	094041	Dredge	USGS-MENLO	Cement for breccia and layers of submetallic manganese in breccia
23.6176	141.8188	1105	TT-192-Marianas/D52/D52-4-ABC TT-192-Marianas/D52/D52-5 TT-192-Marianas/D52/D52-9	094042 094043 094044	Dredge	USGS-MENLO	60 KG of cobbles and pebbles-metallic and submatallic-porous to dense alternating layers; layers commonly deformed-rare layers w/ glassy luster
23.8166	141.7266	1640	TT-192-Marianas/D54/D54-2	094045	Dredge	USGS-MENLO	Cement for Sandstone; submetallic dense and massive layers; rare layers of resinous-brown manganese
24.0283	141.5883	1780	TT-192-Marianas/D55/D55-3 TT-192-Marianas/D55/D55-4	094046 094047	Dredge	USGS-MENLO	8 Kg cobbles and pebbles; cement for sandstone and breccia; cobbles laminated to massive and submetallic; crusts on basaltic tuff
24.0750	141.5533	1500	TT-192-Marianas/D56/D56-1-B TT-192-Marianas/D56/D56-2	094048 094049	Dredge	USGS-MENLO	Crusts up to 30mm ;cobbles with porous black oxide and dense-massive brownish-grey submetallic oxide;cement in breccia;mudstone w oxide - bioturbation
24.0433	141.6700	1730	TT-192-Marianas/D57/D57-2 TT-192-Marianas/D57/D57-4	094050 094051	Dredge	USGS-MENLO	Crust on volcanoclastic sandstone;patina on basalt-cement for and veins in sandstone

A10 STATION DATA FOR SAMPLES ADDED TO DATABASE AFTER JANUARY 1988.

Latitude	Longitude	Depth Interval (m)	Sample	Sequence Number	Sampling Device	Inst.	Description
23.1933	141.3950	1080	TT-192-Marianas/D58/D58-3	094052	Dredge	USGS-MENLO	Crusts on siltstone and volcanic rock;crust on one piece of limestone;crusts to 50mm (avg 25mm); frags;laminated botryoidal texture not smooth
			TT-192-Marianas/D58/D58-4	094053			
			TT-192-Marianas/D58/D58-7	094054			
			TT-192-Marianas/D58/D58-11	094055			
23.0950	141.3883	1470	TT-192-Marianas/D59/D59-4	094056	Dredge	USGS-MENLO	Crusts on silstone 6 to 48 mm thick (avg 30mm) botryoidal; encrusting forams.
22.4466	141.9283	1660	TT-192-Marianas/D71/D71-1	094057	Dredge	USGS-MENLO	Crusts on all rock types to 45mm thick (avg 30mm) layered with iron oxides laced throughout.
			TT-192-Marianas/D71/D71-2	094058			
			TT-192-Marianas/D71/D71-4	094059			
25.1216	141.2733	1620	TT-192-Marianas/D73/D73-1A	094060	Dredge	USGS-MENLO	See Open-file report #87-281
			TT-192-Marianas/D73/D73-1F	094061			
			TT-192-Marianas/D73/D73-2	094063			
-09.9966	-161.0333	1843	TUI-NZOI/U314	316004	Rock Dredge	NZOI-GLASBY	1 Large rock covered with Mn crust
-19.9200	-157.655	1744	TUI-NZOI/U367	351016	Rock Dredge	NZOI-GLASBY	Subangular basaltic boulder with Mn coating (up to 6mm)
-12.7516	-160.7133	4469	TUI-NZOI/U299b	352001	Rock Dredge	NZOI-GLASBY	5 fragments of Mn crust
-10.0333	-161.15	1863	TUI-NZOI/U315	352002	Rock Dredge	NZOI-GLASBY	Up to 15mm thick Mn crusts as well as indurated limestone
-10.0966	-161.09		TUI-NZOI/U316b	352003	Rock Dredge	NZOI-GLASBY	coarse foram ooze and volcaniclastic basalt pebbles and Mn crust fragments
-11.1383	-165.5666	1913	TUI-NZOI/U333b	352004	Rock Dredge	NZOI-GLASBY	Coral (some Mn stained), Mn encrusted volcanic rock, biological material and foram ooze
-11.5550	-165.445	1297	TUI-NZOI/U336b	352005	Rock Dredge	NZOI-GLASBY	Mn crusts and coarse foram ooze
-19.2250	-169.9133	2520	TUI-NZOI/U358	352006	Rock Dredge	NZOI-GLASBY	Coralline LS with Mn crust (3mm)
-21.3033	-159.7383	1272	TUI-NZOI/U375	387001	Rock Dredge	NZOI-GLASBY	Basalt fragments, Mn crust up to 65mm thick, biological material
17.000	170.500	4090		055012		USSR	1-3mm cruts on basalts and siliceous rocks

APPENDIX B

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
7.433	-151.783	-	AMIGO-58	3400135	Dredge	-	-	-	A213	-	-	-
8.718	-150.235	4978	80C75-50-32	3400233	Box core	-	-	-	A337	20-50	Box core	10.5
8.695	-150.312	5009	80C75-50-28	3400236	Box core	-	-	-	A337	>50	Box Core	11.4
9.333	-150.807	4839	80C75-46-9	3400241	Box core	-	-	-	A337	20-50	Box Core	6.2
7.970	-152.287	5189	MULLER-40111	3400265	-	-	-	-	A351	-	-	-
5.872	-160.848	1604	7TOW123D	3410013	Chainbag dredge	-	-	SIO	A119	-	-	-
5.232	-161.497	1307	7TOW122D	3410021	Chainbag dredge	-	-	SIO	A119	-	-	-
8.330	-164.362	1519	7TOW130D	3410170	Rock dredge	-	-	SIO	A119	-	-	-
8.340	-164.390	1640	GH745D52	3410186	Chainbag dredge	-	Calcareous ooze	-	A280	-	-	-
9.817	-170.983	4875	LSDH-93PG	3420007	Trip core	69.	Calcareous ooze	SIO	M025	-	-	-
7.067	-171.700	5386	PROA-137G	3420015	Grab	-	-	SIO	M002	-	-	-
7.317	-175.467	5190	LSDH-90P	3420039	Piston core	546.	Calcareous clay	SIO	M025	-	-	-
.900	-179.333	3091	V-28-8	3420100	Rock dredge	-	-	LDGO	A266	-	-	-
5.002	-173.012	5280	GH761-G193	3420113	Grab	-	Siliceous clay	-	A361	-	Grab	10.7
8.317	176.417	5097	VEMA24#102	3430021	Piston core	1168.	Mn pavement	LDGO	A101	20-50	Photo	-
13.167	-147.750	5610	VEMA21-192	3750069	Piston core	133.	Pelagic clay	LDGO	A110	-	-	-
11.100	-147.500	-	VA05-1-26	3750156	-	-	-	-	A332	>50	Photo	-
11.513	-148.578	5125	SS72-90DB	3750358	Bucket dredge	-	-	SIO	A386	-	-	-
14.317	-152.617	5490	CHAL-STA264	3760027	Gravity core	-	Siliceous ooze	-	A012	-	-	-
11.850	-152.950	5221	WAH--B2P	3760034	Piston core	348.	Siliceous clay	SIO	A033	-	-	-
15.817	-157.067	5118	STYX-24G	3760118	Gravity core	-	-	SIO	A145	-	-	-
19.100	-158.233	3131	DODO6-D	3760145	Dredge	-	-	SIO	A347	-	-	-
18.350	-158.450	1317	DODO-8-D	3760147	Dredge	-	-	SIO	A347	-	-	-
10.938	-153.303	4800	VIT.5996-24	3760208	Core	-	-	USSR	A343	-	-	-
18.717	-158.283	475	DODO-7-D	3760223	Dredge	-	-	SIO	A347	-	-	-
16.100	-161.750	2400	TET-22	3770020	Gravity core	-	-	SIO	A005	-	-	-
18.783	-162.050	3148	DODO-13D	3770022	Trawl dredge	-	-	SIO	A347	-	-	-
19.383	-162.167	4160	DODO-15D	3770025	Dredge	-	-	SIO	A347	-	-	-
19.367	-162.317	4868	DODO-14D	3770026	Dredge	-	-	SIO	A347	-	-	-
10.500	-165.550	4341	PROA-147G	3770055	Gravity core	89.	Calcareous ooze	SIO	M002	-	-	-
12.070	-165.838	1488	7TOW133D	3770056	Chainbag dredge	-	-	SIO	A119	-	-	-
15.600	-166.667	5440	PROA-169G	3770061	Grab	-	-	SIO	M002	-	-	-
14.933	-167.567	4315	PROA-168G	3770073	Gravity core	118.	-	SIO	M002	-	-	-
19.117	-169.733	1740	MIDPAC-25F-1	3770101	Chainbag dredge	-	-	SIO	M038	-	-	-
19.117	-169.733	1740	MIDPAC-25F2	3770103	Chainbag dredge	-	-	SIO	M038	-	-	-
10.063	-165.330	1330	GH745D50	3770121	Chainbag dredge	-	Calcareous ooze	-	A280	-	-	-
10.362	-166.983	2865	GH745D55	3770123	Chainbag dredge	-	Calcareous ooze	-	A280	-	-	-
18.300	-161.767	3060	DODO-9-D	3770138	Dredge	-	-	SIO	A347	-	-	-
19.978	-166.083	4938	SS72-44DB	3770145	Bucket dredge	-	-	-	A386	-	-	-
19.512	-168.875	1805	7TOW-143D	3770153	Rock dredge	-	-	SIO	A119	-	-	-
10.383	-170.950	4469	PROA-156G	3780004	Gravity core	128.	Calcareous ooze	SIO	M002	-	-	-
19.417	-171.000	1409	MIDPAC-26A3	3780005	Chainbag dredge	-	-	SIO	M038	-	-	-
12.267	-172.800	2708	PROA-161G	3780020	Gravity core	-	-	SIO	M002	-	-	-
12.517	-172.850	5464	PROA-162G	3780022	Gravity core	110.	Pelagic clay	SIO	M002	-	-	-
18.333	-173.383	3861	MIDPAC32	3780028	Gravity core	76.	-	SIO	M038	-	-	-
15.713	-174.050	5670	VITYAZ3787	3780032	Trawl dredge	-	-	USSR	N729	-	-	-
17.900	-174.267	1749	MIDPAC-33D	3780035	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
17.800	-174.367	2288	MIDPAC-33K	3780046	Chainbag dredge	-	-	SIO	M038	-	-	-
17.167	-177.167	2050	MIDPAC-37C	3780068	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
17.067	-177.250	2013	MIDPAC-37A	3780070	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
19.243	-179.668	2870	ARIES-7D	3780084	Dredge	-	-	SIO	A167	-	-	-

MARSHALL ISLANDS B-1

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
7.455	136.407	3555	INDP-4D	3470359	Chainbag dredge	-	-	SIO	A340	-	-	-
18.617	171.977	2440	VIT.6358	3790045	Trawl dredge	-	-	USSR	A343	-	-	-
19.047	171.148	1300	VIT.6359	3790046	Trawl dredge	-	-	USSR	A343	-	-	-
12.050	165.000	2090	MIDPAC-43	3800024	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
11.950	164.983	2105	MIDPAC-43D	3800025	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
12.050	164.950	2105	MIDPAC-43C	3800027	Dredge	-	Calcareous ooze	SIO	M038	-	-	-
12.150	164.683	1830	MIDPAC-43C	3800031	Chainbag dredge	-	-	SIO	M038	-	-	-
11.800	165.000	1620	MIDPAC-43DD	3800084	Dredge	-	-	SIO	A166	-	-	-
11.950	164.950	1330	MIDPAC-43LL	3800085	Dredge	-	-	SIO	A166	-	-	-
16.892	155.133	5775	CONRAD10-15	3810070	Piston core	1185.	Pelagic clay	LDGO	A115	-	-	-
17.445	144.565	3857	TSDY-8-14D	3820417	Rock dredge	-	-	SIO	A257	-	-	-
12.283	144.533	6125	VEMA28-10	3820533	Rock dredge	-	-	LDGO	A130	-	-	-
15.533	136.400	4184	VEMA21-119	3830052	Piston core	735.	Pelagic clay	LDGO	A110	-	-	-
18.953	135.793	3195	ANTIPO-58D	3830063	Dredge	-	-	SIO	A174	-	-	-
19.667	135.950	1717	VEMA28-12	3830210	Rock dredge	-	Calcareous ooze	LDGO	A130	-	-	-
19.667	135.950	2678	VEMA28-11	3830211	Rock dredge	-	Calcareous ooze	LDGO	A130	20-50	Photo	-
20.750	173.667	3385	ARIES-13D	4150100	Chainbag dredge	-	-	SIO	A167	-	-	-
20.752	173.440	1623	ARIES-12D	4150104	Chainbag dredge	-	-	SIO	A167	-	-	-
20.788	173.340	1278	ARIES-15D	4150106	Chainbag dredge	-	-	SIO	A167	-	-	-
21.145	163.397	1575	ARIES-19D	4160105	Chainbag dredge	-	-	SIO	A167	-	-	-
21.160	163.147	1437	ARIES-20D	4160136	Chainbag dredge	-	-	SIO	A167	-	-	-
21.688	161.875	1479	ARIES-21D	4160196	Chainbag dredge	-	-	SIO	A167	-	-	-
24.065	160.765	3951	VITYAZ4362	4160224	Grab	-	-	USSR	A148	>50%	Photo	-
25.550	168.020	2870	VIT.6011	4160231	Grab	-	-	USSR	A343	-	-	-
21.167	163.220	3047	VIT.6364	4160237	Trawl dredge	-	-	USSR	A343	-	-	-
27.853	162.928	3090	VIT.6017	4160238	Dredge	-	-	USSR	A343	-	-	-
22.333	161.527	1315	VIT.6365	4160239	Trawl dredge	-	-	USSR	A343	-	-	-
22.658	160.870	1280	VIT.6366	4160240	Dredge	-	-	USSR	A343	-	-	-
21.483	159.538	1265	ARIES-23D	4170002	Chainbag dredge	-	-	SIO	A167	-	-	-
24.027	159.450	3332	ARIES-27D	4170004	Chainbag dredge	-	-	SIO	A167	-	-	-
23.815	159.437	1711	ARIES-26D	4170005	Chainbag dredge	-	-	SIO	A167	-	-	-
29.495	153.362	1719	ARIES-29D	4170035	Chainbag dredge	-	-	SIO	A167	-	-	-
23.533	157.393	1425	VIT.6367	4170066	Dredge	-	-	USSR	A343	-	-	-
26.553	152.217	3200	VIT.6368	4170067	Dredge	-	-	USSR	A343	-	-	-
28.383	148.250	2423	ZETESIIV-5D	4180009	Chainbag dredge	-	-	SIO	A121	-	-	-
27.933	147.650	2728	ZETESIIV-8D	4180011	Pipe dredge	-	-	SIO	A121	-	-	-
20.912	142.532	2423	SCAN-35-D	4180272	Dredge	-	Calcareous ooze	SIO	A117	-	-	-
27.818	145.700	1116	SB930001	4180403	Dredge	-	-	-	A413	-	-	-
32.137	172.262	1309	ARIES-55D	4510017	Chainbag dredge	-	-	SIO	A167	-	-	-
32.018	149.273	1605	ARIES-32D	4540006	Chainbag dredge	-	-	SIO	A167	-	-	-
32.383	148.425	5751	CONRAD10-168	4540010	Piston core	1004.	Pelagic clay	LDGO	A115	-	-	-
34.010	145.945	2515	ARIES-36D	4540033	Chainbag dredge	-	-	SIO	A167	-	-	-

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8.033	-149.900	5073	JYNV-15PG	3390080	Trip core	-	Siliceous clay	SIO	M015	-	-	-
8.897	-146.492	5225	MN7401-06G20	3390102	Freefall grab	10.	Siliceous ooze	HIG	A241	-	Grab	14.4
9.293	-146.050	5000	VA13/2-44KA	3390348	Box grab	-	-	-	A446	-	-	-
7.750	-150.683	-	AMIGO-54	3400111	Box grab	-	-	-	A213	-	-	-

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Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
12.000	-175.717	5340	CM-II-18	3780089	-	-	-	-	A248	-	-	-
17.282	-176.303	4400	OKADA-K-4	3780090	-	-	-	-	A249	-	-	-
13.115	-173.988	5610	GH745G56	3780091	Grab	-	Pelagic clay	-	A280	-	Grab	5.0
19.980	-170.667	2150	VIT.6344	3780095	Trawl dredge	-	-	USSR	A343	-	-	-
18.517	-175.100	1052	VIT.6348	3780096	Trawl dredge	-	-	USSR	A343	-	-	-
18.320	-178.347	1630	VIT.6352	3780097	Trawl dredge	-	-	USSR	A343	-	-	-
19.313	176.735	1753	ARIES-10D	3790020	Chainbag dredge	-	-	SIO	A167	-	-	-
18.527	177.187	2000	VIT.6356	3790044	Trawl dredge	-	-	USSR	A343	-	-	-
28.400	-159.183	5676	VEMA21-180	4120320	Piston core	953.	Pelagic clay	LDGO	A110	-	-	-
23.017	-159.350	4856	VEMA21-D8	4120323	Dredge	-	Pelagic clay	LDGO	A130	0	Photo	-
21.617	-158.688	1680	TE-6-1	4120379	Rock dredge	-	-	HIG	A251	-	-	-
21.892	-158.767	1495	TE-7-1	4120380	Rock dredge	-	-	HIG	A251	-	-	-
21.925	-158.550	1330	TE-7-3	4120382	Rock dredge	-	-	HIG	A251	-	-	-
21.833	-158.617	1255	TE-7-4	4120383	Rock dredge	-	-	HIG	A251	-	-	-
21.718	-158.700	700	TE-8-5	4120389	Rock dredge	-	-	HIG	A251	-	-	-
21.820	-158.803	1300	TE-8-7	4120390	Rock dredge	-	-	HIG	A251	-	-	-
20.137	-156.265	1220	MN75-02-FR-5	4120453	Dredge	-	-	HIG	A380	-	-	-
21.727	-158.292	795	MW1-4	4120457	Dredge	-	-	HIG	A380	-	-	-
21.675	-158.457	920	MW1-5	4120458	Dredge	-	-	HIG	A380	-	-	-
21.692	-158.495	985	MW1-6-5	4120459	Dredge	-	-	HIG	A380	-	-	-
21.850	-158.687	1340	MW1-8	4120461	Dredge	-	-	HIG	A380	-	-	-
21.905	-158.635	1840	MW1-9	4120462	Dredge	-	-	HIG	A380	-	-	-
21.965	-158.610	1985	MW1-10	4120463	Dredge	-	-	HIG	A380	-	-	-
21.782	-158.743	1120	MW1-12	4120464	Dredge	-	-	HIG	A380	-	-	-
21.833	-158.667	1265	MN75-02-FR-1	4120466	Dredge	-	-	HIG	A380	-	-	-
21.923	-158.795	1910	MN75-02-FR-2	4120467	Dredge	-	-	HIG	A380	-	-	-
21.872	-158.823	1115	MN75-02-FR-3	4120468	Dredge	-	-	HIG	A380	-	-	-
21.847	-159.372	900	SS72-138DB	4120475	Bucket dredge	-	Calc. material	-	A386	-	-	-
28.138	-162.278	2561	ARIES-59D	4130055	Chainbag dredge	-	-	SIO	A167	-	-	-
21.535	-167.930	1690	7TOW144D	4130165	Chainbag dredge	-	-	SIO	A119	-	-	-
25.675	-168.697	-	KK72MIDWAY32	4130216	Rock dredge	-	-	HIG	A251	-	-	-
25.488	-168.657	-	KK72MIDWAY33	4130217	Rock dredge	-	-	HIG	A251	-	-	-
24.292	-166.730	-	KK72MIDWAY43	4130227	Rock dredge	-	-	HIG	A251	-	-	-
23.817	-164.420	-	KK72MIDWAY47	4130230	Rock dredge	-	-	HIG	A251	-	-	-
23.367	-163.567	-	KK72MIDWAY49	4130232	Rock dredge	-	-	HIG	A251	-	-	-
28.965	-162.022	3050	KK80-414RD23	4130251	Dredge	-	-	HIG	A458	-	-	-
23.917	-173.655	4000	VITYAZ3782	4140067	Trawl dredge	-	Pelagic clay	USSR	A148	0	Photo	-
28.817	-178.950	-	KK72MIDWAY20	4140221	Rock dredge	-	-	HIG	A251	-	-	-
27.702	-175.683	-	KK72MIDWAY24	4140223	Rock dredge	-	-	HIG	A251	-	-	-
20.695	-170.548	1930	VIT.6002	4140230	-	-	-	USSR	A343	-	-	-
20.517	-170.830	2980	VIT.6000	4140232	Core	-	-	USSR	A343	-	-	-
26.977	177.302	2750	VIT.6265	4150176	Dredge	-	-	USSR	A343	-	-	-
22.133	175.370	1500	VIT.6004	4150177	Core	-	-	USSR	A343	-	-	-
30.717	-159.567	5770	VEMA21-179	4480024	Piston core	701.	Pelagic clay	LDGO	A110	-	-	-
30.350	-163.852	2476	ARIES-57D	4490019	Chainbag dredge	-	-	SIO	A167	-	-	-
31.730	-165.717	5597	SS72-125DB	4490039	Bucket dredge	-	-	-	A386	-	-	-
32.143	-160.272	4000	KK80-414RD15	4490043	Dredge	-	-	HIG	A458	-	-	-
33.928	-162.095	2430	KK80-414RD20	4490047	Dredge	-	-	HIG	A458	-	-	-
31.935	-162.240	2800	KK80-414RD16	4490048	Dredge	-	-	HIG	A458	-	-	-

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Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
33.217	-162.338	2900	KK80-414RD22	4490049	Dredge	-	-	HIG	A458	-	-	-
31.118	-162.365	2400	KK80-414RD21	4490050	Dredge	-	-	HIG	A458	-	-	-
31.802	-162.843	2500	KK80-414RD8	4490051	Dredge	-	-	HIG	A458	-	-	-
31.645	-162.872	2600	KK80-414RD10	4490052	Dredge	-	-	HIG	A458	-	-	-
31.660	-163.017	2450	KK80-414RD9	4490054	Dredge	-	-	HIG	A458	-	-	-
33.627	-165.098	2770	KK80-414RD7	4490055	Dredge	-	-	HIG	A458	-	-	-
32.468	-165.800	3000	KK80-414RD5	4490056	Dredge	-	-	HIG	A458	-	-	-
34.077	-166.502	4500	KK80-414RD2	4490057	Dredge	-	-	HIG	A458	-	-	-
33.863	-166.515	3450	KK80-414RD3	4490058	Dredge	-	-	HIG	A458	-	-	-
SOUTH PACIFIC B-3												
-20.610	-147.588	4570	SCAN-81-G	2310033	Gravity core	101.	Pelagic clay	SIO	A117	-	-	-
-20.390	-148.020	4630	SHIMA-15-3	2310055	-	-	-	-	A248	-	-	-
-22.583	-150.800	807	AMPH-9D	2320002	Chainbag dredge	-	-	SIO	M005	-	-	-
-24.683	-155.250	4542	MSN-126G	2320015	Gravity core	123.	Calcareous ooze	SIO	N682	-	-	-
-24.812	-157.488	4901	SOTW38G	2320019	Gravity core	167.	Calcareous ooze	SIO	A223	-	-	-
-26.033	-157.967	5038	MSN-125G	2320022	Gravity core	142.	Pelagic clay	SIO	M001	-	-	-
-29.583	-159.100	5252	MSN-121G	2320026	Gravity core	132.	Pelagic clay	SIO	M001	-	-	-
-27.943	-159.785	4558	SOTW40D	2320028	Chainbag dredge	-	Pelagic clay	SIO	A223	-	-	-
-27.523	-160.652	4990	SOTW39D	2330001	Chainbag dredge	-	-	SIO	A223	-	-	-
-23.535	-162.902	4993	TNGROAG993E	2330023	Freefall grab	-	-	-	A281	20-50	Sonar & photo	20.5
-22.937	-162.080	4848	TNGROAG994	2330024	Pipe dredge	-	Pelagic clay	-	A281	-	-	-
-21.897	-160.913	4817	TNGROAG996B	2330027	Freefall grab	-	Pelagic clay	-	A281	<20	Sonar & photo	1.8
-27.652	-160.015	4982	TNGROAG1007	2330035	Pipe dredge	-	Pelagic clay	-	A281	-	-	-
-22.598	-160.708	4465	VIT.5965-6	2330053	Core	-	Calcareous clay	USSR	A343	-	-	-
-22.780	-160.727	4850	VIT.6298-62	2330056	Trawl dredge	-	Pelagic clay	USSR	A343	-	-	-
-22.758	-160.780	4850	VIT.6298-30	2330063	Dredge	-	Pelagic clay	USSR	A343	-	-	-
-22.662	-160.788	4830	VIT.5965-1	2330065	Grab	-	Calcareous clay	USSR	A343	-	-	-
-22.667	-160.822	4850	VIT.5965-3	2330069	Trawl dredge	-	-	USSR	A343	-	-	-
-22.808	-160.863	2950	VIT.6298-10	2330074	Core	-	Calcareous ooze	USSR	A343	-	-	-
-22.802	-160.872	3055	VIT.6298-13	2330077	Trawl dredge	-	Rock	USSR	A343	-	-	-
-22.693	-160.920	4535	VIT.6298-53	2330082	Trawl dredge	-	Calcareous clay	USSR	A343	-	-	-
-23.213	-160.973	4630	VIT.5963	2330088	Core	-	-	USSR	A343	-	-	-
-24.920	-161.337	4960	VIT.5962	2330090	Grab	-	-	USSR	A343	<20	Photo	-
-23.218	-161.417	4875	VIT.5964	2330091	Grab	-	Calcareous clay	USSR	A343	>50	Grab	30.0
-27.233	-162.247	4260	VIT.6300	2330092	Trawl dredge	-	-	USSR	A343	-	-	-
-18.600	-126.500	3477	AMPH-5D	2650020	Chainbag dredge	-	-	SIO	M005	-	-	-
-15.383	-136.300	4480	DWHD-15	2660032	Pipe dredge	-	-	SIO	M033	-	-	-
-17.600	-141.917	2132	CARNVII-46	2670023	-	-	Calcareous ooze	SIO	A006	-	-	-
-11.983	-144.367	4875	AMPH-126P	2670071	Piston core	-	Pelagic clay	SIO	M005	-	-	-
-16.483	-145.550	1270	DWHD-16	2670098	Pipe dredge	-	-	SIO	M033	-	-	-
-16.167	-146.000	1190	DWBD-5	2670117	Dredge	-	-	SIO	M009	-	-	-
-17.000	-146.000	1700	DWBD-4	2670119	Dredge	-	-	SIO	M009	-	-	-
-18.917	-146.383	4465	ALBATRO.173	2670130	Trawl dredge	-	Pelagic clay	-	A009	-	-	-
-11.433	-149.283	5106	AMPH-116PG	2670202	Trip core	-	Pelagic clay	SIO	M005	-	-	-
-13.567	-149.300	4520	CM-II-14	2670224	-	-	-	-	A248	-	-	-
-16.583	-146.400	1900	2P-36	2670243	Dredge	-	-	HIG	A381	-	-	-
-13.250	-148.500	4650	TDN.2	2670252	Dredge	-	-	-	A462	-	-	-
-14.483	-150.017	1789	VEMA18-RD29	2680002	Dredge	-	Calcareous ooze	LDGO	A130	0	Photo	-
-13.883	-150.583	3623	MSN-128G	2680008	Gravity core	61.	Calcareous ooze	SIO	N682	>50	Photo	-
-13.883	-150.583	3695	MERO-2P-50	2680009	Dredge	-	-	SIO	A189	-	-	-

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Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
-17.817	-154.017	1260	VEMA18-BBD4	2680026	Bucket dredge	-	Calcareous ooze	LDGO	A130	-	-	-
-17.808	-154.033	983	VEMA18-BBD5	2680027	Bucket dredge	-	Calcareous ooze	LDGO	A130	-	-	-
-17.792	-154.058	1586	VEMA18-BBD6	2680028	Bucket dredge	-	Calcareous ooze	LDGO	A130	-	-	-
-17.867	-154.133	1836	VEMA19-RD1	2680035	Dredge	-	-	LDGO	A130	-	-	-
-17.867	-154.883	4790	VEMA19-RD2	2680039	Dredge	-	Calcareous clay	LDGO	A130	>50	Photo	-
-18.997	-155.005	4605	SCAN-72-G	2680041	Gravity core	135.	Pelagic clay	SIO	A117	-	-	-
-11.583	-158.517	5338	AMPH-85P	2680060	Piston core	590.	Pelagic clay	SIO	M005	-	-	-
-11.667	-159.267	5146	AMPH-84G	2680069	Gravity core	26.	Pelagic clay	SIO	M005	-	-	-
-12.450	-159.383	4990	VEMA-18-280	2680070	Piston core	290.	Pelagic clay	LDGO	A037	-	-	-
-13.917	-150.550	3755	CM-II-10	2680076	-	-	-	-	A248	-	-	-
-14.050	-150.633	3760	CM-II11	2680077	-	-	-	-	A248	-	-	-
-13.833	-150.550	-	CM-9	2680078	Dredge	-	-	-	A256	-	-	-
-11.062	-156.165	4820	VIT.5988-14	2680095	Core	-	-	USSR	A343	-	-	-
-12.700	-160.617	4753	VEMA-18-279	2690013	Piston core	450.	Pelagic clay	LDGO	A037	-	-	-
-12.700	-160.750	3953	VEMA-18-277	2690019	Piston core	31.	Pelagic clay	LDGO	A037	-	-	-
-12.700	-160.817	3587	VEMA-18-276	2690022	Piston core	56.	Calcareous ooze	LDGO	A037	>50	Photo	-
-11.850	-160.850	3803	AMPH-80G	2690023	Gravity core	134.	Calcareous ooze	SIO	M005	-	-	-
-12.750	-160.925	3500	VEMA-18-274	2690030	Piston core	223.	Calcareous ooze	LDGO	A037	>50	Photo	-
-12.733	-160.933	3610	VEMA-18-275	2690033	Piston core	52.	Calcareous ooze	LDGO	A037	-	-	-
-12.275	-161.058	2720	VEMA-18-267	2690056	Piston core	200.	Calcareous ooze	LDGO	A037	>50	Photo	-
-18.597	-161.527	4998	VIT.37-5398	2690065	Grab	18.	Pelagic clay	USSR	A148	>50	Grab	26.4
-12.910	-160.747	4300	VIT.6333	2690132	-	-	-	USSR	A343	-	-	-
-19.767	-161.788	4070	VIT.5968-9	2690137	Grab	-	-	USSR	A343	-	-	-
-19.710	-161.833	4825	VIT.5968-15	2690138	Dredge	-	-	USSR	A343	-	-	-
-19.680	-161.887	4330	VIT.5968-18	2690139	Core	-	-	USSR	A343	-	-	-
-19.775	-161.908	4985	VIT.5968-1	2690142	Grab	-	-	USSR	A343	-	Grab	3.2
-19.752	-161.942	5060	VIT.5968-7	2690144	Trawl dredge	-	-	USSR	A343	-	-	-
-15.573	-164.590	5540	VIT.6331	2690146	Trawl dredge	-	-	USSR	A343	-	-	-
-15.140	-166.900	5372	I-166	2690188	Pipe dredge	-	Pelagic clay	-	A414	-	-	-
-11.917	-169.533	-	STYX-IX02BX	2690197	Box core	52.	-	SIO	A457	-	-	-
-11.317	178.200	770	PROA-72D	2710120	Pipe dredge	-	-	SIO	M002	-	-	-
-5.817	-154.650	4768	AMPH-110P	3040029	Piston core	31.	Calcareous clay	SIO	M005	-	-	-
-4.978	-154.993	4800	CNEXO-B3	3040103	Freefall grab	-	-	-	A369	-	-	-
-4.982	-154.983	4990	CNEXO-B5	3040105	Freefall grab	-	-	-	A369	-	-	-
-2.018	-158.523	5080	CNEXO-B12	3040115	Freefall grab	-	-	-	A369	-	-	-
-8.080	-160.550	4243	VIT.37-5424	3050010	Grab	8.	Calcareous ooze	USSR	A140	<20	Grab	.3
-2.292	-163.958	5243	RC12-87	3050029	Piston core	135.	Pelagic clay	LDGO	A114	0	Photo	-
-9.805	-164.743	4199	SOTW68D	3050039	Chainbag dredge	-	-	SIO	A223	-	-	-
-4.233	-168.283	5204	STYX-46G	3050072	Gravity core	170.	Pelagic clay	SIO	A145	-	-	-
-4.233	-168.283	5230	STYX-48FF	3050076	Grab	-	Siliceous ooze	SIO	A145	-	-	-
-8.275	-168.508	4565	SOTW4FF-C	3050090	Freefall core	114.	Calcareous ooze	SIO	A223	-	-	-
-8.283	-168.520	4751	SOTW4FF-B	3050091	Freefall core	97.	Calcareous clay	SIO	A223	-	-	-
-8.287	-168.528	4758	SOTW4FF-A	3050092	Freefall core	79.	Calcareous clay	SIO	A223	-	-	-
-8.817	-168.550	4550	PROA-116P	3050095	Grab	-	-	SIO	M002	-	-	-
-7.517	-168.817	5288	CATO10PG	3050100	Piston core	103.	Pelagic clay	SIO	A221	-	-	-
-7.675	-161.613	4540	M70-028	3050104	Rock dredge	-	-	HIG	A251	-	-	-
-1.265	-168.243	6965	ERDC-2-05	3050115	Rock dredge	-	-	SIO	A269	-	-	-
-1.297	-168.390	6730	ERDC-2-07	3050117	Rock dredge	-	-	SIO	A269	-	-	-
-8.317	-168.550	4482	CHAIN-100-M	3050127	Freefall core	-	-	-	A284	-	-	-
-7.740	-168.553	4700	CATO-33D	3050129	Rock dredge	-	-	SIO	A221	-	-	-
-7.397	-168.548	5471	CATO-28P	3050130	Piston core	150.	-	SIO	A221	-	-	-
-6.233	-176.717	5853	S-68-006	3060045	Rock dredge	-	-	HIG	A251	-	-	-

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
SOUTH PACIFIC B-3												
32.428	-58.968	3453	VEMA26-3	4380089	Piston core	47	Calcareous ooze	LDGO	A123	-	-	-
32.428	-58.968	3453	VEMA26-D1	4380090	Dredge	-	Calcareous ooze	LDGO	A130	-	-	-
32.033	-59.000	2150	ATL-77	4380112	-	-	-	-	A368	-	-	-
32.133	-59.025	3475	ATL-76	4380113	-	-	-	-	A368	-	-	-
38.067	-60.217	3007	VEMA19-RD11	4390002	Dredge	-	Pelagic clay	LDGO	A130	0	Photo	-
34.867	-62.500	1460	MUIRSMT	4390042	Dredge	-	-	-	A197	-	-	-
39.000	-61.000	-	HUDSON-6	4390353	Dredge	-	-	-	A305	-	-	-
39.000	-60.950	2000	HUDSON-54	4390358	-	-	-	-	A354	-	-	-
U.S. WEST COAST B-4												
31.283	-117.583	2100	SOB-5	4440097	Chainbag dredge	-	-	SIO	M036	-	-	-
30.200	-117.633	1300	SOB-10	4440102	Chainbag dredge	-	-	SIO	M036	-	-	-
30.300	-117.667	1060	SOB-27	4440106	Dredge	-	-	SIO	M036	-	-	-
31.383	-118.050	1040	SOB-20	4440137	Chainbag dredge	-	-	SIO	M036	-	-	-
31.083	-118.617	1650	SOB-25	4440318	Dredge	-	-	SIO	M036	-	-	-
32.933	-132.500	702	NEL-667	4460084	-	-	-	-	A255	-	-	-
38.538	-133.650	4427	RC15-6	4460085	Piston core	368.	Pelagic clay	LDGO	A267	>50	Photo	-
32.927	-133.883	5385	RC15-8	4460089	Piston core	1065.	Pelagic clay	LDGO	A267	<20	Photo	-
40.383	-127.983	1260	FAN-B25D	4810487	Chainbag dredge	-	-	SIO	A189	-	-	-
42.750	-128.050	2520	CAS-D-5	4810492	Dredge	-	-	-	A197	-	-	-
SOUTHEAST ATLANTIC MARGIN B-5												
20.817	-66.917	4878	RC8-RD8	4030109	Chainbag dredge	-	-	LDGO	A130	0	Photo	-
22.453	-71.602	5192	RC10-27	4040109	Piston core	675.	Calcareous ooze	LDGO	A115	-	-	-
24.742	-73.777	5312	RC11-246	4040232	Piston core	245.	Calcareous ooze	LDGO	A116	-	-	-
27.233	-76.433	4710	EASTWD-11068	4040837	Dredge	-	-	-	A272	-	-	-
26.875	-76.633	1535	ATL-121	4040839	-	-	-	-	A368	-	-	-
26.883	-76.637	1545	ATL-122	4040840	-	-	-	-	A368	-	-	-
31.015	-67.113	4764	VEMA26-159	4390213	Piston core	25.	Calcareous ooze	LDGO	A123	-	-	-
30.000	-77.000	2640	BLAKE	4400456	-	-	-	-	B540	-	-	-
30.850	-78.450	732	WHOI-A105	4400536	Dredge	-	-	WHOI	A197	-	-	-
31.213	-78.483	648	GOS74-2390	4400539	Chainbag dredge	-	Calcareous ooze	WHOI	B540	-	-	-
31.383	-78.667	512	GOS74-2389	4400548	Dredge	-	Calcareous ooze	WHOI	B540	-	-	-
30.883	-78.783	815	A266-40	4400564	Dredge	-	Calcareous ooze	WHOI	N170	-	-	-
31.680	-78.800	543	GOS74-2481	4400565	Pipe dredge	-	Calcareous ooze	WHOI	B540	-	-	-
31.253	-78.983	546	GOS74-2387	4400569	Dredge	-	Calcareous ooze	WHOI	B540	-	-	-
SOUTHERN OCEAN B-6												
-62.850	-74.758	4005	ET10-BT9	800024	Trawl dredge	-		FSU	A227	0	Photo	-
-64.517	-145.967	3775	ET25-PC15	870004	Piston core	380.	Calcareous ooze	FSU	A150	20-50	Photo	-
-64.183	-165.933	2932	MSN-91G	890009	Gravity core	100.	Siliceous mud	SIO	M001	-	-	-
-63.067	178.483	3583	MSN-90G	910002	Gravity core	37.	Siliceous mud	SIO	M001	-	-	-
-63.100	177.617	3383	ET27-RS2	910005	Rock dredge	-	-	FSU	A227	-	-	-
56.617	-34.800	3696	VE14 -51	1120022	Piston core	1110.	Terrigenous	LDGO	B509	-	-	-
-55.933	-45.202	3740	ET7-MT1	1130048	Trawl dredge	-	-	FSU	B559	-	-	-
-53.042	-48.883	3118	ET7-PC18	1130061	Piston core	965.	Calcareous ooze	FSU	B559	<20	Photo	-
-59.142	-48.883	3850	ET7-RD16	1130062	Rock dredge	-	-	FSU	A227	-	-	-
-53.058	-48.950	3255	ET7-RD17	1130063	Rock dredge	-	-	FSU	B559	-	-	-
-59.033	-48.978	3862	ET7-PC17	1130065	Piston core	1275.	Terrigenous	FSU	B559	-	-	-

SOUTHERN OCEAN B-6

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
-53.000	-52.900	3101	VEMA18-RD11	1140011	Dredge	-	Calcareous Terrigenous	LDGO	A130	-	-	-
OTHER AREAS B-7												
-57.538	-55.138	4075	VEMA15SBT120	1140029	Trawl dredge	-	Terrigenous	LDGO	A130	-	-	-
-55.100	-55.833	2871	ET6-RD10	1140040	Rock dredge	-	Siliceous mud	FSU	A227	-	-	-
-55.733	-56.050	3914	ET6-PC11	1140051	Piston core	542.	Calc. material	FSU	B559	>50	Photo	-
-56.267	-58.275	4087	ET6RD5	1140081	Rock dredge	-	Calc. material	FSU	A226	-	-	-
-56.233	-58.700	4133	ET6-MT3	1140088	Trawl dredge	-	-	FSU	A227	-	-	-
-55.642	-55.912	4085	RC15-118	1140119	Piston core	449.	Mn pavement	LDGO	A267	-	-	-
-52.833	-50.500	2842	VE-31-64	1140127	Piston core	193.	Mn pavement	LDGO	A308	-	-	-
-51.517	-52.433	2052	VE-31-61	1140128	Piston core	335.	Calcareous ooze	LDGO	A308	-	-	-
-57.050	-60.017	3438	ET22-PC1	1150001	Piston core	425.	Terrigenous	FSU	A227	-	-	-
-58.467	-60.625	3039	ATL-174	1150191	-	-	-	-	A368	-	-	-
-57.983	-70.883	4007	ELT-5-16	1160020	Rock dredge	-	-	FSU	A202	-	-	-
-57.083	-70.983	3767	ET5-RD17	1160025	Rock dredge	-	-	FSU	A227	-	-	-
-52.017	-99.950	4418	ET20-RS8	1180019	Rock dredge	-	-	FSU	A227	-	-	-
-52.167	-142.133	2295	ET17-RS1	1230002	Rock dredge	-	Calcareous ooze	FSU	A226	-	-	-
-59.850	-144.867	3219	ET20-RS4	1230006	Rock dredge	-	-	FSU	A226	-	-	-
-58.083	-144.950	3025	ET20-BT2	1230007	Trawl dredge	-	-	FSU	A227	-	-	-
-59.133	-145.133	3155	ELT-PC7	1230011	Piston core	180.	Siliceous ooze	FSU	A150	-	-	-
-54.500	-163.317	4650	VEMA16-SBT34	1250012	Trawl dredge	-	Siliceous ooze	LDGO	A130	-	-	-
-50.317	176.383	2377	ENDEAVORF133	1270003	Dredge	-	-	-	A260	-	-	-
-50.783	169.958	896	ENDEAVORD169	1280029	Dredge	-	-	-	A260	-	-	-
-56.367	158.467	1595	ET16-RD7	1290010	Rock dredge	-	-	FSU	A227	-	-	-
-55.158	150.050	5866	ELT36-24	1290032	Trawl dredge	-	-	FSU	A250	-	-	-
-56.683	158.767	1280	D-5	1290062	-	-	-	-	A388	-	-	-
-56.417	140.017	3750	OSTWALD-ELT	1300013	Dredge	-	-	-	A243	-	-	-
-56.555	100.068	3409	ELT-TC49-34A	1340035	Trip core	42.	Siliceous ooze	FSU	A226	-	-	-
-54.833	90.140	4662	ELT-PC49-14	1350032	Piston core	111.	Siliceous mud	FSU	A226	0	Photo	-
-52.083	84.547	4232	ELT-PC54-2	1360009	Piston core	830.	Siliceous mud	FSU	A226	-	-	-
-55.880	81.118	4086	ELT-PC54-7	1360023	Piston core	558.	Siliceous mud	FSU	A226	>50	Photo	-
-52.167	10.483	2561	V-29-5	1430013	Rock dredge	-	-	LDGO	A130	-	-	-
-50.367	8.750	4686	V-29-4	1440015	Rock dredge	-	-	LDGO	A130	-	-	-
-49.633	-42.467	2202	VE-31-68	1490051	Piston core	518.	Terrigenous	LDGO	A308	-	-	-
-49.650	-44.117	2952	VE-31-81	1490055	Piston core	55.	Calcareous ooze	LDGO	A308	-	-	-
-49.617	-44.100	2932	VE-31-82	1490056	Piston core	127	Mn pavement	LDGO	A308	-	-	-
-47.933	-57.100	2585	VEMA18-RD6	1500059	Dredge	-	-	LDGO	A130	-	-	-
-47.762	-57.642	3652	RC12-237	1500129	Piston core	445.	Terrigenous	LDGO	A114	>50	Photo	-
-42.067	-81.983	3200	ET25-RS2	1530001	Rock dredge	-	-	FSU	A227	-	-	-
-42.083	-86.050	3012	ET25-RS1	1530003	Rock dredge	-	-	FSU	A227	-	-	-
-41.983	-102.017	4200	DWHD-47	1550005	Dredge	-	Calcareous ooze	SIO	M033	-	-	-
-42.017	-130.033	4839	ET24-RS17	1580001	Rock dredge	-	-	FSU	A227	-	-	-
-45.100	-145.183	4954	ET24-RS4	1590005	Rock dredge	-	-	FSU	A227	-	-	-
-49.667	179.883	2286	ENDEAVORF116	1630063	Dredge	-	Terrigenous	-	A260	-	-	-
-49.400	177.983	978	ENDEAVORF129	1630064	Dredge	-	Calcareous ooze	-	A260	-	-	-
-49.983	177.533	1335	ENDEAVORF132	1630065	Dredge	-	-	-	A260	-	-	-
-49.367	176.267	1280	ENDEAVORF127	1630066	Dredge	-	Terrigenous	-	A260	-	-	-
-33.800	-1.233	1489	VEMA29-115	1810024	Piston core	30.	Terrigenous	LDGO	A265	-	-	-
-33.800	-1.233	1553	VEMA29-116	1810025	Piston core	145.	Calcareous ooze	LDGO	A265	-	-	-
-30.033	-38.950	939	VEMA22-D5	1840038	Rock dredge	-	-	LDGO	A108	-	-	-
-30.500	-35.933	1000	RD15-D8	1840039	Dredge	-	-	LDGO	A130	-	-	-

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
-33.050	-82.050	3881	ET21-RS4	1890007	Rock dredge	-	-	FSU	A227	-	-	-
-33.042	-83.942	3650	ET21-RS6	1890013	Rock dredge	-	-	FSU	A227	-	-	-
-32.967	-88.000	3619	ET21-RS8	1890016	Rock dredge	-	-	FSU	A227	-	-	-
-33.075	-89.550	3795	ET21-RS9	1890022	Rock dredge	-	-	FSU	A227	-	-	-
-39.850	-96.867	3639	ET21-RS11	1900007	Rock dredge	-	-	FSU	A227	-	-	-
-39.892	-96.908	3557	ELT-PC21-8	1900014	Piston core	45.	Terrigenous	FSU	A150	-	-	-
-37.067	-129.967	3548	ET24-RS19	1930004	Rock dredge	-	-	FSU	A227	-	-	-
-35.967	-134.300	4696	ET24-RS15	1940005	Rock dredge	-	-	FSU	A227	-	-	-
-35.183	-135.533	4700	DWHG-31	1940009	Gravity core	-	-	SIO	M033	-	-	-
-32.675	-160.013	5300	TNGROAG1012	1970019	Pipe dredge	-	Pelagic clay	-	A281	-	-	-
-38.643	-167.918	1420	GEOSECS-1D	1970033	Rock dredge	-	-	SIO	A347	-	-	-
-35.850	-178.517	6715	GALATHEA658	1980025	Dredge	-	Terrigenous	-	A083	-	-	-
-33.000	-171.652	3225	VIT.6307	1980049	Trawl dredge	-	-	USSR	A343	-	-	-
-39.750	159.650	-	GALATHEA-574	2010001	-	-	-	-	A200	-	-	-
-37.465	120.255	4316	ELT-PC-55-19	2040011	Piston core	329.	Calcareous ooze	FSU	A289	-	-	-
-37.500	120.167	3736	ELT-PC-55-18	2040014	Piston core	321.	Calcareous ooze	FSU	A289	-	-	-
-37.162	121.223	4243	ELT-PC-55-16	2040016	Piston core	46.	Calcareous ooze	FSU	A289	-	-	-
-38.185	118.675	4023	ELT-PC-55-21	2050067	Piston core	-	Calc. material	FSU	A289	-	-	-
-32.800	103.872	5300	VITYAZ5193	2060016	Dredge	-	Pelagic clay	USSR	N684	-	-	-
-31.500	99.283	2412	VEMA16-SBT22	2070001	Trawl dredge	-	Calcareous ooze	LDGO	A130	-	-	-
-31.283	94.267	2074	RC11-D4	2070019	Dredge	-	-	LDGO	A130	-	-	-
-31.710	91.365	4298	ELT-PC48-39	2070085	Piston core	-	Calc. material	FSU	A226	-	-	-
-30.443	60.805	5731	ANTIPO-117D	2100024	Dredge	-	-	SIO	A174	-	-	-
-32.667	66.383	4910	VEMA29-67	2100027	Piston core	-	-	LDGO	A265	-	-	-
-36.750	44.767	2265	RC14-D3	2120046	Rock dredge	-	-	LDGO	A130	-	-	-
-32.917	35.317	1250	BRUUN386-BC	2130069	Core	-	-	-	A388	-	-	-
-31.900	34.350	2700	BRUUN387-C	2130070	Dredge	-	-	-	A388	-	-	-
-37.433	26.467	2867	VE18 -185	2140009	Piston core	4.	-	LDGO	B579	-	-	-
-38.633	26.133	2960	NIOE-135	2140010	-	-	-	-	A200	-	-	-
-39.533	24.833	2961	VEMA22-123	2140022	Piston core	240.	Terrigenous	LDGO	A108	>50	Photo	-
-39.350	25.050	2875	RC14-2	2140058	Piston core	304.	Mn pavement	LDGO	A268	0	Photo	-
-35.333	22.642	320	DR104	2140071	Dredge	-	-	-	A466	-	-	-
-35.783	22.383	1070	DR92	2140073	Dredge	-	-	-	A466	-	-	-
-35.433	22.367	1700	DR90	2140074	Dredge	-	-	-	A466	-	-	-
-35.617	22.367	230	DR91	2140075	Dredge	-	-	-	A466	-	-	-
-35.650	22.217	202	DR85	2140076	Dredge	-	-	-	A466	-	-	-
-37.550	18.100	3147	VEMA22-D7	2150025	Dredge	-	Calcareous ooze	LDGO	A130	-	-	-
-37.550	18.100	1796	VEMA22-118	2150026	Piston core	83.	Calc. material	LDGO	A108	0	Photo	-
-34.600	17.000	2740	A322	2150054	-	-	-	WHOI	A201	-	-	-
-34.700	16.900	3200	A316	2150058	-	-	-	WHOI	A201	-	-	-
-32.367	15.017	2941	VE18 -182	2150086	Piston core	1153.	Calcareous ooze	LDGO	B579	-	-	-
-32.325	2.158	2047	VEMA22-148	2160038	Piston core	32.	-	LDGO	A108	0	Photo	-
-32.367	2.150	1786	VEMA22-D9	2160039	Dredge	-	-	LDGO	A130	-	-	-
-32.350	2.117	1675	VEMA22-147	2160041	Piston core	35.	Calcareous ooze	LDGO	A108	-	-	-
-31.483	1.033	3043	VEMA22-151	2160050	Piston core	32.	Calc. material	LDGO	A108	0	Photo	-
-31.450	.950	4136	VEMA22-150	2160052	Piston core	106.	Calcareous ooze	LDGO	A108	0	Photo	-
-33.517	2.467	4477	VEMA29-109	2160058	Piston core	715.	Calcareous ooze	LDGO	A265	-	-	-
-28.500	-28.967	3781	VEMA22-54	2190040	Piston core	486.	Calcareous ooze	LDGO	A108	-	-	-
-28.533	-29.000	3566	VEMA22-50	2190042	Piston core	350.	Calcareous ooze	LDGO	A108	>50	Photo	-
-28.533	-29.000	4361	VEMA22-52	2190045	Piston core	208.	Calcareous clay	LDGO	A108	-	-	-
-28.367	-41.217	3280	RD15-D10	2210032	Dredge	-	-	LDGO	A130	-	-	-

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
-25.517	-85.233	920	DWHD-72	2250007	Dredge	-	Calcareous ooze	SIO	M033	-	-	-
-23.550	168.808	1345	GEO-1.14D	2360113	Dredge	-	-	-	A349	-	-	-
-22.090	168.500	800	GEO-1.5D	2360114	Dredge	-	-	-	A349	-	-	-
-22.550	167.963	1875	GEO-1.3D	2360115	Dredge	-	-	-	A349	-	-	-
-21.200	102.800	4962	RC14-58	2420023	Piston core	623.	Pelagic clay	LDGO	A268	-	-	-
-22.363	91.633	5280	VITYAZ5201	2430025	Dredge	-	Pelagic clay	USSR	N684	-	-	-
-22.683	76.017	4940	DODO-112PG	2450014	Trip core	-	-	SIO	M013	-	-	-
-23.267	74.983	4520	DODO-113D	2450016	Chainbag dredge	-	-	SIO	M013	-	-	-
-24.117	72.433	4050	DODO-114D	2450028	Dredge	-	Calcareous ooze	SIO	M013	-	-	-
-25.833	65.517	4450	CIRCE-115D	2460021	Chainbag dredge	-	-	SIO	A125	-	-	-
-27.250	61.033	5588	VEMA16--77	2460037	Piston core	479.	Pelagic clay	LDGO	B511	-	-	-
-29.300	60.650	5415	ANTIPO-113D	2460040	Dredge	-	-	SIO	A174	-	-	-
-29.298	60.602	4564	ANTIPO-114D	2460041	Dredge	-	-	SIO	A174	-	-	-
-22.600	64.983	4449	VEMA29-54	2460049	Piston core	-	-	LDGO	A265	-	-	-
-25.220	57.390	3977	VA07-29GBD	2470085	Freefall grab	-	-	-	A426	-	Grab	10.5
-29.100	36.733	3880	BRUUN375-G	2490034	Dredge	-	-	-	A388	-	-	-
-29.617	10.133	4838	RC17-41	2510100	Piston core	258.	-	LDGO	A336	-	-	-
-28.200	2.750	3129	VEMA29-125	2520084	Piston core	355.	Calcareous ooze	LDGO	A265	-	-	-
-10.633	-109.600	2134	AMPH-2D	2630033	Chainbag dredge	-	-	SIO	M005	-	-	-
-12.732	-113.608	3455	SOTW34D	2640048	Rock dredge	-	-	SIO	A223	-	-	-
-17.450	163.667	1310	GO-209	2720050	Dredge	-	-	-	A349	-	-	-
-10.850	113.017	5150	GALATHEA-469	2770039	Gravity core	-	-	-	A088	-	-	-
-15.883	102.950	5579	RC14-54TW	2780082	Trip core	43.	Pelagic clay	LDGO	A268	-	-	-
-10.833	104.633	3850	VIT.-6731-5	2780095	Trawl dredge	-	-	USSR	A451	-	-	-
-11.817	102.900	5078	VIT.-6734	2780098	Trawl dredge	-	Siliceous ooze	USSR	A451	-	-	-
-13.250	93.200	5325	DODO-75P	2790066	Catcher grab	-	Siliceous clay	SIO	M013	-	-	-
-11.833	96.967	3080	VEMA28-14	2790094	Rock dredge	-	-	LDGO	A130	-	-	-
-17.883	99.100	5471	VM28-15	2790095	Rock dredge	-	-	LDGO	A266	-	-	-
-13.017	91.250	4400	VIT.-6742-2	2790105	Dredge	-	Calcareous ooze	USSR	A451	-	-	-
-13.017	91.250	4260	VIT.-6742-4	2790106	Dredge	-	Calcareous ooze	USSR	A451	-	-	-
-13.017	91.250	4760	VIT.-6742-21	2790113	-	-	Siliceous ooze	USSR	A451	-	-	-
-12.583	95.400	1500	VIT.-6749-1	2790115	Dredge	-	Calcareous ooze	USSR	A451	-	-	-
-15.767	99.900	5000	VIT.-6754-4	2790119	Pipe dredge	-	-	USSR	A451	-	-	-
-15.767	99.900	5600	VIT.-6754-10	2790123	Dredge	-	Siliceous ooze	USSR	A451	-	-	-
-15.767	99.900	3760	VIT.-6754-15	2790126	Trawl dredge	-	-	USSR	A541	-	-	-
-15.767	99.900	3420	VIT.-6754-16	2790127	Pipe dredge	-	-	USSR	A451	-	-	-
-17.333	84.383	5010	MSN-47G	2800039	Grab	-	Mn pavement	SIO	M001	-	-	-
-12.767	88.900	5180	VIT.-6744-2	2800081	Pipe dredge	-	-	USSR	A451	-	-	-
-12.767	88.900	4480	VIT.-6744-8	2800082	Dredge	-	-	USSR	A451	-	-	-
-12.767	88.900	4750	VIT.-6744-37	2800083	Dredge	-	Siliceous ooze	USSR	A451	-	-	-
-12.767	88.900	4830	VIT.-6744-39	2800084	Dredge	-	-	USSR	A451	-	-	-
-10.017	88.017	4620	VIT.-7430	2800086	Dredge	-	-	USSR	A451	-	-	-
-18.800	78.150	4934	VEMA20-RD5	2810005	Rock dredge	-	Mn pavement	LDGO	A130	-	-	-
-10.092	66.418	2422	ANTIPO-136D	2820022	Dredge	-	-	SIO	A174	-	-	-
-17.588	65.653	2502	ANTIPO-86D	2820039	Dredge	-	-	SIO	A174	-	-	-
-18.342	63.638	3451	ANTIPO-77D	2820060	Dredge	-	-	SIO	A174	-	-	-
-10.417	63.250	3115	DODO-123D	2820062	Dredge	-	-	SIO	M013	-	-	-
-19.232	61.022	3260	RC14-D5	2820130	Rock dredge	-	-	LDGO	A130	-	-	-
-14.167	41.567	1485	SU77-DR01	2840074	Dredge	-	-	-	A416	-	-	-
-9.960	-5.387	1394	RC13-D5	2890019	Dredge	-	-	LDGO	A130	-	-	-
-5.783	-11.417	2380	LSDA-199D	2900014	Dredge	-	-	SIO	M003	-	-	-

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
-8.350	-13.200	2265	CIRCE-244D	2900024	Dredge	-	Calcareous ooze	SIO	A125	-	-	-
-1.762	-85.903	2611	JOIDES157	2970068	Drill core	43400.	-	-	A098	-	-	-
-8.125	-104.175	3814	ALBATRO.4721	2990009	Trawl dredge	-	Calcareous ooze	-	A010	-	-	-
-7.833	-108.133	1567	AMPH-1D	2990022	Chainbag dredge	-	-	SIO	M005	-	-	-
-3.713	-102.870	3649	PLDS-1D	2990080	Rock dredge	-	-	SIO	A339	-	-	-
-9.133	104.667	5330	VIT.-6729-1	3140168	Dredge	-	Pelagic clay	USSR	A451	-	-	-
-5.383	97.483	3558	DODO-232D	3150023	Dredge	-	-	SIO	M013	-	-	-
-6.733	90.267	3906	VEMA29-6	3150065	Piston core	380.	Calcareous ooze	LDGO	A265	-	-	-
-9.600	90.483	4850	VIT.-7446	3150077	Dredge	-	-	USSR	A451	-	-	-
-7.332	57.937	2421	ANTIPO-145D	3190018	Dredge	-	-	SIO	A174	-	-	-
-2.133	57.400	4133	DISCOV.5179	3190028	Dredge	-	-	-	A203	-	-	-
-2.100	57.383	4041	DISCOV.5175	3190029	Dredge	-	-	-	A056	-	-	-
-9.650	56.417	2800	DODO-125D	3190044	Chainbag dredge	-	-	SIO	M013	-	-	-
-6.667	51.900	2900	DODO-127D	3190078	Chainbag dredge	-	-	SIO	A082	-	-	-
-6.600	51.567	2990	DODO-128D	3190080	Chainbag dredge	-	-	SIO	A082	-	-	-
-2.555	57.278	3398	SH-1307	3190093	Dredge	-	-	-	A373	-	-	-
-1.225	56.025	4480	SH-1326	3190101	Dredge	-	-	-	A373	-	-	-
.350	-17.517	1712	VEMA22-184	3260221	Piston core	110.	Mn pavement	LDGO	A108	0	Photo	-
6.050	-32.367	3020	LSDA-219D	3280016	Chainbag dredge	-	-	SIO	M003	-	-	-
9.650	-40.450	2388	LSDA-222D	3290001	Chainbag dredge	-	-	SIO	M003	-	-	-
9.950	-108.800	1228	CARRII-6D	3350037	Dredge	-	-	SIO	M004	-	-	-
9.138	-105.450	2651	DPSOND-2	3350075	Rock dredge	-	-	SIO	A325	-	-	-
8.157	-104.457	3325	SIQ-D4	3350090	Rock dredge	-	-	SIO	A360	-	-	-
8.803	-103.892	1822	INMD-D01	3350109	Rock dredge	-	-	SIO	A421	-	-	-
8.825	-103.917	2095	RISE-III-D3	3350124	Rock dredge	-	-	SIO	A431	-	-	-
9.100	-139.750	5040	MN7402-15G23	3380111	Freefall grab	10.	Siliceous ooze	HIG	A242	-	Grab	6.3
7.433	133.715	3869	INDP-6D	3470363	Chainbag dredge	-	-	SIO	A340	-	-	-
5.028	130.400	1600	VIT.6817	3470366	Grab	-	-	USSR	A343	-	-	-
.000	73.033	1728	RC12-D5	3530147	Rock dredge	-	Calcareous ooze	LDGO	A130	-	-	-
5.600	61.883	2176	DIS5106.12	3540040	Dredge	-	-	-	A189	-	-	-
5.567	61.867	2331	DISCOV.5123	3540041	Dredge	-	-	-	A189	-	-	-
2.942	60.057	4042	DISC-6273	3540066	Dredge	-	-	-	A194	-	-	-
2.967	60.047	4093	DISC-6269	3540070	Dredge	-	-	-	A194	-	-	-
2.790	60.042	3816	DISC-6263	3540072	Dredge	-	-	-	A194	-	-	-
6.872	62.893	3640	SH-1301A	3540088	Dredge	-	-	-	A373	-	-	-
5.010	61.548	3000	SH-1303A	3540090	Dredge	-	-	-	A373	-	-	-
2.755	59.903	3975	DISC-6249	3550004	Dredge	-	-	-	A194	-	-	-
2.783	59.883	3374	DISCOV.5136	3550008	Dredge	-	Calcareous ooze	-	A203	-	-	-
2.823	59.862	3563	DISC-6253	3550013	Dredge	-	-	-	A194	-	-	-
2.798	59.862	3776	DISC-6252	3550014	Dredge	-	-	-	A194	-	-	-
2.863	59.855	3617	DISC-6256	3550015	Dredge	-	Calcareous ooze	-	A194	-	-	-
2.803	59.768	3432	DISC-6257	3550018	Dredge	-	-	-	A194	-	-	-
1.210	56.615	930	SH-1320A	3550066	Dredge	-	-	-	A373	-	-	-
1.365	56.612	2940	SH-1323C	3550069	Gravity core	57.	-	-	A373	-	-	-
1.320	56.593	2180	SH-1321A	3550071	Dredge	-	-	-	A373	-	-	-
1.283	56.575	1865	SH-1322	3550073	Gravity core	-	-	-	A373	-	-	-
.177	55.605	1358	SH-1318B	3550075	Box core	-	-	-	A373	-	-	-
.187	55.588	1600	SH-1317B	3550076	Box core	-	-	-	A373	-	-	-
.178	55.518	1200	SH-1315A	3550079	Dredge	-	-	-	A373	-	-	-
.145	55.165	1800	SH-1325A	3550081	Dredge	-	-	-	A373	-	-	-
15.350	-21.867	-	KA68E-13	3630202	Dredge	-	-	-	A430	-	-	-

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Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
17.900	-31.950	4868	VEMA19-305	3640015	Piston core	30.	Calcareous ooze	LDGO	B733	<20	Photo	-
12.833	-100.533	3455	RC13-124	3710037	Piston core	750.	Calc. material	LDGO	A158	>50	Photo	-
12.833	-107.150	3517	RC13-122	3710047	Piston core	44.	Siliceous ooze	LDGO	A158	0	Photo	-
10.402	-108.793	1130	BNFC-29G	3710131	Catcher grab	-	-	-	A233	-	-	-
13.767	-101.872	1693	RISE-III-D28	3710149	Rock dredge	-	-	SIO	A431	-	-	-
14.725	-102.575	1843	RISE-III-D20	3710153	Rock dredge	-	-	SIO	A431	-	-	-
12.525	-103.200	2077	RISE-III-D11	3710154	Rock dredge	-	-	SIO	A431	-	-	-
11.500	-103.292	2703	RISE-III-D6	3710159	Rock dredge	-	-	SIO	A431	-	-	-
11.497	-103.957	2635	RISE-III-D5	3710167	Rock dredge	-	-	SIO	A431	-	-	-
14.607	-117.293	4035	BNFC62P	3720055	Piston core	652.	-	SIO	A233	-	-	-
16.083	-112.633	3069	VEMA28-166	3720078	Piston core	245.	Pelagic clay	LDGO	A266	>50	Photo	-
13.450	-118.417	4208	VEMA28-167	3720079	Piston core	1023.	Pelagic clay	LDGO	A266	0	Photo	-
12.275	-120.158	4471	CONRAD10-91	3730005	Piston core	825.	Siliceous ooze	LDGO	A115	-	-	-
13.052	-125.480	4400	CHUB-5	3730026	Core	100.	Mn pavement	SIO	N184	-	-	-
14.370	-133.115	4684	MIDPAC5-C2	3740019	Gravity core	-	-	SIO	M038	-	-	-
11.017	-139.967	4877	RC11-203	3740063	Piston core	1540.	Siliceous clay	LDGO	A116	<20	Photo	-
10.008	-143.320	5075	MN7401-07G30	3750090	Freefall grab	10.	Siliceous ooze	HIG	A241	-	Grab	21.3
11.050	-140.000	4780	MN7402-16G33	3750099	Freefall grab	10.	Siliceous clay	HIG	A242	-	Grab	4.3
11.100	-140.017	4800	MN7402-16G35	3750101	Freefall grab	10.	Siliceous clay	HIG	A242	-	Grab	2.0
11.100	-140.017	4800	MN7402-16G37	3750103	Freefall grab	10.	Siliceous clay	HIG	A242	-	Grab	1.1
11.035	-140.088	4909	MN7503-01G11	3750125	Freefall grab	10.	-	SIO	A309	-	-	-
11.043	-140.070	4895	MN7503-01G14	3750128	Freefall grab	10.	-	SIO	A309	-	-	-
10.950	-140.158	4223	MN7503-01G19	3750131	Freefall grab	10.	-	SIO	A309	-	-	-
10.965	-140.148	4619	MN7503-01G20	3750132	Freefall grab	10.	-	SIO	A309	-	-	-
11.028	-140.113	4868	MN7601-20B01	3750163	Box core	30.	Siliceous ooze	SIO	A338	-	-	-
11.018	-140.147	-	MN7601-20D01	3750183	Rock dredge	-	-	SIO	A338	-	-	-
13.567	-140.633	4721	CLB72-B45	3750390	Bucket dredge	-	-	-	A392	-	-	-
13.160	-141.008	6010	KK72MNFFG009	3750410	Freefall grab	-	-	HIG	A251	-	-	-
12.583	-142.150	-	CLB72-B130	3750438	Bucket dredge	-	-	-	A392	-	-	-
13.313	134.560	2010	VIT.6822	3830273	Trawl dredge	-	-	USSR	A343	-	-	-
18.613	128.130	4550	VIT.6704	3840299	Core	-	-	USSR	A343	-	-	-
12.728	47.373	1170	DISC-6224	3920032	Chainbag dredge	-	-	-	A194	-	-	-
26.517	-11.775	1600	SH73:077	3980907	Dredge	-	-	-	A467	-	-	-
25.750	-20.233	2791	CHAL-STA3	3990010	Gravity core	-	Calcareous ooze	-	A012	-	-	-
26.067	-22.367	2300	DISC-4799	3990101	-	-	-	-	A354	-	-	-
26.008	-22.367	2286	ATL-51	3990102	-	-	-	-	A368	-	-	-
28.875	-25.442	4648	ATL-43	3990103	-	-	-	-	A368	-	-	-
23.367	-43.650	4565	VEMA20-242	4010035	Piston core	742.	Calcareous ooze	LDGO	B830	<20	Photo	-
26.333	-44.850	2500	VEMA25-2	4010046	Dredge	-	Calcareous ooze	LDGO	A130	-	-	-
24.517	-45.517	3400	VEMA25-3	4010064	Dredge	-	-	LDGO	A130	-	-	-
23.768	-46.617	3155	VEMA25-9	4010081	Dredge	-	-	LDGO	A130	-	-	-
23.950	-47.483	4124	VEMA25-10	4010090	Dredge	-	-	LDGO	A130	-	-	-
24.390	-48.990	5396	VEMA25-12	4010103	Dredge	-	-	LDGO	A130	-	-	-
24.778	-50.435	5726	VEMA25-13	4020004	Dredge	-	Calcareous ooze	LDGO	A130	0	Photo	-
21.850	-56.150	4049	RC5-D1	4020045	Chainbag dredge	-	Pelagic clay	LDGO	A130	-	-	-
29.283	-57.383	5840	THETA1-6	4020058	Dredge	-	-	-	A197	-	-	-
26.430	-58.630	5141	RC10-5	4020070	Piston core	46.	Pelagic clay	LDGO	A115	-	-	-
27.417	-59.717	5842	RC16-188	4020092	Piston core	409.	Mn pavement	LDGO	A306	-	-	-
26.583	-59.867	5297	RC16-191	4020094	Piston core	481.	Pelagic clay	LDGO	A306	-	-	-
25.967	-60.317	5868	VEMA23-135	4030005	Piston core	748.	Pelagic clay	LDGO	A109	>50	Photo	-
27.433	-61.300	5762	VEMA23-136	4030014	Piston core	969.	Pelagic clay	LDGO	A109	>50	Photo	-

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Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
22.833	-109.278	1125	BAC-17	4070161	Dredge	-	Rock	SIO	A417	-	-	-
22.817	-109.242	846	BAC-59	4070166	Dredge	-	Rock	SIO	A417	-	-	-
22.838	-109.753	1326	BAC-58	4070195	Dredge	-	Rock	SIO	A417	-	-	-
21.450	-108.300	1540	TURTLE-281	4070216	-	-	-	-	A439	-	-	-
23.050	-108.750	-	TURTLE-280	4070217	-	-	-	-	A439	-	-	-
20.150	-109.000	1900	TURTLE-279	4070218	-	-	-	-	A439	-	-	-
20.850	-109.217	1825	TURTLE-278	4070225	-	-	-	-	A439	-	-	-
20.750	-112.783	1711	TRI-2D	4080106	Pipe dredge	-	-	SIO	A146	-	-	-
21.800	-113.050	3450	DH-9	4080121	Dredge	-	Pelagic clay	SIO	A197	-	-	-
29.517	-117.283	820	SOB-13	4080253	Chainbag dredge	-	-	SIO	M036	-	-	-
27.717	-119.283	1310	SIO-DX-1	4080306	-	-	-	SIO	A166	-	-	-
25.250	-119.667	64	HENDRSNSMT	4080310	Dredge	-	-	SIO	A165	-	-	-
20.883	-114.083	2560	MR-13	4080336	Dredge	-	-	-	A285	-	-	-
21.100	-114.150	3560	MR-8	4080342	Dredge	-	-	-	A285	-	-	-
20.500	-114.350	3790	MR-68	4080386	Dredge	-	-	-	A285	-	-	-
20.517	-114.533	3100	MR-51	4080399	Dredge	-	-	-	A285	-	-	-
22.000	-114.000	3400	HRS-1	4080464	Dredge	-	-	HIG	A381	-	-	-
21.450	-126.717	4300	DWBD-1	4090002	Dredge	-	-	SIO	M009	-	-	-
23.717	-124.100	3787	STYX-2FF	4090021	Grab	-	Pelagic clay	SIO	A145	-	-	-
20.067	-130.067	4959	STYX-3FF	4100004	Grab	-	Pelagic clay	SIO	A145	-	-	-
23.283	-138.250	4890	NAGA-8C	4100063	Dredge	-	Pelagic clay	SIO	A197	-	-	-
34.867	-16.517	1480	ATL-139	4340358	-	-	-	-	A368	-	-	-
36.308	-12.575	3800	SH73:171	4340396	Dredge	-	-	-	A467	-	-	-
36.292	-12.583	3700	SH73:169	4340397	Dredge	-	-	-	A467	-	-	-
36.033	-12.850	4600	SH73:178	4340398	Dredge	-	-	-	A467	-	-	-
35.133	-12.933	1450	SH73:100	4340399	Dredge	-	-	-	A467	-	-	-
36.943	-33.065	2670	CYP74-23-12	4360183	Grab	-	-	-	A464	-	-	-
36.968	-33.063	2100	CYP74-22-10A	4360184	Grab	100000.	-	-	A464	-	-	-
36.950	-33.058	2680	CYP74-22-9	4360185	Grab	-	-	-	A464	-	-	-
36.945	-33.067	2690	CYP74-26-15	4360186	Grab	200000.	-	-	A464	-	-	-
36.953	-33.078	2560	CYP74-19-7	4360187	Grab	-	-	-	A464	-	-	-
36.950	-33.070	2700	CYP74-23-11	4360188	Grab	-	-	-	A464	-	-	-
36.833	-33.178	-	CYP74-31-40	4360189	Grab	-	-	-	A464	-	-	-
36.937	-33.167	-	ARP74-13-23	4360190	Grab	-	-	-	A464	-	-	-
31.817	-43.417	3700	BM197(1960)	4370030	-	-	-	-	A201	-	-	-
30.817	-44.550	3540	WHOI-7	4370045	Dredge	-	Calcareous ooze	WHOI	A197	-	-	-
35.700	-140.850	5207	VEMA20-70	4470008	Piston core	562.	Pelagic clay	LDGO	B830	>50	Photo	-
36.000	-157.000	-	MAHI-1969	4480030	Chainbag dredge	-	-	-	A277	-	-	-
37.725	-174.485	5500	SS72-122DB	4500034	Bucket dredge	-	-	-	A386	-	-	-
38.677	-177.390	6401	SS72-121PC	4500037	Piston core	-	-	-	A386	-	-	-
38.940	-178.622	5396	SS72-115DB	4500042	Bucket dredge	-	-	-	A386	-	-	-
35.582	170.953	1607	ARIES-44D	4510023	Chainbag dredge	-	-	SIO	A167	-	-	-
37.267	162.400	1295	ZETESIII-2D	4520015	Chainbag dredge	-	-	SIO	A121	-	-	-
38.000	146.000	3500	JEDS-5	4540030	Trawl dredge	-	-	-	A197	-	-	-
36.028	143.412	-	OKADA-KA-2	4540200	-	-	-	-	A249	-	-	-
38.563	14.180	740	T/76MT EOLO	4670471	Dredge	-	-	-	A477	-	-	-
38.640	14.017	690	T/76ENARETE	4670472	Dredge	-	-	-	A477	-	-	-
41.350	-14.475	5005	ATL-138									
42.858	-19.933	2692	ATL-41									
42.900	-20.142	3288	ATL-44									
42.910	-20.187	3292	ATL-52	4710182	-	-	-	-	A368	-	-	-

OTHER AREAS B-7

Latitude	Longitude	Depth(m)	Sample	Sequence Number	Sampling Device	Length core(m)	Surface Lithology	Inst.	Ref. No.	Estimated coverage(%)	Source	Areal Coverage(Kg/m2)
42.903	-20.213	3194	ATL-42	4710183	-	-	-	-	A368	-	-	-
42.907	-20.223	3294	ATL-50	4710184	-	-	-	-	A368	-	-	-
42.900	-20.250	3345	ATL-47									
44.088	-21.927	1675	ATL-136	4710187	-	-	-	-	A368	-	-	-
44.038	-21.948	2275	ATL-137	4710188	-	-	-	-	A368	-	-	-
44.135	-22.295	2885	ATL-140	4710189	-	-	-	-	A368	-	-	-
45.583	-27.050	2262	ATL-26									
45.350	-27.167	2097	ATL-7	4710192	-	-	-	-	A368	-	-	-
45.300	-27.383	2575	ATL-9	4710193	-	-	-	-	A368	-	-	-
45.617	-27.717	2231	ATL-10	4710194	-	-	-	-	A368	-	-	-
45.767	-27.967	1938	ATL-20	4710195	-	-	-	-	A368	-	-	-
45.833	-28.300	2421	ATL-21	4710196	-	-	-	-	A368	-	-	-
45.750	-28.947	2189	ATL-18	4710197	-	-	-	-	A368	-	-	-
45.700	-28.933	2865	ATL-19	4710198	-	-	-	-	A368	-	-	-
45.767	-28.983	2558	ATL-13	4710199	-	-	-	-	A368	-	-	-
45.800	-29.117	2295	ATL-15	4710200	-	-	-	-	A368	-	-	-
45.750	-29.233	2096	ATL-23	4710201	-	-	-	-	A368	-	-	-
45.267	-29.433	2660	ATL-16	4710202	-	-	-	-	A368	-	-	-
45.517	-29.567	2752	ATL-17	4710203	-	-	-	-	A368	-	-	-
45.233	-29.800	2468	ATL-25									
45.233	-29.833	2468	ATL-24	4710206	-	-	-	-	A368	-	-	-
45.217	-29.867	2395	ATL-11	4710207	-	-	-	-	A368	-	-	-
40.235	-155.917	5033	NH-10	4840006	Core	-	Siliceous ooze	SIO	A077	-	-	-
40.267	170.333	2037	ZETESIII-3D	4870015	Chainbag dredge	-	-	SIO	A121	-	-	-
40.340	175.630	5304	SS72-112DB	4870025	Bucket dredge	-	-	SIO	A386	-	-	-
56.167	-145.250	-	GA-3	5190054	Dredge	-	-	-	A165	-	-	-
52.783	-150.083	-	GILBERTSMT.	5200002	Dredge	-	-	-	A165	-	-	-
54.537	-150.368	972	RC11-175	5200003	Piston core	260.	Terrigenous	LDGO	A116	<20	Photo	-

BLAKE PLATEAU B-8

27.233	-76.433	4710	EASTWD-11068	4040837	Dredge	-	-	-	A272	-	-	-
30.000	-77.000	2640	BLAKE	4400456	-	-	-	-	B540	-	-	-
30.850	-78.450	732	WHOI-A105	4400536	Dredge	-	-	WHOI	A197	-	-	-
31.213	-78.483	648	GOS74-2390	4400539	Chainbag dredge	-	Calcareous ooze	WHOI	B540	-	-	-
31.383	-78.667	512	GOS74-2389	4400548	Dredge	-	Calcareous ooze	WHOI	B540	-	-	-
30.883	-78.783	815	A266-40	4400564	Dredge	-	Calcareous ooze	WHOI	N170	-	-	-
31.680	-78.800	543	GOS74-2481	4400565	Pipe dredge	-	Calcareous ooze	WHOI	B540	-	-	-
31.253	-78.983	546	GOS74-2387	4400569	Dredge	-	Calcareous ooze	WHOI	B540	-	-	-

APPENDIX C

Table 1. Composition of crusts analyzed by USGS Reston Labs

Sequence#	002002	009001	009002	009003	009004	010001	010002	010003	010004	010005†	010008	010009
Latitude	.150	1.875	3.877	.535	3.020	1.385	1.817	2.752	3.525	3.350	2.633	2.698
Longitude	-17.317	-86.548	-81.687	-85.605	-84.237	-93.733	-93.635	-95.245	-93.798	-93.648	-95.467	-95.242
Depth	3150	2750	2240	2340	2293	2643	2755	2768	2795	2969	3000	2596
Lab#	W-222728	W-224394	W-222717	W-222577	W-222521	W-224389	W-224390	W-224391	W-224392	W-224393	W-222518	W-231372
SiO_2(wt.%)	28.5	14.9	27.6	16.1	13.1	25.9	19.0	25.1	20.8	47.6	15.3	.44
TiO_2	.74	.49	.85	.43	.08	.72	1.24	1.21	1.02	2.03	.24	.02
MnO_2	14.5	44.9	23.5	46.7	18.6	29.5	28.3	21.5	26.4	2.41	53.2	75.1
Fe_2O_3	20.7	16.2	15.8	12.1	47.1	20.4	27.1	24.8	25.2	11.5	7.62	.37
Al_2O_3	7.28	3.39	7.19	3.38	1.62	2.29	4.02	6.31	5.35	16.1	4.49	.20
Co_3O_4	.137	.040	.047	.049	.034	.096	.125	.086	.089	.009	.032	<.001
NiO	.159	.954	.711	.960	.117	.941	.434	.311	.374	.052	.805	.089
CuO	.057	.330	.092	.224	.098	.166	.084	.061	.085	.025	.584	.034
CaO	3.72	2.22	3.83	2.68	2.69	2.78	4.92	5.45	5.29	9.10	1.55	1.95
MgO	9.01	3.68	3.35	2.97	1.71	4.57	3.00	3.50	3.31	5.90	3.85	3.31
Na_2O	2.89	2.53	3.33	3.20	2.06	2.54	2.45	3.11	2.52	3.35	2.49	4.37
K_2O	.60	.98	.87	1.06	.48	1.33	.54	.74	.54	1.35	1.43	1.42
CO_2	.22	.22	.45	.42	.50	.49	.50	.58	.39	.06	.10	.02
P_2O_5	.62	.39	.68	.38	1.39	.48	.76	.66	.72	.40	.28	<.06
H_2O+	9.6	10.2	7.8	5.9	8.7	8.5	9.1	6.9	7.7	1.5	7.5	9.3
H_2O-	11.7	5.3	15.9	21.8	19.3	9.4	6.1	10.1	4.7	1.6	9.9	6.9
Sum	98.8	101.5	96.2	96.6	98.3	100.7	101.5	100.3	99.7	101.4	99.5	96.6
As(ppm)	159	95	119	105	360	121	181	145	199	20	49	22
Ba	430	4100	980	1900	1200	1300	1300	930	1200	380	4600	690
Cd	1.7	14.0	4.4	14.1	1.9	9.1	3.4	3.7	2.6	.5	18.9	24.7
Co	860	127	260	107	81	121	224	145	220	59	79	<10
Cr	540	25	77	2	17	25	25	49	81	152	22	0
Mo	88	290	260	370	211	232	270	134	360	<4	320	1300
Pb	410	106	190	109	47	55	280	122	199	<4	39	<15
Sr	590	950	770	770	1200	790	1300	970	1200	440	540	410
V	500	410	430	410	830	380	580	480	550	244	570	<4
Y	83	57	81	51	174	85	149	122	157	32	43	10
Zn	1400	2400	830	1800	740	1200	710	670	610	203	1800	1600
γ	.998	.972	1.025	1.021	1.003	.979	.971	.983	.989	.973	.991	1.020
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	0-15mm	0-8mm	0-12mm	-	0-1mm	0-11mm	0-1mm	0-28mm	<1mm	-	0-10mm

Sequence#	010010	011001	011002	011003	011005	016001	016002	016003†	016005	017001	017002	017003
Latitude	2.422	8.257	9.917	9.950	8.825	2.087	.544	3.640	.707	5.232	5.872	9.333
Longitude	-95.407	-104.143	-104.483	-108.800	-103.917	-157.341	-157.898	-159.523	-157.287	-161.497	-160.848	-163.167
Depth	2267	3139	1716	1227	1190	1520	1750	2800	2300	1307	1604	1563
Lab#	W-231369	W-222576	W-222683	W-222578	W-222540	W-224396	W-224397	W-224402	W-231394	W-222563	W-222564	W-222565
SiO_2(wt.%)	17.3	16.9	6.05	5.33	.82	25.7	1.90	40.9	9.73	2.46	2.78	6.25
TiO_2	.98	.52	.17	.64	.03	2.29	1.49	5.01	2.12	1.80	1.14	1.86
MnO_2	25.9	23.0	52.0	57.5	65.2	15.9	48.2	.36	34.0	51.9	40.5	45.4
Fe_2O_3	26.4	35.1	17.5	5.36	.42	17.5	16.0	16.1	28.5	19.1	19.0	19.4
Al_2O_3	4.18	3.46	.76	4.93	.55	7.18	.43	15.3	2.26	1.01	.53	2.03
Co_3O_4	.138	.084	.040	.079	.004	.374	1.02	.007	.921	2.05	.603	1.46
NiO	.359	.216	.332	.419	.048	.309	.924	.009	.438	.991	.564	1.003
CuO	.059	.149	.031	.058	.011	.026	.103	.010	.119	.108	.040	.150
CaO	4.95	2.74	3.24	2.54	12.6	12.6	12.3	9.13	3.17	4.40	12.0	5.89
MgO	2.89	1.73	2.87	6.40	1.93	4.38	1.89	2.57	1.93	2.49	1.51	2.48
Na_2O	2.60	2.75	4.03	2.38	4.30	2.43	2.38	3.83	2.75	3.28	2.41	2.72
K_2O	.52	.66	1.00	1.07	.62	.92	.63	2.24	.66	.61	.52	.69
CO_2	.34	.33	.53	.56	8.06	4.65	1.43	1.14	.13	.51	1.39	.69
P_2O_5	1.02	.96	.84	.73	<.06	.77	.55	1.57	.84	1.25	5.80	2.24
H_2O+	6.8	9.9	8.5	10.8	6.6	5.5	9.6	3.4	7.5	5.3	9.2	5.0
H_2O-	15.0	23.5	15.7	11.9	7.0	5.3	16.0	3.4	15.7	26.8	21.0	26.4
Sum	94.5	98.5	97.9	98.8	101.1	100.4	98.9	101.6	95.0	97.3	98.0	97.3
As(ppm)	235	260	202	80	17	116	167	18	260	232	203	190
Ba	1100	1800	840	940	910	650	2100	290	1300	2000	1900	1900
Cd	3.1	2.4	14.2	60.2	3.3	2.3	5.5	.1	2.9	6.7	2.9	4.5
Co	247	235	61	109	<10	270	1300	74	1100	1500	1500	960
Cr	66	12	11	19	13	270	11	25	6	22	19	31
Mo	224	248	390	440	204	201	870	<4	330	920	770	670
Pb	340	196	154	97	<15	670	1400	<4	1800	2500	1800	1800
Sr	1300	1400	970	600	550	1100	2100	570	1300	1600	2000	1500
V	600	590	450	320	83	490	830	42	560	710	750	600
Y	177	157	95	83	<4	92	250	52	190	157	270	190
Zn	660	730	1100	1500	151	440	1000	21	530	900	630	830
γ	1.044	1.001	1.007	.998	.975	.982	.997	.971	1.038	1.013	1.006	1.014
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-3.5mm	0-10mm	-	0-3mm	-	0-9mm	0-12mm	<1mm	-	0-2mm	0-8mm	0-4mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	017004	017004	017005	017006	017007	017008	017009	017010	017011	017012	017013	017014
Latitude	8.330	8.330	8.186	8.414	8.414	8.414	8.398	8.398	8.389	8.353	8.353	8.308
Longitude	-164.362	-164.362	-161.919	-164.289	-164.289	-164.289	-164.359	-164.359	-164.294	-164.317	-164.317	-164.346
Depth	1519	1519	3890	1850	1850	1850	2400	2400	1600	1150	1150	1400
Lab#	W-222566	W-222566	W-224395	W-223766	W-223767	W-223768	W-223769	W-223770	W-223771	W-223772	W-223773	W-223774
SiO_2(wt.%)	2.15	2.56	11.6	5.54	5.70	5.80	7.05	8.82	5.90	2.71	2.52	2.10
TiO_2	1.21	1.22	1.73	1.97	2.16	2.46	1.79	1.97	1.74	1.36	1.68	1.53
MnO_2	41.9	43.0	33.7	45.2	40.2	40.1	40.9	38.2	39.1	56.0	44.8	50.3
Fe_2O_3	13.1	13.9	32.4	24.1	26.7	27.8	24.8	26.9	21.9	12.7	20.0	19.0
Al_2O_3	1.10	1.15	1.71	.84	1.03	1.14	1.15	1.57	1.56	.87	.48	.31
Co_3O_4	1.11	1.13	.365	1.36	1.02	1.20	1.12	1.20	1.64	3.48	1.66	1.69
NiO	1.169	1.211	.355	.659	.514	.511	.575	.527	.724	1.153	.428	.874
CuO	.111	.114	.433	.071	.079	.105	.095	.094	.091	.089	.042	.037
CaO	12.2	13.8	3.12	4.05	4.49	3.90	3.97	4.31	7.51	3.94	7.94	4.03
MgO	2.57	2.63	1.70	1.86	1.69	1.74	1.74	1.94	2.31	2.94	1.92	2.02
Na_2O	1.91	2.07	2.12	2.29	2.02	2.01	2.21	2.23	2.25	2.81	2.31	2.33
K_2O	.66	.68	.62	.65	.57	.62	.68	.73	.61	.90	.66	.61
CO_2	1.55	1.46	.55	.55	.61	.40	.38	.51	.91	.41	.82	.50
P_2O_5	6.56	7.27	.69	1.13	1.44	.95	1.06	1.36	3.69	.98	3.86	1.02
H_2O+	9.4	4.5	11.7	10.7	10.3	9.5	8.0	8.0	8.4	7.6	8.7	11.3
H_2O-	16.2	18.0	10.4	17.0	15.8	10.4	4.9	5.9	6.8	4.0	4.9	9.7
Sum	96.8	96.8	102.8	101.0	98.5	98.2	95.6	98.3	98.3	97.9	97.8	97.6
As(ppm)	134	191	167	290	290	300	280	290	260	219	300	320
Ba	2200	3800	2300	1800	2300	2300	1900	2100	1600	1600	3400	1800
Cd	6.8	6.4	2.3	3.5	2.6	2.7	2.8	3.2	4.2	9.4	3.5	4.3
Co	790	750	890	1000	1300	1600	820	860	900	810	1400	1200
Cr	21	7	10	-	-	-	-	-	-	-	-	-
Mo	590	580	390	590	590	540	600	510	490	810	930	870
Pb	1700	1600	860	1700	1800	1700	1500	1400	1800	2000	2000	1900
Sr	1600	1600	1700	1700	1800	1800	1700	1600	1600	1300	2000	1800
V	570	560	740	650	720	740	620	580	650	570	800	800
Y	270	239	156	169	166	179	179	181	340	115	260	144
Zn	1000	1100	960	770	890	900	680	710	800	970	660	700
γ	1.019	1.018	.959	.976	1.001	1.004	1.032	1.003	1.003	1.007	1.008	1.010
Sampled	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk
Interval	0-4mm	0-4mm	0-20mm	-	-	-	-	-	0-15mm	-	-	-

Sequence#	017015	017016	017019	017020	017021	017044*	017045	017047	017048	017049	017050	017051
Latitude	8.308	8.308	8.194	8.194	8.186	3.532	3.092	9.694	9.694	9.694	9.694	9.696
Longitude	-164.346	-164.346	-164.200	-164.200	-164.202	-160.243	-160.243	-162.178	-162.178	-162.178	-162.178	-162.181
Depth	1400	1400	1600	1600	1800	2150	1350	1993	1993	1993	1993	1927
Lab#	W-223775	W-223776	W-223778	W-223777	W-223779	W-231376	W-231393	W-229261	W-229262	W-228955	W-229281	W-228992
SiO_2(wt.%)	2.33	1.98	3.32	3.55	8.81	35.1	12.7	6.18	4.33	7.62	5.48	3.33
TiO_2	1.48	1.38	1.59	1.80	2.05	.48	.13	1.87	2.26	2.22	2.47	1.52
MnO_2	48.1	52.3	47.8	45.7	38.3	6.01	57.2	42.5	47.8	41.3	43.8	34.7
Fe_2O_3	20.4	17.8	20.6	23.2	20.2	11.6	7.19	23.2	18.6	22.8	22.4	18.4
Al_2O_3	.52	.33	.63	.47	1.98	2.17	2.26	.88	.82	1.51	.79	.58
Co_3O_4	1.45	2.49	1.98	1.17	1.81	.113	.030	1.22	2.05	1.36	1.95	.591
NiO	.748	.884	.578	.603	.653	.215	.080	.668	.938	.682	.742	.421
CuO	.046	.022	.054	.074	.046	.016	.043	.072	.083	.067	.067	.076
CaO	4.81	3.86	3.87	3.92	4.06	2.33	2.29	4.31	3.99	3.93	4.28	15.8
MgO	1.84	2.19	1.84	1.70	1.85	26.93	2.20	1.74	2.11	1.88	1.90	1.32
Na_2O	2.33	2.54	2.55	2.15	2.68	.57	5.24	2.33	2.78	2.43	2.70	1.89
K_2O	.60	.61	.69	.64	.94	.18	1.01	.55	.63	.70	.59	.47
CO_2	.53	.43	.47	.37	.72	.46	.04	.62	.51	.61	1.04	1.83
P_2O_5	1.35	1.04	1.14	.94	1.18	.34	.17	1.23	.70	1.06	.72	8.37
H_2O+	10.8	11.0	9.4	10.4	9.3	11.2	8.1	8.3	8.5	8.2	9.2	7.1
H_2O-	9.8	9.3	9.7	7.1	10.3	5.2	4.5	14.3	14.5	16.0	14.3	12.4
Sum	97.3	98.9	96.5	96.7	94.5	97.7	98.6	95.6	96.1	96.4	98.1	96.4
As(ppm)	330	320	370	330	260	68	22	290	234	191	245	160
Ba	2000	1200	2300	2700	1200	243	360	1500	1600	1500	1600	3000
Cd	4.7	5.4	4.7	3.7	4.0	.6	4.3	3.9	6.0	5.0	4.6	2.3
Co	1200	860	870	1300	880	137	<10	890	1200	990	1500	2100
Cr	-	-	-	-	-	1600	5	8	11	18	12	14
Mo	930	840	1100	790	430	34	660	560	560	490	400	630
Pb	1800	2000	2000	1600	1400	310	<15	1400	1500	1700	1600	1800
Sr	1900	1500	1900	2000	1400	340	300	1600	1500	1500	1500	2100
V	840	720	910	1000	640	190	<4	650	560	640	540	830
Y	200	165	166	172	178	43	8	198	152	179	175	228
Zn	780	660	640	860	670	310	209	760	900	820	810	820
γ	1.013	.997	1.021	1.020	1.043	1.009	1.000	1.031	1.026	1.023	1.005	1.022
Sampled	Bottom	Top	Top	Bulk-minus	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Porous	Old
Interval	-	-	-	Top	-	0-5mm	0-20mm	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	017051	017053	017059	017059	017059	017059	017060	017062	017063	017064	017064	017083
Latitude	9.696	9.696	9.716	9.716	9.716	9.716	9.716	9.682	9.705	9.705	9.705	6.263
Longitude	-162.181	-162.181	-162.167	-162.167	-162.167	-162.167	-162.167	-162.184	-162.184	-162.184	-162.184	-162.963
Depth	1927	1927	1602	1602	1602	1602	1602	2706	1940	1940	1940	2887
Lab#	W-229263	W-229264	W-228956	W-229265	W-229266	W-229267	W-229268	W-229269	W-229270	W-229271	W-229272	W-228959
SiO_2(wt.%)	3.53	4.80	1.70	2.53	2.04	2.50	2.11	15.0	3.71	2.67	3.16	8.80
TiO_2	1.57	1.99	.98	1.42	1.45	1.49	1.43	1.77	1.65	1.17	1.39	1.84
MnO_2	49.0	43.5	46.3	51.5	39.0	44.3	53.1	29.1	38.1	22.1	50.5	39.2
Fe_2O_3	19.7	22.1	11.1	18.2	16.1	17.6	16.8	17.4	19.8	12.4	16.9	26.2
Al_2O_3	.44	.80	1.30	.49	.47	.54	.42	4.30	.83	1.39	.66	1.35
Co_3O_4	1.81	1.34	1.51	2.22	.659	1.31	2.34	1.31	.597	.628	2.20	1.04
NiO	.883	.760	1.769	.921	.602	.745	1.018	.459	.501	.747	.872	.583
CuO	.057	.070	.139	.058	.061	.063	.066	.034	.115	.084	.064	.071
CaO	3.85	4.00	10.1	3.97	14.8	9.48	3.92	10.3	11.5	26.7	4.75	3.65
MgO	1.99	1.86	3.32	2.21	1.51	1.83	2.28	1.51	1.51	2.00	1.98	1.89
Na_2O	2.51	2.45	2.25	2.65	2.09	2.27	2.65	3.07	1.92	3.31	2.54	2.32
K_2O	.58	.54	.82	.60	.49	.54	.61	1.14	.46	.25	.73	.64
CO_2	.49	.50	1.11	.46	1.70	1.10	.41	1.21	1.39	2.84	.53	.58
P_2O_5	.84	1.10	5.35	.94	7.46	4.37	.86	4.88	5.41	16.10	1.30	.89
H_2O+	8.8	8.9	7.8	9.5	7.9	8.4	8.8	6.5	7.9	6.2	8.6	8.5
H_2O-	15.0	14.6	10.1	14.3	11.2	12.9	15.0	11.3	11.1	4.6	13.9	14.8
Sum	96.0	94.8	95.6	97.6	96.4	96.5	96.8	98.0	95.4	98.6	96.3	97.5
As(ppm)	290	300	134	214	241	290	280	164	191	330	88	211
Ba	1500	1900	3000	2800	2200	1500	1600	1200	5600	2100	3400	1400
Cd	5.4	4.0	8.8	2.6	4.0	5.8	6.1	4.1	3.0	4.9	2.8	4.2
Co	810	1000	650	1800	1400	900	950	780	1900	750	1000	770
Cr	4	8	31	3	4	6	3	21	17	10	23	21
Mo	810	670	720	800	840	890	920	300	660	1300	178	430
Pb	1800	1900	1600	1700	1800	2000	2100	1000	1800	2000	1300	1300
Sr	1600	1800	1200	2000	1800	1600	1600	1400	2100	1600	1800	1500
V	710	730	530	680	710	710	710	430	800	870	460	670
Y	165	187	370	410	290	163	153	237	203	128	510	188
Zn	810	820	1300	770	770	810	820	580	810	730	820	740
γ	1.027	1.041	1.031	1.010	1.023	1.021	1.018	1.007	1.034	1.000	1.024	1.012
Sampled	Young	Bulk	Bulk	Young	Old	Bulk	Top	Top	Bulk	Old	Young	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	017084	017085	017085	017085	017085	017086	017087†	017087	017088	017088	017088	017089
Latitude	6.263	6.290	6.290	6.290	6.290	9.164	9.172	9.172	9.179	9.179	9.179	9.166
Longitude	-162.963	-162.970	-162.970	-162.970	-162.970	-164.842	-164.826	-164.826	-164.830	-164.830	-164.830	-164.798
Depth	2887	2486	2486	2486	2486	2291	1853	1853	1263	1263	1263	1427
Lab#	W-229274	W-228972	W-228973	W-229275	W-229279	W-228968	W-228963	W-228971	W-228962	W-228965	W-228980	W-228961
SiO_2(wt.%)	9.91	5.31	5.06	5.28	4.96	8.25	39.3	5.40	2.60	2.06	3.68	2.52
TiO_2	1.96	2.01	1.95	1.74	1.91	1.54	2.54	2.07	1.70	1.44	1.86	1.51
MnO_2	35.6	39.2	39.7	42.7	41.9	39.0	.47	46.2	50.0	47.8	48.5	46.8
Fe_2O_3	26.9	29.5	30.1	27.3	27.4	26.8	11.0	18.6	18.4	16.5	21.1	15.6
Al_2O_3	1.76	.91	.67	.59	.65	.93	15.4	1.39	.44	.41	.58	.63
Co_3O_4	.894	.674	.738	.782	.869	1.02	.022	2.11	1.85	1.36	1.91	1.86
NiO	.542	.495	.480	.599	.572	.533	.016	.796	.864	.870	.801	.773
CuO	.094	.133	.108	.060	.092	.065	.005	.092	.047	.050	.052	.066
CaO	4.50	3.78	3.74	3.78	3.80	3.69	11.1	4.19	3.93	7.55	4.15	7.70
MgO	1.74	1.70	1.68	1.75	1.70	1.80	1.14	2.03	2.12	2.03	2.05	2.15
Na_2O	2.32	2.08	2.10	2.39	2.28	2.51	4.02	2.69	2.53	2.36	2.53	2.44
K_2O	.60	.50	.47	.47	.47	.59	3.36	.89	.65	.64	.64	.76
CO_2	.74	.53	.54	.52	.59	.59	.80	.49	.49	.89	.50	.84
P_2O_5	1.35	1.00	1.03	.95	.89	1.19	5.97	1.10	.94	3.27	1.14	3.42
H_2O+	8.4	8.6	9.0	10.0	8.9	8.0	2.9	9.8	8.4	8.0	8.2	8.3
H_2O-	13.2	15.2	15.1	12.9	15.4	18.8	2.9	18.5	14.6	16.6	15.8	12.8
Sum	97.2	96.4	97.4	98.8	96.9	96.5	98.1	97.9	95.0	95.2	97.6	95.3
As(ppm)	250	260	270	320	330	270	196	25	192	249	260	195
Ba	1500	2700	2700	2200	2000	1400	1700	550	1900	1700	1600	2300
Cd	3.0	2.7	2.8	3.1	2.6	3.4	5.9	<.1	5.9	5.6	6.6	4.7
Co	940	1200	1200	1100	910	790	1200	97	1600	1100	1100	1300
Cr	42	6	11	7	5	15	15	87	7	14	12	52
Mo	360	820	790	720	680	500	710	<4	780	780	850	1100
Pb	1200	1400	1400	1300	1400	1400	1800	24	2200	2100	2200	1800
Sr	1500	2000	2000	2000	2000	1600	1600	760	1800	1800	1800	1700
V	580	990	930	830	820	760	690	237	730	750	740	750
Y	196	200	189	177	207	197	160	32	340	154	141	229
Zn	690	1100	1000	900	790	730	820	260	900	830	830	790
γ	1.014	1.023	1.013	.998	1.017	1.022	1.005	1.008	1.037	1.035	1.010	1.034
Sampled	Bulk	Bottom	Middle	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Young	Old	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	017093	017093	017095	017095	017096	017096	017097	017098	017098	017099	017099	017101
Latitude	9.225	9.225	9.247	9.247	9.247	9.247	9.247	9.247	9.247	9.200	9.200	9.716
Longitude	-164.780	-164.780	-164.846	-164.846	-164.846	-164.846	-164.846	-164.846	-164.846	-164.929	-164.929	-162.167
Depth	1456	1456	-	-	-	-	-	-	-	-	-	1602
Lab#	W-228974	W-228983	W-228964	W-228970	W-228966	W-228967	W-228979	W-228969	W-228975	W-228976	W-228978	W-229273
SiO_2(wt.%)	3.05	2.66	2.75	2.79	2.57	2.05	4.08	2.00	3.20	1.60	2.13	3.38
TiO_2	1.89	1.88	1.76	1.75	1.69	1.50	1.46	1.39	1.99	1.23	1.65	1.62
MnO_2	45.9	49.9	41.0	49.6	50.0	40.1	50.4	41.1	47.9	47.4	52.8	43.3
Fe_2O_3	19.5	21.1	18.2	19.0	19.1	16.2	16.8	16.6	20.7	15.1	16.7	17.2
Al_2O_3	.54	.35	.56	.49	.34	.30	1.01	.42	.49	.29	.34	.83
Co_3O_4	1.38	1.85	1.11	1.91	1.95	1.08	2.52	.880	1.80	1.02	2.51	1.75
NiO	.730	.806	.651	.869	.835	.651	.934	.718	.804	.954	1.019	.745
CuO	.072	.050	.048	.047	.045	.038	.051	.049	.059	.044	.058	.069
CaO	7.19	4.08	10.8	4.14	3.86	12.4	3.75	12.3	3.89	10.2	3.74	8.82
MgO	1.86	2.04	1.81	2.17	2.10	1.66	2.76	1.73	2.04	1.90	2.28	2.02
Na_2O	2.33	2.47	2.16	2.49	2.55	2.16	2.68	2.10	2.49	2.26	2.74	2.31
K_2O	.59	.62	.53	.64	.62	.51	.73	.52	.65	.63	.71	.58
CO_2	.87	.47	1.14	.48	.47	1.59	.37	1.53	.39	1.15	.41	.98
P_2O_5	2.85	.94	5.42	1.13	.93	6.30	.83	6.17	.99	4.64	.79	4.00
H_2O+	7.9	9.1	7.7	8.5	8.6	8.3	8.4	6.6	8.4	7.7	8.0	8.2
H_2O-	16.3	14.7	12.0	15.1	16.2	12.0	14.2	14.9	14.5	14.6	16.3	11.2
Sum	96.7	98.4	95.7	96.0	95.7	94.9	96.8	94.2	95.9	96.1	95.9	95.9
As(ppm)	203	223	182	260	182	227	233	176	222	176	203	237
Ba	2000	1800	1900	1600	1800	1600	1400	2000	1900	2100	1600	3400
Cd	4.4	5.0	4.0	6.2	3.7	5.7	6.9	3.8	5.3	5.6	7.0	4.4
Ce	1600	1300	1400	1200	1500	1200	890	1400	1300	1800	1200	1200
Cr	13	8	17	8	7	6	34	5	13	5	8	8
Mo	850	860	700	780	720	800	800	800	770	1000	810	710
Pb	1800	2000	1700	2100	1600	2100	2100	1500	2100	1900	2200	1800
Sr	1900	1900	1900	1600	1900	1800	1500	1900	1900	1900	1600	1700
V	750	770	680	720	660	740	650	710	760	750	660	610
Y	250	141	310	141	250	131	140	400	140	390	143	237
Zn	860	810	820	820	810	780	800	880	870	1100	900	780
γ	1.020	1.002	1.031	1.027	1.030	1.039	1.019	1.047	1.028	1.026	1.029	1.029
Sampled	Old	Young	Old	Young	Young	Old	Top	Old	Young	Old	Young	-
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	017102	017103	017104	019001	019002	019006	019007	019008	020004	020005	020006	020006
Latitude	9.223	2.755	2.767	6.667	7.333	7.250	7.250	7.250	8.747	8.747	8.755	8.755
Longitude	-164.858	-165.022	-165.017	172.417	172.333	171.008	171.008	171.008	169.738	169.738	169.792	169.792
Depth	1420	1326	1298	1700	1260	2250	2250	2250	3550	3550	2900	2900
Lab#	W-228977	W-222561	W-222562	W-231387	W-231388	D1-1	D1-3	D1-8	D4-3	D4-4	D6-1-A	D6-1-B
SiO_2(wt.%)	1.82	2.21	8.76	14.0	4.06	7.12	7.38	4.40	37.1	14.8	4.70	3.18
TiO_2	1.60	1.19	.70	2.55	1.50	1.83	1.77	1.97	2.80	2.43	2.49	1.45
MnO_2	54.5	44.6	43.5	30.7	40.7	44.9	43.5	50.1	10.3	33.9	46.6	34.3
Fe_2O_3	15.1	19.7	19.2	19.9	16.8	22.5	25.3	20.8	19.1	23.1	22.3	20.9
Al_2O_3	.28	.56	1.81	4.48	1.17	1.48	1.24	.72	11.3	3.90	.99	.76
Co_3O_4	2.45	.938	.703	1.24	1.09	1.87	1.54	2.31	.184	1.22	1.69	.447
NiO	1.127	.673	1.436	.535	.674	.715	.649	.854	.113	.475	.984	.674
CuO	.067	.059	.126	.059	.089	.034	.037	.036	.031	.073	.121	.126
CaO	3.68	7.57	2.86	5.62	10.7	4.31	4.11	4.26	5.19	4.09	4.29	15.4
MgO	2.37	1.84	3.38	2.25	1.94	2.00	1.91	2.13	2.31	2.21	2.20	1.59
Na_2O	2.74	2.09	2.64	2.27	1.88	2.70	2.59	2.90	2.99	2.87	2.42	2.21
K_2O	.73	.58	.78	1.21	.76	.81	.71	.56	2.43	1.15	.68	.47
CO_2	.38	.93	.46	.56	1.04	.84	.79	.73	.80	.51	.91	1.99
P_2O_5	.70	3.10	.94	2.28	5.43	1.07	1.14	.97	.98	.97	.79	7.92
H_2O+	8.4	13.5	11.0	8.8	8.5	7.4	8.9	8.2	3.9	-	7.3	6.1
H_2O-	17.6	18.7	16.7	14.4	11.3	27.0	25.5	27.0	11.1	19.6	27.6	20.7
Sum	96.0	99.5	98.4	96.4	96.3	99.6	101.6	100.9	99.5	-	98.5	97.5
As(ppm)	170	270	216	175	226	280	310	270	98	224	109	202
Ba	1700	2100	2500	1200	3800	1100	1200	1200	470	1200	1900	2100
Cd	7.9	4.8	11.8	3.4	5.1	5.6	5.0	2.6	.6	3.2	2.6	2.9
Ce	1000	1200	280	840	1700	1000	980	1100	300	1100	900	1400
Cr	0	5	30	75	23	5	8	3	79	57	7	7
Mo	860	890	470	370	990	420	430	510	82	350	320	380
Pb	2100	2000	820	1400	2300	1600	1600	1600	440	1400	850	1400
Sr	1600	1800	1100	2500	1700	1500	1600	1500	730	1200	1500	1800
V	630	810	500	570	700	640	710	630	400	560	400	570
Y	120	280	120	260	430	192	215	192	75	162	330	790
Zn	910	870	1100	630	870	820	770	850	330	610	840	760
γ	1.028	.990	1.002	1.023	1.024	.990	.970	.977	.991	-	1.001	1.012
Sampled	-	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	0-10mm	10-20mm
Interval	-	0-5mm	0-2mm	-	-	0-2mm	0-2mm	0-2mm	0-2mm	0-5mm	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	020006	020007	020007	020007	020007	020008	020009	020009	020009	020010	020010	020010
Latitude	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755	8.755
Longitude	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792	169.792
Depth	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900	2900
Lab#	D6-1-C	D6-2-A	D6-2-B	D6-2-C	D6-2-D	D6-4-A	D6-6-A	D6-6-B	D6-6-C	D6-13-A	D6-13-B	D6-13-C
SiO_2(wt.%)	2.17	8.29	12.0	6.39	3.41	6.43	4.48	8.73	5.49	5.73	10.0	6.66
TiO_2	1.01	1.87	2.36	2.30	1.49	1.52	1.47	2.23	2.30	1.71	2.22	2.25
MnO_2	27.3	41.7	34.2	42.0	38.2	41.2	47.9	41.2	42.5	44.1	38.2	39.6
Fe_2O_3	12.7	27.0	29.0	26.8	18.8	28.8	24.7	26.8	28.3	26.2	27.7	28.2
Al_2O_3	.90	1.31	2.89	1.40	.66	.86	.49	1.87	1.19	.77	2.00	1.47
Co_3O_4	.350	1.07	.718	1.06	.644	.969	1.22	.909	.785	1.15	.867	.926
NiO	.683	.612	.556	.666	.696	.512	.692	.621	.617	.626	.673	.623
CuO	.161	.069	.113	.152	.126	.071	.053	.135	.197	.091	.148	.221
CaO	26.4	3.61	3.81	3.77	13.9	3.81	4.14	3.81	4.16	3.80	3.37	3.64
MgO	1.61	1.84	1.79	1.91	1.59	1.96	1.87	1.77	1.76	1.88	1.80	1.80
Na_2O	1.93	2.45	2.39	2.20	2.30	3.09	2.47	2.41	2.08	2.50	2.39	2.31
K_2O	.42	.56	.79	.57	.45	.52	.59	.73	.55	.51	.72	.57
CO_2	4.32	.67	.66	.60	1.64	.58	.67	.55	.63	.66	.56	.56
P_2O_5	13.64	1.01	1.27	.97	7.24	1.14	1.06	.85	1.02	1.00	.78	.81
H_2O+	5.8	7.5	8.4	8.4	7.2	7.5	7.5	8.2	8.0	7.4	7.5	7.6
H_2O-	14.3	25.2	22.2	21.7	19.6	25.5	26.4	22.1	23.7	26.8	26.2	26.5
Sum	99.5	99.5	100.9	99.3	98.4	99.0	99.3	100.9	99.6	98.1	98.9	97.3
As(ppm)	249	199	219	270	300	350	250	290	340	244	290	330
Ba	1900	1900	1800	2300	1600	1200	1900	2800	1300	1800	2400	1500
Cd	5.7	3.3	3.0	4.3	4.0	3.6	3.5	3.1	4.4	3.7	3.1	3.8
Co	1500	1400	950	1200	840	890	940	1300	750	1000	1200	830
Cr	9	6	17	9	33	3	22	5	3	22	9	11
Mo	480	570	300	540	510	500	460	600	720	370	500	590
Pb	1800	1400	1400	1700	1700	1600	1400	1400	1900	1300	1400	1800
Sr	1500	1900	1500	1800	1700	1600	1700	2000	1800	1500	1600	1600
V	570	620	570	750	760	770	650	830	840	580	790	750
Y	180	270	193	153	187	201	167	157	217	149	117	205
Zn	950	770	780	970	740	660	850	1100	680	720	880	720
γ	.991	.991	.978	.993	1.002	.996	.993	.978	.990	1.005	.997	1.014
Sampled	Mn-P_2O_5	Botryoids	7-15mm	20-40mm	40-60mm	Bulk	0-10mm	10-25mm	25-35mm	Porous	5-25mm	25-45mm
Interval	cement	0-7mm	-	-	-	0-5mm	-	-	-	0-5mm	-	-

Sequence#	036001	039001	041001	043001	046001	047001	047003	047004	047005	047006	047007	047008
Latitude	.542	15.340	10.895	15.483	13.042	10.367	10.400	10.600	11.458	11.483	11.458	12.550
Longitude	2.483	-21.850	-45.297	-64.083	-97.067	-108.383	-108.433	-108.800	-103.300	-103.217	-103.233	-103.267
Depth	2652	-	4640	1086	3888	3140	3843	4592	1498	1235	1408	1240
Lab#	W-222718	W-231374	W-222720	W-228415	W-231351	W-222681	W-222682	W-222579	W-222541	W-222542	W-222543	W-222544
SiO_2(wt.%)	24.3	4.31	16.3	9.27	29.0	18.0	30.4	25.5	25.4	18.3	20.5	19.5
TiO_2	.83	1.65	.88	.85	.78	1.36	.09	1.39	.65	.75	.47	.79
MnO_2	19.0	20.3	19.9	27.1	23.6	27.1	27.1	28.5	18.8	22.6	19.0	21.1
Fe_2O_3	27.5	34.6	35.0	30.2	19.5	29.7	24.8	16.5	29.0	34.1	34.5	32.0
Al_2O_3	6.24	3.04	5.54	4.38	7.15	3.90	.82	7.19	6.23	4.43	4.75	4.39
Co_3O_4	.225	.793	.250	.379	.048	.187	.023	.157	.045	.103	.054	.097
NiO	.450	.193	.218	.546	.540	.334	.382	.602	.242	.255	.173	.254
CuO	.354	.036	.089	.078	.172	.153	.153	.823	.117	.110	.104	.072
CaO	1.24	10.6	2.05	4.38	3.56	3.80	.78	1.94	4.22	3.63	3.15	5.07
MgO	3.32	2.55	2.23	3.46	2.49	2.11	2.88	2.87	2.60	2.08	1.72	1.99
Na_2O	2.59	1.26	1.59	1.62	3.08	2.84	2.83	2.77	2.69	2.57	2.90	2.30
K_2O	1.14	.38	.60	.68	1.09	.60	2.72	1.53	.84	.74	.81	.81
CO_2	.11	4.42	.45	2.20	.18	.48	.06	.14	.31	.44	.47	1.62
P_2O_5	.49	2.61	1.09	1.12	.60	.89	.16	.45	.82	1.04	1.05	1.03
H_2O+	9.1	6.6	9.8	11.1	7.2	7.4	7.0	8.9	6.3	7.7	7.8	7.6
H_2O-	15.2	14.1	18.2	13.7	12.8	20.0	10.1	13.3	15.7	20.3	19.2	19.9
Sum	96.9	93.3	95.9	97.4	99.1	98.8	100.2	99.2	98.2	98.9	97.5	98.6
As(ppm)	142	480	430	570	161	238	32	81	178	260	235	225
Ba	1400	1500	930	1700	1300	1400	580	3000	1200	1300	1400	1200
Cd	1.7	4.0	2.4	4.5	3.7	2.9	8.3	2.3	2.7	2.5	3.1	2.6
Co	1300	2900	1600	780	310	550	47	280	154	290	210	260
Cr	67	57	28	60	44	14	3	22	57	34	27	42
Mo	<5	310	280	380	300	280	200	108	100	188	90	150
Pb	1000	1900	980	930	172	380	<55	196	190	290	136	250
Sr	840	1400	1000	1300	890	1300	211	620	1000	1200	1100	1200
V	440	1200	940	1000	500	610	75	420	450	580	540	540
Y	64	151	171	174	115	188	20	57	116	163	136	150
Zn	710	550	550	790	570	590	870	670	650	650	660	640
γ	1.018	1.056	1.028	1.013	.995	.998	.984	.994	1.004	.997	1.011	1.000
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-14mm	0-15mm	0-24mm	0-5mm	0-35mm	-	-	0-12mm	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	047010	047011	047013†	047014†	047015	047016	047017	047018	047020	047021	047022†	047023
Latitude	12.733	12.717	13.400	13.358	13.022	12.983	13.767	13.767	13.447	12.723	12.745	13.012
Longitude	-102.583	-102.583	-102.517	-102.467	-100.817	-100.817	-101.875	-101.872	-102.610	-102.513	-102.562	-100.848
Depth	1450	1020	887	630	1340	1342	928	990	3424	2700	2202	2381
Lab#	W-222545	W-222546	W-222547	W-222548	W-222549	W-222550	W-222551	W-222552	W-222506	W-222507	W-222508	W-222509
SiO_2(wt.%)	19.3	19.5	47.1	48.8	16.4	21.6	13.9	9.76	23.4	24.4	49.0	16.1
TiO_2	.89	1.28	1.32	2.20	.35	.63	1.47	1.34	.44	.58	1.23	.80
MnO_2	23.8	29.3	1.55	.24	41.0	22.1	28.1	35.3	16.5	18.2	.26	28.1
Fe_2O_3	29.9	22.2	10.9	13.0	20.2	29.0	33.2	29.2	34.5	32.7	10.6	30.8
Al_2O_3	5.15	6.06	15.4	14.7	3.97	5.94	2.65	2.14	5.97	5.67	17.0	3.71
Co_3O_4	.141	.332	.049	.004	.064	.082	.608	.737	.041	.077	.007	.190
NiO	.314	.441	.026	.004	.669	.272	.227	.520	.158	.211	.011	.323
CuO	.078	.068	.007	.002	.322	.134	.021	.040	.171	.136	.016	.122
CaO	3.81	2.69	11.5	10.6	1.80	3.34	3.03	3.14	2.24	2.88	12.9	3.26
MgO	2.06	3.83	6.41	4.70	2.91	1.79	1.86	1.92	1.81	1.97	5.53	1.68
Na_2O	2.33	2.44	2.75	3.55	2.34	2.26	2.17	2.51	2.82	2.54	2.99	2.55
K_2O	.92	1.18	.34	.62	1.14	.10	.78	.60	1.02	.89	.32	.82
CO_2	.99	.53	-	.01	.41	.88	.42	.46	.20	.20	.01	.51
P_2O_5	.92	.71	.19	.30	.48	.89	1.29	1.24	1.00	.88	.10	1.07
H_2O+	9.5	8.0	1.5	1.2	9.8	10.9	9.6	10.3	7.0	6.1	1.0	7.5
H_2O-	22.9	22.1	1.7	1.3	14.4	20.5	21.6	24.2	19.6	21.7	1.1	21.1
Sum	100.1	98.5	-	100.1	101.9	100.0	99.2	99.2	97.3	97.4	101.0	97.5
As(ppm)	182	128	14	16	11	189	310	290	224	217	21	280
Ba	1100	950	45	36	4200	1400	1300	1300	1400	1500	28	1500
Cd	1.8	12.5	<.1	<.1	6.0	2.1	2.2	3.7	2.6	2.4	.4	2.8
Co	380	580	59	29	175	280	1300	1300	174	230	<9	480
Cr	40	57	370	213	18	18	55	19	25	47	350	13
Mo	221	205	<4	<4	210	189	340	440	93	54	<4	390
Pb	320	630	36	<9	70	189	1400	1300	224	270	44	380
Sr	1200	960	224	213	960	1100	1500	1600	920	1200	121	1500
V	520	420	300	400	560	530	730	740	550	520	310	670
Y	156	103	32	38	82	138	204	185	124	111	28	203
Zn	610	760	112	122	1100	590	590	650	610	730	152	650
γ	.985	1.001	-	.985	.968	.986	.993	.994	1.014	1.012	.977	1.011
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-22mm	0-9mm	-	-	0-16mm	0-11mm	0-5mm	0-7mm	-	-	-	-

Sequence#	047024	047025	047026	047027	047028	047029	047030	047031	051001	051003	052001	052003
Latitude	12.962	12.260	12.567	12.037	11.418	11.963	11.263	11.240	11.017	14.417	18.350	18.699
Longitude	-100.900	-100.507	-100.363	-101.600	-101.625	-101.617	-101.088	-101.125	-140.142	-145.867	-158.450	-158.380
Depth	3478	2600	3317	3070	3034	2900	3205	3050	4602	4618	1317	3261
Lab#	W-222510	W-222511	W-222512	W-222513	W-222514	W-222515	W-222516	W-222517	W-222700	W-229850	W-222531	W-228990
SiO_2(wt.%)	18.3	36.4	15.1	18.4	22.0	21.8	18.8	11.8	11.0	11.3	10.3	15.4
TiO_2	.51	1.56	.38	.49	.44	.41	.52	.30	1.64	2.07	1.33	3.24
MnO_2	24.2	10.9	43.6	22.6	29.5	27.7	36.9	54.4	35.8	39.2	39.8	24.1
Fe_2O_3	33.3	18.7	18.0	34.3	22.6	27.0	17.9	9.05	28.2	22.8	21.8	34.5
Al_2O_3	4.38	11.9	4.29	3.99	6.01	4.81	5.46	4.36	2.51	2.73	3.38	3.32
Co_3O_4	.069	.077	.046	.090	.071	.082	.057	.026	.448	.565	.649	.457
NiO	.259	.143	.738	.281	.706	.623	.858	1.007	.611	.576	.607	.206
CuO	.135	.052	.378	.215	.318	.352	.407	.637	.269	.425	.055	.120
CaO	2.65	5.82	2.35	2.27	2.12	1.94	2.36	1.93	3.06	3.37	5.19	3.22
MgO	1.62	4.79	2.18	1.87	3.07	2.66	2.87	3.50	1.91	1.92	3.07	1.67
Na_2O	2.58	3.13	3.50	2.73	2.67	2.56	3.04	2.59	1.88	2.47	3.84	2.08
K_2O	.84	1.14	.93	.75	1.07	1.03	1.06	1.23	.69	.89	.89	.71
CO_2	.34	.18	.23	.18	.10	.11	.13	.11	.43	.39	.77	.45
P_2O_5	.96	.59	.55	.93	.48	.59	.55	.31	.78	.63	1.09	1.09
H_2O+	6.9	6.7	7.1	9.5	7.6	6.6	7.6	7.7	7.3	8.7	4.6	8.1
H_2O-	21.4	11.1	17.2	18.6	13.5	18.3	16.9	11.5	20.9	20.4	24.5	13.5
Sum	97.0	102.1	99.3	98.5	98.8	98.2	98.5	98.8	96.6	98.0	97.4	98.7
As(ppm)	270	97	145	246	101	147	132	76	240	176	199	173
Ba	1400	600	1400	2200	2300	2200	2000	3300	1500	1900	2600	1900
Cd	2.5	1.7	8.7	3.6	4.6	5.6	10.6	12.4	3.9	3.6	4.4	2.1
Co	280	203	169	270	162	184	205	113	1100	1600	2100	1600
Cr	12	124	9	10	37	21	25	10	16	3	20	29
Mo	280	350	350	184	98	135	320	340	390	400	700	173
Pb	153	169	112	233	113	171	156	78	1100	1000	2500	1400
Sr	1200	670	820	1400	880	920	870	680	1300	1400	1600	1400
V	600	320	430	640	460	470	420	410	660	600	740	650
Y	165	81	89	147	65	70	77	45	177	126	83	220
Zn	620	380	1600	850	980	950	1600	1800	1100	680	860	760
γ	1.017	.966	.993	1.001	.998	1.004	1.001	.998	1.021	1.006	1.012	.999
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	0-1mm	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	052005	052005	052005	052005	052006	052006	052006	052007	052007	052008	052009	052010
Latitude	18.643	18.643	18.643	18.643	18.643	18.643	18.643	18.643	18.643	18.643	18.637	18.637
Longitude	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.313	-158.313
Depth	1924	1924	1924	1924	1924	1924	1924	1924	1924	1924	2002	2002
Lab#	W-228954	W-229243	W-229244	W-229245	W-229246	W-229247	W-229280	W-228991	W-229248	W-229249	W-229250	W-229251
SiO_2(wt.%)	12.4	15.2	15.6	13.8	13.1	14.3	13.2	14.7	11.0	14.4	10.7	10.7
TiO_2	2.48	2.54	2.29	2.02	1.98	1.39	2.34	2.11	2.29	2.18	2.14	2.15
MnO_2	28.8	29.2	29.5	32.7	32.2	31.8	31.7	30.4	32.0	32.8	31.4	32.8
Fe_2O_3	33.4	27.7	26.8	26.3	27.1	25.8	29.1	27.7	31.2	24.2	31.5	29.6
Al_2O_3	1.95	3.51	3.73	3.10	3.13	4.07	2.61	3.46	1.72	3.59	1.71	1.84
Co_3O_4	.607	.723	.618	.646	.611	.450	.685	.769	.708	.670	.594	.686
NiO	.254	.367	.390	.412	.395	.479	.342	.411	.323	.422	.307	.343
CuO	.068	.119	.171	.203	.173	.314	.146	.133	.069	.215	.102	.120
CaO	3.10	3.44	3.37	3.38	3.46	3.48	3.47	3.22	3.33	3.79	3.24	3.31
MgO	1.63	1.84	1.75	1.63	1.70	1.74	1.67	1.66	1.65	1.67	1.60	1.61
Na_2O	2.12	2.32	2.37	2.40	2.38	2.47	2.40	2.51	2.21	2.47	2.10	2.14
K_2O	.55	.79	.89	.82	.83	1.17	.65	1.22	.54	.88	.50	.58
CO_2	.48	.44	.43	.46	.47	.41	.50	.47	.45	.54	.52	.52
P_2O_5	1.10	.95	.94	.85	.92	.91	.99	1.03	1.01	.84	.95	.94
H_2O+	8.6	6.4	8.6	8.3	8.9	9.2	9.0	9.4	8.0	8.1	8.8	9.3
H_2O-	14.7	13.4	11.9	13.5	13.1	12.3	14.5	13.2	13.4	12.6	12.9	14.6
Sum	97.4	95.6	97.4	97.0	97.4	97.9	98.8	99.3	96.4	96.8	96.2	96.6
As(ppm)	227	231	243	246	245	260	280	161	310	217	310	280
Ba	2400	2100	1900	1800	1900	2000	2000	2200	1500	1800	1600	1500
Cd	2.5	2.5	2.5	2.5	2.3	2.2	2.3	2.5	2.4	2.9	2.3	2.9
Co	1100	1100	1200	1100	810	1100	1100	1100	1100	1100	1100	1100
Cr	25	38	13	16	6	13	16	14	14	14	10	10
Mo	280	280	360	290	400	370	350	370	370	290	390	370
Pb	1100	1300	1000	1600	550	890	1200	1400	1500	1000	1400	1400
Sr	1400	1400	1500	1600	1400	1500	1600	1600	1500	1500	1600	1500
V	540	550	570	690	550	600	630	680	660	530	670	590
Y	227	231	220	246	171	219	234	219	231	101	230	231
Zn	650	650	660	740	700	660	630	690	670	650	710	660
γ	1.012	1.031	1.013	1.016	1.012	1.007	.998	.993	1.023	1.019	1.025	1.021
Sampled	Top	Bulk	Bulk	Bottom	Bulk	Bottom	Top	-	Bulk	Top	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052010	052011	052012	052015	052015	052015	052016	052016	052016	052017	052017	052017
Latitude	18.637	18.637	18.637	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.683
Longitude	-158.313	-158.313	-158.313	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314
Depth	2002	2002	2002	1047	1047	1047	1047	1047	1047	1047	1047	1047
Lab#	W-229252	W-229253	W-229254	W-229255	W-229256	W-229257	W-229258	W-229276	W-229277	W-229259	W-229260	W-229278
SiO_2(wt.%)	10.4	12.5	9.83	5.90	6.98	5.33	8.69	7.47	10.3	6.67	4.33	6.31
TiO_2	2.28	2.46	2.18	1.81	2.25	1.72	2.18	2.24	1.40	1.96	1.41	1.77
MnO_2	34.2	29.5	34.2	38.2	41.6	37.0	39.7	42.0	28.1	40.7	32.5	36.2
Fe_2O_3	28.9	31.5	29.4	21.2	23.5	18.7	22.3	23.0	17.0	22.4	16.0	20.6
Al_2O_3	1.84	2.25	1.68	1.38	1.47	1.37	2.07	1.56	3.15	1.61	1.15	1.60
Co_3O_4	.834	.607	.708	.740	1.06	.603	.984	1.03	.445	.877	.514	.690
NiO	.412	.276	.353	.544	.607	.563	.661	.687	.610	.658	.452	.545
CuO	.109	.079	.133	.145	.131	.227	.155	.158	.259	.173	.153	.169
CaO	3.38	3.28	3.33	8.57	3.84	12.2	4.18	3.80	13.7	5.63	16.8	10.1
MgO	1.72	1.63	1.61	1.59	1.76	1.54	1.82	1.77	1.63	1.72	1.40	1.59
Na_2O	2.18	2.11	2.14	2.15	2.31	2.15	2.44	2.52	2.22	2.37	1.81	2.29
K_2O	.60	.59	.57	.57	.67	.62	.80	.65	1.12	.65	.51	.54
CO_2	.45	.43	.47	1.02	.51	1.36	.44	.46	1.54	.66	1.93	1.20
P_2O_5	.95	.97	.90	3.84	1.23	6.04	1.22	1.00	7.52	2.08	8.65	4.88
H_2O+	8.9	8.9	9.4	9.0	10.0	7.9	8.6	9.0	7.8	9.2	7.7	8.0
H_2O-	13.5	12.5	13.5	13.5	14.1	11.9	11.4	13.0	8.2	13.0	9.9	11.2
Sum	97.2	97.1	96.9	96.7	97.9	97.4	96.1	97.3	96.9	97.3	95.3	96.4
As(ppm)	290	300	310	216	249	330	142	260	280	178	237	280
Ba	1600	1600	1600	2300	2000	1900	5000	1900	2000	2800	2100	2000
Cd	2.3	2.6	2.5	2.7	3.1	3.5	2.1	3.4	2.9	2.4	3.0	3.3
Co	1100	1100	1100	1400	1300	1200	1100	1100	1300	1400	1400	1100
Cr	8	19	6	4	5	8	9	7	6	28	11	6
Mo	370	310	400	540	590	660	360	500	560	570	560	600
Pb	1300	1500	1300	1100	1500	1500	990	1400	1500	1400	1400	1300
Sr	1500	1500	1600	1700	1600	1900	1700	1600	1700	1800	1800	1700
V	630	630	670	560	670	700	490	590	680	630	660	690
Y	223	217	220	340	185	175	410	147	138	244	214	172
Zn	690	720	680	740	720	710	730	760	760	710	690	720
γ	1.014	1.016	1.017	1.020	1.007	1.013	1.026	1.013	1.018	1.013	1.035	1.022
Sampled	Bulk	Bulk	Bulk	Bulk	Young	Old	Bulk	Young	Old	Young	Old	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	052019	052023	052024	052025	052026	052027	052028	052029	052030	052031	052032	052033
Latitude	19.481	18.637	18.635	18.635	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792
Longitude	-157.054	-158.313	-158.320	-158.320	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229
Depth	2750	2002	2760	2760	2013	2013	2013	2013	2013	2013	2013	2013
Lab#	W-234337	W-228958	W-235995	W-235996	W-236057	W-235997	W-235998	W-235999	W-236000	W-236001	W-236002	W-236003
SiO_2(wt.%)	12.2	13.8	19.7	25.0	17.5	17.7	14.1	13.7	21.8	27.9	17.2	28.0
TiO_2	2.10	2.20	1.50	1.53	2.43	1.97	1.98	1.89	1.48	.86	1.94	.78
MnO_2	31.6	30.6	28.8	22.6	28.1	28.7	35.0	25.1	25.8	20.4	28.4	21.3
Fe_2O_3	29.2	27.6	22.3	19.9	25.6	24.7	24.4	21.5	20.8	18.0	25.8	16.7
Al_2O_3	2.08	2.64	5.82	7.68	4.28	4.77	3.18	3.75	6.56	9.11	4.65	9.07
Co_3O_4	1.00	.630	.482	.395	.813	.633	.752	.466	.460	.275	.591	.296
NiO	.312	.412	.436	.355	.334	.394	.458	.378	.475	.499	.418	.407
CuO	.064	.174	.192	.233	.052	.146	.143	.200	.190	.337	.161	.243
CaO	3.12	3.01	2.91	4.42	3.04	3.10	3.70	10.7	2.64	3.07	3.17	3.34
MgO	1.70	1.76	1.57	1.66	1.72	1.68	1.67	1.51	1.60	1.60	1.87	1.36
Na_2O	2.30	2.25	2.99	3.01	3.01	2.72	2.48	2.23	3.31	3.64	2.53	3.74
K_2O	.72	.85	2.13	1.86	1.35	1.55	1.08	1.13	2.37	3.44	1.21	3.28
CO_2	.32	.42	.33	.40	.31	.34	.32	1.14	.35	.22	.31	.81
P_2O_5	.93	.85	.70	1.52	.96	.85	1.10	5.49	.67	1.23	.86	.55
H_2O+	10.0	8.2	4.3	5.1	5.5	6.1	5.7	2.2	5.8	4.6	5.9	6.2
H_2O-	18.3	13.5	15.3	13.9	16.2	16.1	16.7	12.4	14.2	10.8	14.7	12.5
Sum	97.7	95.3	94.1	95.7	95.1	95.4	96.0	91.4	94.4	95.2	95.0	96.1
As(ppm)	290	173	189	151	227	203	234	137	163	135	188	126
Ba	1500	2200	1900	2000	1400	1800	2000	5700	2100	2100	2200	1400
Cd	2.4	2.9	3.0	2.0	2.7	3.6	3.0	1.8	2.6	2.0	2.3	1.7
Ce	1600	1400	810	720	920	920	1300	960	680	620	900	580
Cr	15	19	25	10	20	24	11	9	14	4	23	5
Mo	320	400	320	221	270	310	500	270	270	235	246	229
Pb	2100	1600	760	600	1600	1100	1700	1000	700	570	880	470
Sr	1500	1500	1300	1300	1300	1300	1600	1600	1100	920	1300	960
V	600	680	530	460	570	570	680	530	480	400	530	350
Y	220	150	105	174	179	143	132	194	101	101	188	70
Zn	590	750	610	550	600	600	650	610	620	610	620	530
γ	1.009	1.034	1.047	1.031	1.037	1.034	1.027	1.078	1.045	1.036	1.038	1.026
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	7-11mm	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052034	052035	052036	052037	052038	052039	052040	052041	052042	052043	052044	052045
Latitude	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792	18.792
Longitude	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229	-158.229
Depth	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013	2013
Lab#	W-236004	W-236005	W-236006	W-236007	W-236008	W-236009	W-236010	W-236011	W-236012	W-236013	W-236014	W-236015
SiO_2(wt.%)	24.0	16.2	20.3	19.1	21.3	21.6	10.7	8.84	16.9	22.5	17.3	11.0
TiO_2	1.01	2.15	1.50	2.09	1.13	2.23	1.63	1.89	1.64	1.33	1.36	1.85
MnO_2	20.8	30.2	27.7	28.0	24.9	25.1	35.4	36.9	29.1	23.6	27.9	38.6
Fe_2O_3	17.5	21.9	22.1	22.6	23.7	22.2	27.2	28.0	24.1	21.8	25.7	21.0
Al_2O_3	7.01	4.38	6.03	5.38	6.37	6.39	2.54	1.51	4.62	6.95	4.78	2.46
Co_3O_4	.322	.702	.486	.558	.360	.543	.535	.882	.622	.402	.427	1.07
NiO	.387	.462	.469	.447	.351	.373	.439	.444	.432	.470	.399	.645
CuO	.225	.114	.187	.176	.187	.132	.253	.065	.191	.277	.247	.151
CaO	7.55	4.73	2.76	2.97	2.67	2.61	3.40	3.47	3.19	3.12	2.93	4.03
MgO	1.42	1.67	1.74	1.71	1.56	1.65	1.62	1.71	1.65	1.69	1.69	1.72
Na_2O	3.21	2.71	3.06	2.78	2.98	2.94	2.34	2.33	2.71	3.27	2.61	2.60
K_2O	2.52	1.52	2.00	1.62	2.16	2.09	.82	.71	1.61	2.61	1.47	1.15
CO_2	1.68	.44	.28	.29	.28	.25	.40	.40	.30	.51	.30	.25
P_2O_5	2.81	1.83	.69	.72	.76	.78	.76	1.03	1.02	.85	.77	1.22
H_2O+	5.0	6.6	6.9	6.2	6.3	6.4	6.4	6.4	6.5	5.9	5.9	5.9
H_2O-	11.1	14.6	13.2	14.6	13.1	14.8	16.0	19.7	14.6	18.7	13.9	17.1
Sum	95.5	95.6	96.2	94.6	95.1	95.2	94.5	94.5	94.6	95.3	93.9	93.6
As(ppm)	124	187	173	176	184	153	238	300	199	160	197	205
Ba	1600	1900	1800	4900	1800	1800	2000	1500	2000	2000	2100	1600
Cd	2.1	2.7	2.5	2.6	1.8	2.8	2.4	3.0	2.3	1.8	2.0	3.4
Ce	510	1100	880	850	780	800	1000	910	970	800	930	940
Cr	15	22	17	19	8	19	5	9	11	11	8	8
Mo	214	320	280	246	260	200	420	520	330	221	300	480
Pb	460	1500	850	1000	660	1200	770	1900	970	810	660	1300
Sr	1000	1300	1200	1400	1200	1200	1500	1600	1300	1000	1300	1400
V	370	540	470	490	490	520	650	720	550	500	570	590
Y	180	222	127	141	107	141	101	237	234	113	114	193
Zn	530	610	630	660	560	620	700	610	610	690	690	660
γ	1.033	1.031	1.025	1.042	1.037	1.036	1.043	1.044	1.043	1.035	1.051	1.053
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	052046	052047	052048	052049	052050	052051	052052	052053	052054	052055	052056	052057
Latitude	18.792	18.723	18.723	18.723	18.723	18.723	18.723	18.723	18.723	18.723	18.752	18.752
Longitude	-158.229	-158.312	-158.312	-158.312	-158.312	-158.312	-158.312	-158.312	-158.312	-158.312	-158.330	-158.330
Depth	2013	1350	1350	1350	1350	1350	1350	1350	1350	1350	2100	2100
Lab#	W-236016	W-236017	W-236018	W-236019	W-236020	W-236021	W-236022	W-236023	W-236024	W-236025	W-236026	W-236027
SiO_2(wt.%)	13.5	10.6	12.2	9.74	19.1	13.7	10.2	14.5	8.64	6.72	8.99	12.4
TiO_2	2.20	2.47	2.82	2.15	1.87	2.22	2.26	2.95	2.27	2.18	1.99	2.41
MnO_2	31.8	33.8	28.1	37.7	30.7	32.3	35.1	29.0	37.2	39.3	34.8	32.0
Fe_2O_3	26.5	27.6	32.1	23.9	18.2	22.8	27.5	27.7	25.7	26.8	30.3	28.8
Al_2O_3	2.91	2.02	2.42	2.36	5.59	3.46	1.77	3.46	1.79	1.00	1.32	2.59
Co_3O_4	.726	.859	.789	.949	.749	.890	.929	.912	.928	1.09	.806	.842
NiO	.401	.402	.292	.505	.625	.529	.434	.365	.433	.526	.377	.355
CuO	.138	.064	.026	.116	.205	.131	.061	.054	.090	.055	.055	.077
CaO	3.34	3.51	3.48	3.50	3.11	3.69	3.39	3.43	3.57	3.51	3.36	3.39
MgO	1.69	1.71	1.68	1.81	1.98	1.81	1.66	1.94	1.73	1.78	1.69	1.85
Na_2O	2.61	2.32	2.23	2.35	2.85	2.34	2.28	2.32	2.20	2.26	2.22	2.32
K_2O	.96	.64	.64	.72	1.93	.93	.67	.89	.63	.59	.60	.80
CO_2	.31	.19	.37	.35	.24	.20	.19	.24	.40	.22	.31	.32
P_2O_5	1.00	1.11	1.38	1.02	.83	1.17	1.06	1.12	1.14	1.07	1.08	1.00
H_2O+	6.0	6.4	6.1	5.7	3.6	5.6	6.3	5.8	7.0	6.2	6.9	5.9
H_2O-	17.5	17.6	17.2	16.8	14.5	15.8	17.9	16.4	17.8	22.6	15.5	17.5
Sum	94.1	93.7	94.6	92.8	91.6	91.7	93.8	94.6	93.7	93.2	94.8	95.0
As(ppm)	242	300	310	280	175	190	280	245	300	340	300	270
Ba	1900	1600	1600	1800	2900	14000	1600	1900	4000	1600	1500	1500
Cd	2.7	2.9	2.4	4.2	4.4	3.7	3.0	2.9	3.6	3.2	2.8	3.0
Ce	1100	1100	1200	950	700	900	1100	1100	970	1000	1100	1100
Cr	12	17	28	14	20	20	16	43	9	10	8	17
Mo	360	420	300	520	360	340	430	280	470	530	410	330
Pb	1300	1700	1900	1600	1100	1300	1700	1600	1800	1900	1900	1700
Sr	1500	1600	1600	1700	1300	2300	1600	1400	1700	1700	1700	1500
V	630	700	740	730	510	590	670	560	770	700	700	610
Y	230	206	217	144	90	154	219	203	170	233	249	206
Zn	630	590	600	620	640	610	580	590	620	590	690	630
γ	1.048	1.053	1.042	1.062	1.076	1.075	1.051	1.042	1.052	1.058	1.040	1.038
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052058	052059	052060	052061	052062	052063	052064	052065	052066	052067	052068	052069
Latitude	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752
Longitude	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330
Depth	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
Lab#	W-236028	W-236029	W-236030	W-236031	W-236032	W-236033	W-236034	W-236036	W-236037	W-235994	W-236038	W-236039
SiO_2(wt.%)	9.22	12.0	14.4	8.52	6.81	13.9	13.8	8.49	10.4	13.4	12.2	10.4
TiO_2	2.51	2.36	2.28	1.97	2.49	2.73	2.12	2.04	2.14	2.46	2.26	2.03
MnO_2	35.3	29.8	28.8	35.3	39.0	30.0	29.6	35.7	34.9	28.5	29.5	36.8
Fe_2O_3	27.3	32.9	28.4	29.7	26.0	29.6	29.9	28.3	27.2	32.2	32.0	24.6
Al_2O_3	1.57	2.05	3.21	1.19	.95	2.63	2.93	1.26	2.01	2.65	2.09	2.47
Co_3O_4	1.08	.600	.636	.811	1.30	.818	.577	.892	.930	.684	.546	1.05
NiO	.413	.258	.290	.387	.472	.345	.299	.386	.427	.282	.255	.491
CuO	.075	.057	.067	.051	.063	.077	.047	.040	.090	.075	.063	.105
CaO	3.71	3.28	3.52	3.37	3.67	3.23	3.37	3.58	3.65	3.20	3.38	3.86
MgO	1.85	1.68	1.75	1.70	1.84	1.89	1.70	1.77	1.77	1.70	1.66	1.82
Na_2O	2.43	2.15	2.37	2.28	2.64	2.32	2.30	2.42	2.42	2.16	2.21	2.55
K_2O	.70	.62	.76	.58	.62	.81	.68	.66	.69	.72	.60	.72
CO_2	.32	.33	.34	.35	.38	.32	.37	.45	.39	.29	.35	.37
P_2O_5	1.10	1.12	1.07	1.07	.99	1.00	1.08	1.22	1.13	1.07	1.19	1.10
H_2O+	5.9	5.2	6.1	7.5	7.7	13.5	6.6	6.8	7.1	6.3	7.4	6.6
H_2O-	23.0	16.0	16.5	14.4	16.4	15.1	15.0	17.6	16.5	14.4	15.2	14.4
Sum	93.5	94.3	94.0	94.8	94.9	103.2	95.4	94.0	95.3	95.7	95.7	94.9
As(ppm)	247	300	260	300	280	250	280	330	260	270	290	245
Ba	1800	1700	1400	1500	1700	1500	1500	1300	1400	1600	1800	1400
Cd	3.0	2.4	1.9	2.6	3.6	2.7	2.6	3.0	3.2	2.7	2.7	3.5
Ce	1400	1100	980	1100	1400	1200	990	1100	1100	1200	1000	1000
Cr	19	10	9	7	11	24	14	7	12	13	9	10
Mo	340	330	350	430	380	260	340	400	410	290	370	460
Pb	1700	1800	1600	1900	1800	1600	1600	1800	1700	1800	1700	1600
Sr	1600	1700	1600	1600	1700	1400	1500	1700	1600	1500	1700	1600
V	600	710	650	700	590	590	660	690	650	670	740	610
Y	260	250	216	245	227	224	235	243	228	234	248	222
Zn	600	670	590	620	600	640	620	580	590	630	660	550
γ	1.054	1.045	1.049	1.040	1.039	.956	1.034	1.049	1.035	1.030	1.030	1.039
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	052070	052071	052072	052073	052074	052075	052076	052077	052078	052079	052080	052081
Latitude	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752	18.752
Longitude	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330
Depth	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
Lab#	W-236040	W-236041	W-236042	W-236043	W-236044	W-236045	W-236046	W-236047	W-236048	W-236049	W-236050	W-236051
SiO_2(wt.%)	12.6	11.8	8.97	13.3	12.5	14.4	13.0	12.0	13.7	9.79	12.2	11.7
TiO_2	2.31	2.26	2.00	2.29	2.53	2.61	2.43	2.24	2.04	2.35	2.31	2.32
MnO_2	29.0	31.0	33.0	29.1	29.6	27.1	28.1	30.0	29.4	35.7	29.8	30.4
Fe_2O_3	32.7	30.4	31.7	31.1	31.0	31.0	32.9	31.7	28.1	26.6	32.5	32.2
Al_2O_3	2.06	2.07	1.05	2.64	2.34	2.81	2.33	2.05	2.94	1.74	2.04	1.95
Co_3O_4	.607	.745	.710	.602	.751	.742	.629	.665	.713	1.04	.678	.579
NiO	.269	.333	.355	.303	.321	.260	.256	.288	.318	.471	.286	.263
CuO	.053	.071	.052	.064	.073	.080	.059	.066	.057	.103	.064	.065
CaO	3.17	3.29	3.29	3.41	3.20	3.11	3.22	3.31	4.53	3.51	3.23	3.39
MgO	1.65	1.70	1.63	1.71	1.79	1.75	1.63	1.66	1.62	1.82	1.67	1.64
Na_2O	2.18	2.23	2.14	2.25	2.29	2.31	2.20	2.28	2.50	2.51	2.27	2.18
K_2O	.62	.63	.51	.68	.71	.77	.63	.60	.74	.73	.61	.61
CO_2	.35	.35	.42	.34	.34	.31	.33	.36	.41	.34	.35	.23
P_2O_5	1.16	1.09	1.17	1.17	1.08	1.04	1.11	1.12	1.80	1.04	1.11	1.16
H_2O+	7.2	6.9	7.1	7.9	6.7	7.2	6.3	6.9	6.7	6.6	6.7	7.4
H_2O-	14.8	15.9	17.5	11.8	12.9	11.9	15.6	16.0	15.9	16.3	15.6	13.0
Sum	95.9	94.9	94.1	96.8	95.3	95.5	95.1	95.2	95.5	94.4	95.9	96.1
As(ppm)	280	270	300	270	250	238	270	290	250	239	280	300
Ba	1800	1700	1700	1600	1600	1600	1800	1700	1400	1700	1700	1700
Cd	2.6	2.7	2.9	2.6	2.9	2.3	2.4	2.6	2.4	3.6	2.5	2.5
Co	1200	1200	1200	1100	1100	1200	1200	1100	1100	1200	1200	1000
Cr	12	11	9	16	18	20	13	13	12	19	14	9
Mo	320	330	410	320	260	227	270	330	330	380	300	380
Pb	1600	1700	1800	1600	1700	1600	1700	1700	1500	1700	1800	1600
Sr	1600	1500	1700	1600	1500	1500	1500	1500	1500	1600	1500	1600
V	690	670	740	680	620	590	660	680	620	590	660	740
Y	246	238	250	238	230	216	237	238	226	239	237	250
Zn	650	630	650	650	640	600	650	630	580	600	640	670
γ	1.028	1.039	1.048	1.018	1.035	1.032	1.036	1.036	1.033	1.044	1.028	1.026
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052082	052083	052084	052085	052086	052087	053001	053002	053003	053004	053005	053006
Latitude	18.752	18.752	18.752	18.752	18.752	18.752	18.300	18.783	18.783	19.367	19.350	10.293
Longitude	-158.330	-158.330	-158.330	-158.330	-158.330	-158.330	-161.767	-162.050	-162.050	-162.317	-162.167	-165.995
Depth	2100	2100	2100	2100	2100	2100	3111	4629	3147	4868	4209	1790
Lab#	W-236052	W-236035	W-236053	W-236054	W-236055	W-236056	W-222532	W-222533	W-222534	W-222535	W-222536	W-222567
SiO_2(wt.%)	12.3	10.2	10.7	12.8	10.1	18.5	7.69	12.2	22.7	9.09	25.3	5.42
TiO_2	2.13	2.14	2.42	2.35	1.98	2.07	2.29	2.47	3.35	2.62	2.62	2.08
MnO_2	30.4	31.1	34.0	28.5	32.2	24.6	41.6	31.7	20.5	37.1	20.3	47.8
Fe_2O_3	31.4	33.2	27.7	32.8	31.9	25.0	29.0	34.3	29.5	30.7	26.1	21.3
Al_2O_3	2.19	1.30	2.14	2.21	1.40	4.82	1.16	2.34	5.92	1.61	7.47	1.28
Co_3O_4	.666	.648	.933	.655	.640	.615	1.18	.623	.357	.863	.387	.923
NiO	.319	.303	.407	.262	.314	.280	.516	.257	.302	.386	.236	1.069
CuO	.057	.040	.070	.059	.051	.055	.117	.115	.195	.153	.130	.187
CaO	3.36	3.22	3.56	3.14	3.30	5.51	3.72	3.39	3.14	3.66	2.94	4.55
MgO	1.70	1.64	1.89	1.67	1.66	1.61	1.92	1.83	2.28	1.80	1.88	2.47
Na_2O	2.25	2.12	2.40	2.29	2.23	2.87	2.52	2.42	2.37	2.48	2.84	2.71
K_2O	.65	.53	.73	.63	.54	.98	.59	.50	1.29	.51	1.78	.69
CO_2	.37	.40	.23	.18	.22	.21	.56	.55	.35	.54	.33	.43
P_2O_5	1.18	1.15	1.02	1.10	1.21	2.31	.93	1.11	1.00	1.04	.91	1.12
H_2O+	6.7	6.1	7.6	7.1	6.9	5.5	6.0	5.5	5.7	6.9	6.0	6.1
H_2O-	16.2	24.3	12.4	12.7	14.9	13.7	28.5	25.7	19.9	27.4	19.0	26.2
Sum	95.7	94.1	95.8	95.7	94.6	95.0	99.8	99.4	99.0	99.4	99.3	98.2
As(ppm)	290	320	250	270	310	197	238	229	150	234	161	203
Ba	1600	1700	1500	1700	1600	1400	1700	1700	1600	1800	1500	2400
Cd	2.6	2.6	3.1	2.9	2.6	2.1	3.1	3.0	3.0	2.6	2.2	5.0
Co	1100	1200	1100	1100	1100	940	1400	1600	1100	1700	1400	1500
Cr	11	8	17	16	6	17	11	19	84	17	36	22
Mo	350	360	340	290	420	270	450	320	121	430	185	680
Pb	1700	2000	1600	1700	1800	1300	1800	1800	1200	1700	1100	1600
Sr	1600	1700	1500	1500	1600	1400	1500	1500	106	1700	990	1600
V	690	730	580	650	740	530	630	660	470	650	460	650
Y	239	250	217	241	247	243	231	233	154	231	221	163
Zn	640	670	610	640	650	530	590	570	620	620	530	980
γ	1.031	1.047	1.029	1.030	1.042	1.038	.988	.992	.996	.992	.993	1.005
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	0-10mm	0-7mm	0-5mm	0-12mm	0-7mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	053007	053008	053009	053010	053011	053012	053013	053014	053017	053018	053019	053020
Latitude	14.458	18.135	19.117	10.813	13.462	14.982	15.156	16.436	19.335	19.369	19.369	19.511
Longitude	-168.978	-169.067	-169.733	-165.544	-165.419	-166.448	-168.102	-168.114	-168.665	-168.695	-168.695	-168.835
Depth	1750	2139	1805	1325	3850	2800	2700	2325	3791	2000	2000	1800
Lab#	W-222568	W-222569	W-222570	W-224403	W-224404	W-224405	W-224406	W-224407	W-223748	W-223749	W-223750	W-223751
SiO_2(wt.%)	4.00	10.9	10.1	7.87	9.46	24.9	13.8	13.2	11.1	11.3	9.92	11.6
TiO_2	1.82	1.88	1.96	2.16	2.09	2.20	2.04	1.88	2.20	2.23	1.81	1.96
MnO_2	48.5	37.9	39.1	39.9	37.2	21.6	33.5	33.7	34.6	34.9	36.2	37.7
Fe_2O_3	20.0	29.0	26.1	27.3	28.0	21.6	26.0	24.2	29.9	25.1	26.4	28.0
Al_2O_3	.66	1.68	2.15	1.16	1.77	6.86	3.16	3.19	2.05	2.57	1.85	1.85
Co_3O_4	1.56	1.04	1.09	.881	.683	.464	.713	.859	.797	1.28	.998	1.06
NiO	.865	.462	.619	.494	.421	.336	.411	.502	.317	.405	.416	.426
CuO	.088	.061	.112	.126	.171	.165	.195	.169	.069	.045	.052	.072
CaO	3.92	3.57	3.78	3.77	4.47	4.16	3.90	5.36	3.49	4.60	5.21	3.68
MgO	2.06	1.83	1.99	1.77	1.80	2.01	1.81	1.87	1.76	2.00	1.72	1.75
Na_2O	2.53	2.55	2.43	2.48	2.39	2.75	2.34	2.70	2.17	2.63	2.37	2.39
K_2O	.59	.63	.57	.61	.63	2.12	1.13	1.07	.65	.78	.68	.69
CO_2	.44	.48	.39	.65	.71	1.21	.65	.96	.36	1.10	1.69	.44
P_2O_5	.70	1.02	1.12	.94	1.52	1.36	1.25	1.94	.97	.90	1.01	.90
H_2O+	9.6	5.8	5.3	11.1	9.7	9.2	9.8	10.7	8.8	8.7	9.6	8.7
H_2O-	25.0	25.6	26.0	7.3	12.3	9.1	10.2	11.2	7.7	8.8	11.3	16.4
Sum	97.4	98.8	96.8	101.3	101.0	100.9	100.6	102.2	99.2	98.5	100.0	101.3
As(ppm)	227	260	243	227	217	121	189	180	206	208	226	227
Ba	1600	1400	1600	1700	1600	2100	1800	2100	1100	1100	1100	1400
Cd	4.7	3.0	3.9	2.9	2.7	2.0	2.7	2.9	3.3	3.4	3.8	3.5
Ce	1000	1000	990	1200	1100	730	1200	1000	1600	1400	900	1100
Cr	9	18	62	8	11	41	15	14	-	-	-	-
Mo	750	470	490	540	460	220	370	350	300	330	410	420
Pb	2100	2000	2200	1400	1300	810	1200	1500	1800	1600	1700	1900
Sr	1600	1600	1600	1600	1600	1300	1400	1500	1400	1400	1400	1600
V	670	670	690	660	660	450	580	530	590	540	560	610
Y	113	222	189	248	240	143	260	237	195	186	180	191
Zn	690	560	730	630	590	570	590	640	610	590	590	620
γ	1.012	.998	1.018	.974	.976	.977	.980	.965	.994	1.001	.986	.974
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top
Interval	0-9mm	0-14mm	0-10mm	0-8mm	0-13mm	0-8mm	0-20mm	0-10mm	-	-	-	-

Sequence#	053021	053022	053023	053024	053025	053026	053027	053028	053029	053030	053031	053032
Latitude	19.511	19.511	19.511	19.511	19.511	19.695	19.553	19.553	19.515	19.515	19.515	19.515
Longitude	-168.835	-168.835	-168.835	-168.835	-168.835	-168.995	-168.832	-168.832	-168.855	-168.855	-168.855	-168.855
Depth	1800	1800	1800	1800	1800	4500	2400	2400	1790	1790	1790	1790
Lab#	W-223752	W-223753	W-223754	W-223755	W-223756	W-223757	W-223758	W-223759	W-223760	W-223761	W-223762	W-223763
SiO_2(wt.%)	2.18	7.27	13.1	3.00	7.98	18.5	10.1	13.1	5.98	4.71	8.70	3.46
TiO_2	1.69	1.93	1.99	1.96	2.02	2.74	2.02	2.13	1.59	1.59	1.80	1.45
MnO_2	51.7	44.1	39.2	50.2	43.4	27.1	37.3	33.8	41.7	42.8	38.9	44.6
Fe_2O_3	17.1	21.9	27.1	20.7	23.7	28.5	27.6	23.0	23.3	21.3	27.4	19.4
Al_2O_3	.43	1.33	1.86	.52	1.44	4.95	2.00	3.03	.96	.81	1.47	.61
Co_3O_4	1.04	1.24	1.24	1.04	1.14	.418	.490	.734	.892	.880	.976	.850
NiO	.708	.612	.507	.588	.619	.511	.458	.462	.483	.530	.464	.553
CuO	.212	.140	.069	.089	.081	.355	.118	.279	.119	.274	.078	.154
CaO	7.78	6.04	3.66	6.99	4.54	2.81	3.62	3.61	7.24	8.74	3.78	8.58
MgO	1.84	1.82	1.78	1.78	1.80	2.15	1.79	1.83	1.64	1.63	1.75	1.63
Na_2O	2.30	2.34	2.24	2.37	2.37	2.24	2.36	2.23	2.18	2.19	2.23	2.12
K_2O	.68	.73	.74	.65	.72	.97	.70	.78	.60	.61	.62	.59
CO_2	.79	.73	.47	.76	.56	.35	.38	.52	.77	.82	.52	.86
P_2O_5	2.47	1.75	.80	1.97	.94	.73	1.03	.91	2.90	3.51	1.16	3.45
H_2O+	9.6	9.1	9.6	10.6	9.4	8.5	8.9	10.3	9.3	7.8	10.2	9.3
H_2O-	17.3	18.9	19.7	19.9	19.8	15.3	11.0	14.7	13.0	8.7	14.9	10.3
Sum	100.5	101.0	104.3	103.2	100.7	100.9	98.9	96.7	99.6	98.2	100.0	97.6
As(ppm)	169	210	237	212	237	177	290	223	241	219	330	223
Ba	2700	2000	1500	2700	2100	1500	1300	1500	2100	2100	1500	2300
Cd	5.2	4.9	3.9	5.0	4.5	4.8	3.3	3.2	3.7	4.1	3.8	4.2
Ce	2200	1600	1200	2400	1700	1500	1100	1100	1600	1600	1100	2000
Cr	-	-	-	-	-	-	-	-	-	-	-	-
Mo	930	630	450	840	600	130	380	235	660	680	480	760
Pb	2100	1900	1900	2400	2100	1300	1800	1800	2200	2200	2000	2300
Sr	1800	1600	1600	1900	1600	1100	1600	1400	1800	1800	1600	1900
V	710	600	249	740	650	470	610	530	710	670	680	690
Y	133	160	187	112	137	154	214	152	195	175	200	167
Zn	870	740	650	800	720	760	640	770	710	760	690	800
γ	.982	.976	.945	.955	.979	.977	.997	1.020	.990	1.004	.986	1.010
Sampled	Bottom	Bulk	Top	Bottom	Bulk	Top	Bulk	Bulk	Bulk	Top	Top	Bottom
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	053033	053034	054001	055001	055002	055003	055004	055008	055008	055008	055009	055009
Latitude	19.515	19.515	19.243	19.355	19.317	18.163	19.070	11.020	11.020	11.020	11.008	11.008
Longitude	-168.855	-168.855	-179.668	176.780	176.745	171.517	173.373	170.177	170.177	170.177	170.203	170.203
Depth	1790	1790	3224	3672	1861	2000	2100	1575	1575	1575	2000	2000
Lab#	W-223764	W-223765	W-222588	W-222589	W-222590	W-231405	W-231406	D12-1-A	D12-1-B	D12-1-C	D13-1-A	D13-1-B
SiO_2(wt.%)	12.0	2.79	13.3	9.89	10.2	30.0	7.08	6.00	8.77	3.14	4.23	2.62
TiO_2	1.94	1.51	1.79	1.79	1.91	1.76	1.12	1.65	2.14	1.69	2.07	1.94
MnO_2	35.6	46.0	28.0	38.8	39.5	13.7	23.9	45.4	40.0	50.9	48.6	51.2
Fe_2O_3	28.0	20.9	23.8	26.2	26.1	15.7	15.4	25.6	25.9	22.3	20.7	20.8
Al_2O_3	2.05	.70	2.90	1.38	1.49	8.80	1.38	1.03	2.11	.60	.54	.29
Co_3O_4	1.11	.681	.593	1.18	1.24	.362	.774	1.38	.933	1.29	2.47	1.58
NiO	.429	.503	.375	.552	.555	.212	.384	.680	.759	.899	.816	.948
CuO	.063	.086	.160	.071	.068	.046	.052	.082	.121	.142	.048	.138
CaO	3.49	8.30	10.9	4.93	4.77	7.76	19.5	3.96	4.35	4.44	3.72	4.33
MgO	1.72	1.60	1.63	1.84	1.83	2.83	1.44	1.95	1.89	1.92	2.06	2.01
Na_2O	2.37	1.98	2.18	2.71	2.72	2.15	2.91	2.45	2.28	2.46	2.72	2.52
K_2O	.74	.60	.94	.65	.75	2.30	.57	.63	.75	.66	.58	.59
CO_2	.55	.87	1.41	.75	.82	.61	1.97	.67	1.21	.73	.64	.54
P_2O_5	.92	3.04	5.58	1.55	1.62	4.04	11.43	1.10	.90	.83	.84	.81
H_2O+	10.1	9.8	5.1	5.0	5.0	6.7	6.3	8.3	8.5	8.7	5.6	8.2
H_2O-	19.9	14.0	21.9	26.2	26.6	9.8	13.8	25.1	21.2	25.0	26.7	20.8
Sum	101.1	99.4	98.7	97.3	98.6	96.9	94.2	100.9	100.6	100.6	95.6	98.4
As(ppm)	310	209	154	244	232	109	151	250	290	330	250	260
Ba	1500	2700	1700	1400	1400	630	2200	1900	2300	1300	2100	1400
Cd	2.5	2.8	3.1	3.4	3.4	.9	2.0	3.9	4.3	4.0	5.4	5.9
Co	1100	2400	1000	1000	1100	420	650	1000	1200	890	1400	1200
Cr	-	-	12	19	12	189	4	11	1	5	7	7
Mo	410	850	310	560	460	166	290	440	870	610	860	570
Pb	1900	2700	1500	2000	2200	850	1300	1700	1600	2000	1800	2000
Sr	1600	2000	1400	1600	1600	800	1500	1500	1700	1700	1800	1600
V	620	780	510	680	680	320	410	610	800	790	760	640
Y	187	174	231	217	218	189	480	140	129	200	139	191
Zn	620	710	550	580	600	470	440	840	950	770	1000	800
γ	.976	.992	.999	1.025	1.000	1.017	1.047	.978	.980	.980	1.032	1.002
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	0-5mm	5-15mm	15-25mm	0-8mm	10-20mm
Interval	-	-	0-8mm	0-2mm	0-4mm	-	-	-	-	-	-	-

Sequence#	055009	055010	055010	055010	055011	055011	056002	056014	056015	056015	056015	056016
Latitude	11.008	11.008	11.008	11.008	11.005	11.005	10.458	12.183	12.183	12.183	12.183	12.183
Longitude	170.203	170.203	170.203	170.203	170.230	170.230	160.900	168.995	168.995	168.995	168.995	168.995
Depth	2000	2000	2000	2000	1800	1800	1805	1300	1300	1300	1300	1300
Lab#	D13-1-C	D13-2-A	D13-2-B	D13-2-C	D14-1-A	D14-1-B	W-229861	D15-1e-A	D15-2-A	D15-2-B	D15-2-C	D15-3-A
SiO_2(wt.%)	3.15	4.02	2.84	2.63	5.36	3.21	2.76	4.08	5.56	8.53	3.06	5.50
TiO_2	1.82	2.40	2.52	1.91	2.18	1.83	1.00	1.68	1.53	2.16	1.77	2.14
MnO_2	46.9	49.0	51.4	50.4	45.2	42.7	28.7	47.2	45.3	39.9	49.9	44.3
Fe_2O_3	24.0	21.1	20.5	21.2	22.7	22.3	18.2	21.6	25.7	27.1	22.1	20.9
Al_2O_3	.52	.65	.44	.49	.72	.60	.56	1.00	.76	2.04	.73	1.54
Co_3O_4	.769	2.67	1.81	1.15	2.13	.909	.297	1.82	1.40	.817	1.16	1.44
NiO	.876	.703	.960	.909	.698	.743	.468	.798	.637	.628	.982	1.175
CuO	.172	.041	.142	.172	.046	.164	.128	.123	.038	.159	.293	.201
CaO	4.28	3.92	3.95	4.64	3.78	7.98	22.2	3.89	3.87	3.81	4.49	4.16
MgO	1.92	2.04	2.05	1.99	1.91	1.78	1.28	2.17	1.89	1.95	2.10	2.62
Na_2O	2.71	2.74	2.61	2.64	2.54	2.40	1.36	3.36	2.46	2.43	2.56	2.71
K_2O	.51	.65	.70	.65	.58	.50	.36	.62	.59	.79	.66	.65
CO_2	.56	.65	.48	.54	.62	.97	2.53	.50	.45	.55	.54	.68
P_2O_5	.85	.85	.63	.92	.90	3.35	12.38	1.00	1.12	1.01	.98	1.26
H_2O+	6.9	8.7	8.7	7.7	7.6	7.5	7.1	7.5	7.2	7.3	7.4	7.1
H_2O-	27.4	27.6	23.1	30.0	28.9	28.1	13.0	26.6	28.1	25.0	27.4	25.3
Sum	95.9	100.1	99.7	98.0	97.0	96.9	99.4	97.4	98.5	99.1	98.7	96.3
As(ppm)	260	234	243	260	250	300	195	300	280	280	350	228
Ba	2500	2200	2700	1300	2500	1400	1700	1400	1900	2300	1200	1700
Cd	4.7	6.1	5.1	5.7	3.8	4.9	2.0	4.9	2.9	4.5	4.3	6.4
Co	1800	1800	2100	1400	1800	1200	1100	820	1000	1100	820	1100
Cr	5	3	4	3	9	10	4	5	9	4	6	21
Mo	540	480	590	460	560	460	430	630	410	810	580	500
Pb	1800	2200	2400	2100	1800	2000	1300	2200	1600	1500	2100	1700
Sr	1800	1600	1700	1500	1800	1500	1800	1500	1600	1800	1500	1500
V	690	530	630	580	710	650	570	690	640	760	740	600
Y	207	143	229	193	500	197	570	150	187	134	209	147
Zn	880	960	940	760	860	760	640	760	750	1000	720	1100
γ	1.028	.985	.989	1.006	1.017	1.017	.992	1.013	1.001	.995	.999	1.024
Sampled	20-25mm	0-3mm	5-16mm	17-20mm	Porous	20-25mm	Bulk	Bulk	0-5mm	5-25mm	25-55mm	0-5mm
Interval	-	-	-	-	0-5mm	-	-	0-5mm	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	056016	056017	056018	056019	056020	056020	056021	056021	056021	056022	056022	056023
Latitude	12.183	12.183	12.183	13.905	13.905	13.905	13.900	13.900	13.900	13.900	13.900	13.900
Longitude	168.995	168.995	168.995	167.627	167.627	167.627	167.653	167.653	167.653	167.653	167.653	167.653
Depth	1300	1300	1300	1600	1600	1600	1600	1600	1600	1600	1600	1600
Lab#	D15-3-B	D15-4-A	D15-9	D17-2-A	D17-6	D17-6	D18-1-A	D18-1-B	D18-1-C	D18-3-A	D18-3-B	D18-7-A
SiO_2(wt.%)	4.16	4.59	5.80	9.91	3.59	8.64	5.70	11.3	3.19	7.87	2.71	5.66
TiO_2	1.92	1.88	1.94	1.32	2.12	1.62	2.27	2.10	1.38	1.66	1.33	1.77
MnO_2	40.0	46.1	44.2	40.3	47.8	42.3	43.9	34.5	29.4	40.5	40.7	43.4
Fe_2O_3	24.6	23.9	24.1	25.1	22.3	24.5	24.6	28.1	17.9	25.7	17.1	26.8
Al_2O_3	.98	.82	.91	1.26	.80	1.19	.97	2.30	.81	1.02	.53	.89
Co_3O_4	.911	1.63	1.47	1.09	1.57	1.34	2.34	.804	.580	1.45	.707	1.50
NiO	.787	.709	.722	.528	.872	.662	.600	.523	.512	.528	.847	.562
CuO	.205	.078	.078	.049	.124	.075	.028	.104	.147	.038	.155	.048
CaO	6.89	4.21	3.85	4.40	4.22	3.57	3.73	4.13	20.2	3.62	12.9	3.86
MgO	1.97	2.10	1.93	1.93	2.05	1.86	1.93	1.77	1.43	1.86	1.74	1.85
Na_2O	2.47	2.85	2.55	2.83	2.61	2.55	2.65	2.51	2.06	2.67	2.49	2.53
K_2O	.52	.64	.58	.60	.68	.61	.58	.76	.37	.55	.50	.63
CO_2	.97	.61	.48	.58	.47	.51	.67	.63	2.46	.58	1.46	.57
P_2O_5	3.01	1.09	1.05	1.60	1.07	1.00	1.02	1.62	11.39	1.14	6.65	1.14
H_2O+	8.2	7.4	7.9	6.8	7.4	7.1	8.3	8.2	6.6	6.8	6.7	7.2
H_2O-	20.8	28.2	27.7	25.3	31.4	27.0	27.9	22.1	15.5	27.7	24.9	27.5
Sum	97.5	98.5	97.6	98.2	97.7	97.5	99.3	99.4	98.5	96.0	96.4	98.4
As(ppm)	250	310	320	350	280	330	178	260	280	213	360	194
Ba	2100	1500	1500	1200	2000	1500	1500	1700	1300	1900	1300	1800
Cd	4.0	4.2	4.6	3.4	4.7	4.0	2.7	3.0	4.6	4.5	3.7	3.7
Co	1000	1100	1000	760	1500	890	650	1200	1500	970	1000	1100
Cr	14	6	9	4	31	11	8	22	14	3	7	0
Mo	560	570	550	560	540	560	410	350	430	650	530	570
Pb	1500	2000	2100	2100	2200	2100	1000	1800	2200	1500	2100	1600
Sr	1800	1700	1700	1600	1600	1600	1800	1500	1500	1700	1700	1700
V	770	710	680	760	630	680	570	630	640	610	720	570
Y	390	195	208	187	204	178	270	310	194	330	208	246
Zn	970	810	730	640	930	6700	710	670	740	870	590	840
γ	1.011	1.001	1.010	1.004	1.010	1.011	.993	.992	1.001	1.027	1.022	1.002
Sampled	5-15mm	Bulk	Bulk	Bulk	Bulk	Bulk	Knobby	Porous	Massive	0-5mm	5-30mm	Knobby
Interval	-	0-10mm	0-30mm	0-5mm	0-30mm	0-30mm	0-7mm	10-25mm	25-60mm	-	-	0-5mm

Sequence#	056023	056023	056023	056024	056025	057001	057002	057003	058001†	058002†	058003†	058004
Latitude	13.900	13.900	13.900	13.900	13.900	15.717	19.523	15.467	17.883	17.827	18.320	17.683
Longitude	167.653	167.653	167.653	167.653	167.653	152.200	153.617	153.242	144.695	143.983	144.437	143.933
Depth	1600	1600	1600	1600	1600	2423	2158	2385	3200	4200	3600	4200
Lab#	D18-7-B	D18-7-C	D18-7-D	D18-10b-A	D18-11	W-229882	W-229877	W-229881	W-224385	W-224386	W-224387	W-224388
SiO_2(wt.%)	3.59	11.5	2.49	6.32	8.05	7.31	9.03	6.64	48.7	37.9	46.8	32.4
TiO_2	1.78	1.83	1.29	1.72	1.89	2.63	2.02	2.00	1.00	1.47	1.11	1.38
MnO_2	48.5	36.3	39.5	41.2	41.0	38.4	40.4	41.0	2.28	8.11	4.77	13.1
Fe_2O_3	23.2	27.0	16.4	24.0	26.5	24.8	25.5	27.7	13.4	21.8	15.9	21.5
Al_2O_3	.63	3.24	.66	.96	1.31	1.46	1.51	.91	16.5	12.3	15.3	10.5
Co_3O_4	1.30	.712	.651	1.59	1.69	1.26	1.05	.833	.010	.031	.018	.046
NiO	.794	.546	.806	.581	.521	.581	.624	.547	.016	.045	.048	.091
CuO	.111	.138	.150	.037	.034	.074	.178	.160	.026	.048	.063	.053
CaO	4.09	4.11	15.2	6.01	3.76	4.48	3.57	3.73	6.77	4.98	5.27	5.02
MgO	1.98	2.09	1.69	2.05	1.83	1.82	1.88	1.77	3.93	3.30	3.57	3.07
Na_2O	2.52	2.17	2.11	2.48	2.46	2.86	2.54	2.40	3.60	2.82	3.01	3.59
K_2O	.63	1.03	.56	.57	.66	.69	.76	.60	1.36	1.51	1.69	1.14
CO_2	.53	.47	1.78	.75	.45	.93	.45	.52	.07	.15	.15	.29
P_2O_5	.95	1.14	7.76	2.37	1.09	.93	.89	.96	.19	.43	.30	.60
H_2O+	7.4	6.4	7.4	8.1	7.2	5.5	9.3	9.4	4.6	8.1	4.4	7.2
H_2O-	27.9	25.4	22.6	25.5	26.7	23.4	22.5	23.2	2.9	4.4	7.1	8.1
Sum	98.0	98.7	98.4	98.7	98.5	93.8	99.7	99.2	102.5	102.9	102.3	99.9
As(ppm)	280	310	340	310	320	248	300	310	14	67	39	94
Ba	1600	1700	1400	1300	1300	1800	1500	1800	320	500	470	650
Cd	2.1	3.8	3.7	3.7	3.3	3.8	3.6	3.5	.1	1.3	.6	1.7
Co	820	1100	1100	1000	1100	1600	1100	1100	45	126	76	174
Cr	15	1	9	48	18	18	4	<2	28	23	21	15
Mo	400	690	570	420	440	350	490	570	<4	<4	<4	19
Pb	1300	2100	2200	2000	2200	1800	1800	1800	46	188	70	196
Sr	1600	1800	1700	1600	1600	1600	1500	1800	380	630	430	850
V	640	710	740	680	650	510	620	720	237	320	260	350
Y	215	166	221	201	205	196	207	169	34	79	52	103
Zn	700	760	690	700	600	730	630	760	196	350	280	410
γ	1.006	.999	1.002	.999	1.001	1.052	.989	.994	.961	.958	.963	.987
Sampled	5-15mm	25-40mm	40-45mm	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	0-2mm	0-6mm	-	-	-	0-18mm	0-10mm	0-17mm	0-21mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	058005†	058006	059002	059003	059004	059005	059006	061001	077004	077005	077006	078003
Latitude	17.437	16.458	16.017	18.362	18.273	19.035	19.667	17.617	27.250	27.200	26.983	24.953
Longitude	144.567	148.958	134.500	139.413	136.487	138.968	135.950	116.983	-43.967	-43.600	-42.667	-51.752
Depth	3971	2385	5085	2350	2757	2600	2741	-	2785	3670	3500	5960
Lab#	W-222575	W-229884	W-229862	W-229888	W-229860	W-229859	W-231343	W-229887	W-222732	W-222730	W-222731	W-229869
SiO_2(wt.%)	46.5	10.3	16.9	23.1	19.0	6.38	14.3	18.3	7.00	16.5	7.74	17.1
TiO_2	1.13	1.88	1.84	1.62	1.69	1.40	1.12	1.68	.33	1.90	1.97	1.01
MnO_2	2.56	36.7	26.2	17.9	20.8	40.2	22.9	18.4	25.5	21.4	28.2	24.6
Fe_2O_3	15.4	30.1	32.4	31.8	37.0	27.5	26.8	37.3	33.7	27.4	31.4	30.2
Al_2O_3	15.3	1.67	4.81	5.95	4.75	1.78	3.32	4.70	3.48	5.84	3.92	7.55
Co_3O_4	.012	.786	.400	.248	.233	.903	.475	.198	.920	.783	1.10	.389
NiO	.022	.457	.296	.141	.129	.666	.291	.103	.235	.183	.313	.538
CuO	.028	.122	.184	.111	.125	.109	.051	.112	.062	.057	.108	.257
CaO	6.19	3.44	2.74	2.60	2.37	3.62	6.73	2.37	5.33	5.36	5.09	1.82
MgO	3.93	1.79	1.81	2.10	1.84	2.41	2.23	1.91	2.40	4.84	2.26	3.01
Na_2O	2.37	2.26	1.49	3.17	2.12	2.68	4.69	3.09	2.69	2.24	2.29	2.01
K_2O	1.30	.60	.69	1.08	.84	.54	.77	.73	.47	.55	.53	.94
CO_2	.06	.51	.32	.22	.32	.52	3.25	.19	2.09	1.56	2.09	.22
P_2O_5	.20	1.00	.81	.81	.92	1.17	1.19	.92	1.32	.96	1.13	.92
H_2O+	5.0	9.1	9.3	7.7	8.7	9.1	6.5	9.1	10.9	9.6	11.1	9.5
H_2O-	7.3	22.0	18.3	17.7	18.0	21.6	16.9	17.5	18.6	16.5	18.6	12.4
Sum	100.0	100.7	100.1	98.5	100.8	98.9	94.6	99.1	96.5	99.2	99.2	100.0
As(ppm)	30	290	233	260	290	380	290	300	540	360	410	340
Ba	260	1700	1600	1200	1500	1700	910	1300	1100	770	960	780
Cd	.8	3.1	2.8	2.2	2.2	5.5	2.3	1.9	3.1	2.0	3.2	4.1
Co	49	940	1300	920	1200	1000	690	990	1800	1700	2200	1600
Cr	24	6	9	11	9	5	18	9	20	59	17	27
Mo	<4	500	270	122	183	560	300	158	184	168	233	270
Pb	54	1800	1600	1100	1300	2700	1700	1200	1600	1300	1600	710
Sr	350	1700	1200	980	1100	1700	1200	1000	1500	1100	1200	670
V	300	710	590	520	620	820	540	630	1200	870	950	740
Y	36	180	196	146	171	179	181	158	233	168	197	104
Zn	205	620	600	580	520	870	460	550	630	490	590	570
γ	.986	.980	.985	1.001	.978	.996	1.042	.995	1.022	.994	.994	.986
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-4mm	-	-	-	-	-	0-12mm	-	-	-	-	-

Sequence#	078004	079001	079005	079006	079007	079008	079010	079011	079012	080001	080002	080003
Latitude	21.850	24.277	27.600	28.033	27.067	27.583	28.033	28.757	27.700	22.317	22.333	22.570
Longitude	-56.150	-68.107	-61.133	-61.000	-60.467	-60.400	-61.000	-60.358	-61.167	-72.080	-72.085	-72.375
Depth	4049	5668	5706	5028	5891	5536	5105	5338	5390	3363	2250	3420
Lab#	W-231344	W-222722	W-231352	W-231349	W-231359	W-231361	W-231362	W-229863	W-231348	W-222702	W-222703	W-222704
SiO_2(wt.%)	13.8	30.1	13.0	20.5	13.7	15.5	16.6	12.7	19.5	6.30	5.84	10.7
TiO_2	1.16	.89	2.48	1.01	1.27	1.04	1.02	1.15	.92	1.78	1.95	1.52
MnO_2	24.8	15.5	19.3	22.9	26.1	24.9	25.0	29.8	24.1	16.5	24.9	17.1
Fe_2O_3	27.6	25.5	32.3	26.1	29.4	27.2	26.4	30.7	22.9	34.1	43.4	38.1
Al_2O_3	6.20	10.2	5.41	7.53	6.84	8.29	7.84	6.11	8.54	4.63	4.17	6.50
Co_3O_4	.433	.219	.644	.388	.477	.425	.439	.484	.385	.545	.916	.468
NiO	.449	.173	.220	.348	.461	.485	.528	.482	.647	.216	.275	.250
CuO	.147	.138	.088	.138	.190	.159	.216	.223	.325	.091	.081	.135
CaO	2.88	1.58	5.00	2.47	2.29	2.07	2.11	2.49	1.71	8.82	3.37	6.53
MgO	3.55	3.08	2.91	2.70	2.61	2.64	2.73	2.67	3.69	3.01	2.74	2.85
Na_2O	3.22	2.11	2.20	2.22	1.82	2.01	2.06	1.86	2.60	4.85	1.78	1.60
K_2O	.67	1.36	.82	1.32	.79	1.03	1.05	.77	1.16	.61	.55	.75
CO_2	.34	.33	1.96	.39	.28	.24	.30	.40	.15	-	1.12	3.69
P_2O_5	1.27	.80	1.22	.86	1.07	.95	.92	1.03	.83	1.69	1.45	1.52
H_2O+	9.4	5.6	10.3	10.3	8.8	9.1	9.9	9.6	9.5	6.9	6.5	7.5
H_2O-	15.0	19.3	13.3	12.2	14.4	13.4	13.2	15.6	11.5	17.5	21.2	18.6
Sum	95.8	97.6	97.9	99.1	96.0	96.0	97.1	100.4	97.1	-	99.0	99.2
As(ppm)	340	235	440	280	330	290	300	340	260	158	660	540
Ba	960	500	970	640	740	690	790	850	850	740	1300	770
Cd	4.1	2.4	2.0	2.8	4.0	3.7	4.5	4.9	4.9	2.3	2.5	3.6
Co	1900	1500	1600	2200	2300	2200	2200	2300	1500	1600	2300	1600
Cr	47	71	127	57	32	29	23	23	40	102	79	112
Mo	310	198	219	250	300	280	310	360	290	206	370	233
Pb	840	580	980	690	970	800	840	1000	700	840	1400	880
Sr	950	500	1200	740	820	750	770	940	600	860	1400	960
V	780	690	1000	670	790	680	670	830	660	1100	1500	1100
Y	153	74	185	105	164	150	150	178	102	170	222	154
Zn	560	410	480	430	500	490	530	590	640	450	560	520
γ	1.029	1.011	1.007	.995	1.027	1.027	1.016	.982	1.016	-	.996	.994
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-10mm	0-12mm	-	0-4mm	0-8mm	0-40mm	0-10mm	-	0-6mm	0-2mm	0-17mm	0-4mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	080004	080005	080006	080007	080008	083001	083003	083004	084001†	084002	084003	084004
Latitude	22.642	23.157	23.183	23.487	21.833	24.775	22.870	22.870	26.472	20.750	21.300	20.750
Longitude	-72.850	-73.752	-73.973	-74.200	-70.573	-109.203	-108.075	-108.075	-110.718	-112.783	-112.700	-114.450
Depth	2390	3126	1315	2910	5416	3038	3127	3127	2501	1712	2497	3840
Lab#	W-222705	W-222706	W-222707	W-222708	W-222719	W-222615	W-222586	W-222587	W-222616	W-222581	W-222582	W-222583
SiO_2(wt.%)	10.9	7.84	4.90	3.93	8.49	39.1	30.9	26.9	47.7	11.4	19.0	15.5
TiO_2	.96	1.12	1.64	1.64	1.56	.81	.31	.47	2.09	1.13	.47	.39
MnO_2	14.2	10.2	27.2	29.2	20.2	27.7	31.8	22.0	.33	31.4	35.0	43.6
Fe_2O_3	31.7	24.5	38.7	38.6	41.9	5.30	10.5	25.7	12.5	31.6	20.2	12.9
Al_2O_3	7.24	4.19	5.19	4.46	4.88	11.2	6.05	4.38	14.2	1.89	3.56	4.47
Co_3O_4	.310	.279	.931	.946	.486	.004	.031	.055	.005	.478	.257	.177
NiO	.229	.133	.394	.434	.219	.027	.698	.218	.006	.331	.839	1.431
CuO	.165	.067	.162	.128	.094	.006	.112	.035	.006	.036	.221	.993
CaO	11.6	24.5	3.97	3.30	2.93	4.15	1.92	2.56	8.46	2.91	2.14	2.32
MgO	2.78	1.88	2.99	3.26	2.45	3.34	2.46	1.58	6.74	1.72	2.54	2.75
Na_2O	1.44	1.25	1.42	1.44	1.48	4.13	2.97	2.81	4.59	2.21	2.24	2.72
K_2O	.72	.53	.48	.47	.58	1.38	2.34	1.18	.21	.70	1.35	1.25
CO_2	8.26	18.2	1.55	.93	1.09	.21	.32	.50	1.56	.53	.58	.78
P_2O_5	1.26	.89	1.36	1.38	1.44	.19	.37	.98	.22	1.31	.65	.46
H_2O+	5.9	4.3	8.8	8.1	7.1	4.7	7.3	9.2	2.3	9.9	6.5	9.1
H_2O-	16.5	12.0	22.5	23.7	18.7	5.6	12.5	18.1	4.1	23.0	15.1	15.5
Sum	97.6	99.9	99.7	98.3	94.9	102.2	98.0	98.5	100.9	97.6	95.5	98.9
As(ppm)	420	380	440	620	690	21	105	260	2	390	189	154
Ba	730	490	1500	1400	1000	1200	2200	1000	38	1400	7300	2000
Cd	3.4	2.0	4.5	4.1	2.5	2.3	16.0	2.9	<.1	3.0	14.1	15.4
Ce	1400	1000	2300	2200	2200	39	330	660	18	1400	480	450
Cr	77	63	74	56	44	40	91	34	167	21	28	13
Mo	216	136	440	430	300	280	410	171	<4	470	310	580
Pb	800	610	1500	1500	1100	<10	206	570	<9	1400	440	380
Sr	1200	680	1300	1400	1200	510	570	1100	167	1600	1400	720
V	780	750	1200	1200	1500	233	380	530	380	810	540	450
Y	78	114	136	190	209	19	57	159	40	208	100	85
Zn	500	350	770	730	600	300	1700	560	89	640	1100	1700
γ	1.010	.987	.989	1.003	1.039	.965	1.006	1.001	.977	1.011	1.032	.997
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-28mm	0-5mm	0-30mm	0-40mm	0-19mm	0-8mm	0-20mm	0-6mm	-	0-22mm	0-20mm	0-11mm

Sequence#	084005	088001	088002	088003	088004	088005	088006	088007	088013	088015	088018	089001
Latitude	21.083	23.317	24.883	26.583	26.000	26.067	27.550	27.417	25.951	25.944	25.951	21.670
Longitude	-119.367	-158.317	-157.117	-158.833	-158.967	-158.200	-158.550	-159.867	-159.914	-159.878	-159.914	-167.953
Depth	2985	3000	3000	3525	4070	4750	4850	3400	3600	2600	3600	1690
Lab#	W-222584	W-224422	W-224423	W-224424	W-224425	W-224426	W-224427	W-224428	W-234336	W-234339	W-234342	W-222571
SiO_2(wt.%)	18.2	13.3	24.5	14.5	21.7	40.6	18.8	15.7	16.3	9.31	15.0	17.2
TiO_2	1.86	2.23	1.89	2.21	1.55	3.48	1.78	2.16	1.98	1.86	1.96	1.23
MnO_2	28.0	27.0	23.5	32.2	20.2	5.32	28.0	29.9	27.0	38.3	28.7	38.8
Fe_2O_3	25.9	29.6	18.0	27.2	17.9	20.7	23.9	26.7	29.5	25.5	27.7	17.5
Al_2O_3	3.88	2.74	7.08	2.93	6.38	14.9	5.08	4.29	3.33	1.66	2.88	5.50
Co_3O_4	.542	.652	.541	.919	.532	.095	.580	.486	.572	1.27	.790	.413
NiO	.376	.241	.419	.324	.376	.117	.342	.330	.244	.521	.323	1.236
CuO	.127	.047	.171	.125	.185	.081	.196	.284	.114	.106	.150	.714
CaO	2.87	4.21	3.34	3.10	10.0	1.06	3.76	3.33	3.34	3.39	3.76	2.21
MgO	1.98	1.85	1.75	1.72	2.27	2.88	2.23	1.74	1.77	1.81	1.72	3.22
Na_2O	2.44	3.34	3.63	2.54	2.22	2.44	2.35	2.38	2.24	2.47	2.24	2.43
K_2O	1.13	.58	1.91	.96	1.52	2.93	1.11	1.05	.67	.70	.79	1.14
CO_2	.14	.40	.27	.39	.98	.15	.47	.43	.32	.25	.42	.24
P_2O_5	.71	1.61	.91	.89	5.80	.24	1.39	.94	.94	.91	1.25	.42
H_2O+	9.0	17.6	10.3	12.1	11.7	7.7	12.9	13.1	9.0	9.8	9.1	5.9
H_2O-	22.1	10.2	11.9	9.6	5.2	13.8	10.8	7.5	16.7	19.4	17.3	17.6
Sum	97.2	105.3	98.3	102.1	103.4	102.7	102.9	102.9	97.4	97.9	96.7	98.3
As(ppm)	231	234	104	199	101	33	168	162	280	280	242	146
Ba	1300	1400	2000	1500	1000	310	1300	2200	1600	1700	1500	1700
Cd	2.7	2.2	2.3	2.5	2.2	.7	1.8	2.4	2.2	3.6	2.3	8.4
Ce	1700	1200	1100	1900	1500	350	1600	1900	1100	1200	1600	1200
Cr	28	12	28	16	25	280	12	13	56	11	19	22
Mo	260	310	204	330	169	13	310	290	280	450	242	460
Pb	1100	2000	1000	1900	1100	340	1200	1300	1900	2000	1900	1000
Sr	1200	1600	1100	1400	950	290	1200	1400	1400	1500	1300	780
V	460	650	390	580	360	174	530	620	640	660	580	470
Y	180	200	170	221	330	37	300	173	192	186	194	103
Zn	580	580	540	550	470	560	560	690	620	610	590	760
γ	1.015	.936	1.003	.966	.953	.960	.958	.959	1.013	1.007	1.020	1.003
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-10mm	0-8mm	0-4mm	0-24mm	0-28mm	0-2mm	0-30mm	0-32mm	-	6-8mm	7-25mm	0-3mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	089002	089003	089004	089005	089006	089007	089008	089009	089010	089011	089013	089014
Latitude	23.711	23.112	28.965	26.917	26.633	27.317	26.150	25.183	25.133	22.181	22.208	22.256
Longitude	-165.602	-162.480	-162.022	-160.050	-161.200	-161.650	-162.067	-161.600	-161.950	-166.810	-166.882	-166.854
Depth	1325	1650	2820	3000	3000	3500	2450	2600	3600	3950	2402	1970
Lab#	W-224379	W-224380	W-224421	W-224429	W-224430	W-224431	W-224432	W-224433	W-224434	W-223731	W-223732	W-223733
SiO_2(wt.%)	14.6	11.8	14.6	17.6	25.8	30.9	12.8	10.0	30.2	14.9	15.7	13.0
TiO_2	2.11	1.95	1.78	1.99	2.03	2.68	2.15	2.31	2.12	1.88	2.45	2.26
MnO_2	33.0	34.2	32.3	29.7	20.0	15.6	34.6	33.0	16.7	29.2	27.7	30.8
Fe_2O_3	22.3	25.1	25.1	26.2	21.2	22.7	22.7	29.9	20.9	29.0	27.1	28.3
Al_2O_3	3.98	2.61	2.92	3.69	7.74	8.92	3.24	1.74	8.59	3.02	3.90	2.77
Co_3O_4	1.16	.811	.096	.960	.633	.409	1.05	.770	.317	.552	.648	.791
NiO	.522	.447	.407	.400	.240	.191	.464	.338	.256	.271	.426	.384
CuO	.042	.052	.108	.071	.075	.081	.082	.071	.132	.187	.284	.136
CaO	4.57	4.17	3.09	3.49	5.11	2.25	5.85	3.39	3.55	3.43	3.63	3.60
MgO	3.14	2.65	1.74	1.80	1.84	2.31	1.95	2.10	2.80	1.77	1.79	1.63
Na_2O	2.74	3.40	2.76	2.49	2.88	2.36	2.57	3.11	2.96	2.24	2.27	2.23
K_2O	.72	.53	1.04	.80	1.47	2.46	.92	.47	1.91	.81	.82	.65
CO_2	.44	.50	.39	.47	.87	.27	.62	.43	.33	.42	.53	.54
P_2O_5	1.01	.98	.99	.97	1.35	.59	2.33	1.08	.92	.95	.87	.87
H_2O+	10.9	11.4	12.0	11.2	9.1	9.5	15.8	13.6	11.2	7.6	9.3	10.4
H_2O-	5.0	6.0	9.3	7.8	9.7	6.8	6.7	13.3	5.4	6.2	7.5	10.5
Sum	101.3	100.6	99.2	101.8	100.3	101.3	107.0	102.4	102.9	96.2	97.4	98.2
As(ppm)	232	223	199	217	122	103	182	250	106	181	162	201
Ba	1000	1100	1300	1300	1100	750	1200	1600	1300	1300	1700	1700
Cd	3.6	2.9	2.6	2.6	1.9	1.2	3.1	2.2	1.8	3.3	2.7	2.5
Co	850	780	1400	1200	750	900	950	1100	810	1600	920	960
Cr	116	117	7	59	48	20	15	7	99	-	-	-
Mo	520	560	360	310	177	140	420	420	127	171	195	310
Pb	2000	1900	1800	1800	1200	930	1700	2200	1100	1800	1700	1800
Sr	1400	1600	1400	1300	940	730	1400	1600	800	1300	1400	1500
V	670	670	560	590	430	380	540	660	390	570	610	660
Y	168	213	199	174	122	140	225	196	169	149	141	168
Zn	570	560	550	570	420	460	530	610	490	640	840	730
γ	.974	.981	.994	.969	.983	.973	.921	.963	.958	1.025	1.013	1.004
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top
Interval	0-18mm	0-11mm	0-14mm	0-8mm	0-2mm	0-10mm	0-8mm	0-6mm	0-4mm	-	-	<1mm

Sequence#	089015	089016	089017	089018	089019	089020	089021	089022	089023	089025	089026	089027
Latitude	22.316	22.316	21.718	21.718	21.718	21.718	21.796	21.796	21.796	20.209	20.209	20.209
Longitude	-166.899	-166.899	-167.578	-167.578	-167.578	-167.578	-167.624	-167.624	-167.624	-169.506	-169.506	-169.506
Depth	2350	2350	2400	2400	2400	2400	2100	2100	2100	4500	4500	4500
Lab#	W-223734	W-223780	W-223735	W-223736	W-223737	W-223781	W-223738	W-223739	W-223740	W-223741	W-223742	W-223743
SiO_2(wt.%)	13.1	9.45	12.7	13.0	15.8	8.37	8.54	14.0	15.2	17.5	24.5	23.2
TiO_2	1.95	2.28	2.55	2.33	1.89	2.54	3.19	2.88	1.78	3.66	3.03	2.67
MnO_2	31.4	34.0	35.5	33.6	29.8	35.7	38.8	28.5	30.4	24.8	19.5	23.5
Fe_2O_3	27.6	29.1	25.0	31.0	29.4	23.6	27.5	32.0	31.0	31.7	27.2	25.2
Al_2O_3	2.64	1.64	2.96	2.64	3.21	1.76	1.47	3.01	2.66	4.63	7.03	6.84
Co_3O_4	.833	.924	.727	.703	.746	1.59	1.38	.558	.734	.436	.344	.441
NiO	.431	.425	.510	.358	.291	.526	.421	.302	.283	.204	.187	.313
CuO	.119	.117	.228	.104	.043	.085	.051	.101	.048	.132	.171	.196
CaO	3.67	3.42	3.74	3.78	3.83	4.00	3.58	3.77	3.44	3.13	3.09	3.13
MgO	1.76	1.64	1.69	1.71	1.67	1.76	1.95	1.59	1.59	1.77	2.27	2.41
Na_2O	2.18	2.22	2.31	2.23	2.40	2.75	2.67	2.16	2.23	2.13	2.21	2.23
K_2O	.76	.60	.92	.72	.87	.68	.76	.68	.75	.86	1.25	1.24
CO_2	.37	.48	.50	.38	.51	.91	.46	.29	.49	.17	.16	.26
P_2O_5	1.18	1.05	.75	1.05	1.13	1.02	.91	.99	1.05	.76	.63	.59
H_2O+	9.5	10.2	12.7	9.0	10.6	6.9	7.8	8.0	10.4	7.6	6.9	7.7
H_2O-	8.4	10.1	17.6	14.8	12.4	5.6	6.3	7.2	14.7	6.2	4.9	10.5
Sum	97.6	97.6	102.9	102.7	102.1	92.2	99.5	98.8	102.2	99.4	98.5	100.0
As(ppm)	197	310	182	223	217	260	213	194	223	181	105	123
Ba	1400	1800	1900	1600	1100	1500	1600	1800	1300	1700	1400	1500
Cd	3.1	2.1	2.5	2.5	2.3	3.1	3.3	2.2	2.6	2.3	2.2	2.7
Co	1100	1100	1200	1200	1100	1700	1500	1100	1300	1800	1400	1500
Cr	-	-	-	-	-	-	-	-	-	-	-	-
Mo	320	430	350	350	300	300	310	280	320	160	63	101
Pb	2000	1900	1300	1900	1700	2000	2100	1800	2000	1400	1000	1100
Sr	1400	1800	1600	1500	1400	1600	1500	1500	1400	1200	880	910
V	590	700	530	610	580	600	510	570	620	530	410	440
Y	186	260	182	211	194	180	213	216	211	192	137	134
Zn	660	670	760	690	550	720	640	740	590	640	540	560
γ	1.011	1.011	.958	.960	.965	1.069	.991	.998	.965	.991	1.001	.986
Sampled	Bulk	Bulk	Bottom	Top	Top	Top	Bulk	Bulk	Top	Bulk	Top	Bottom
Interval	-	-	-	-	-	<1mm	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	089028	089029	089030	089031	089033	089034	089035	089036	089037	089038	089039	089040
Latitude	20.209	20.335	20.335	20.335	23.817	25.675	23.172	25.900	29.555	24.322	25.783	25.929
Longitude	-169.506	-169.575	-169.575	-169.575	-164.420	-168.697	-162.434	-162.050	-163.372	-168.083	-167.733	-167.755
Depth	4500	2400	2400	2400	870	1510	1849	3200	2496	1225	1600	2500
Lab#	W-223744	W-223745	W-223746	W-223747	W-231381	W-231380	W-231375	W-224419	W-222614	W-228552	W-228573	W-228579
SiO_2(wt.%)	20.5	11.6	11.6	8.32	23.9	17.4	43.6	15.5	20.0	30.8	5.68	8.29
TiO_2	4.01	2.04	2.37	2.87	2.23	2.03	2.73	.60	1.48	2.67	.49	1.91
MnO_2	22.0	33.3	33.0	38.4	15.8	28.6	3.36	8.68	26.0	4.22	68.5	38.1
Fe_2O_3	29.7	31.5	31.9	27.7	22.0	24.8	14.1	6.66	23.0	24.1	3.01	29.6
Al_2O_3	5.89	1.77	1.92	1.46	9.76	4.52	15.5	3.91	5.49	10.7	2.59	1.10
Co_3O_4	.379	.818	.721	1.20	.440	.782	.062	.089	.568	.174	.106	1.13
NiO	.227	.320	.330	.433	.534	.537	.076	.408	.386	.176	.442	.446
CuO	.195	.052	.085	.094	.058	.097	.009	.168	.190	.033	.145	.057
CaO	2.96	3.36	3.31	3.94	3.61	2.97	6.52	27.7	3.89	6.86	1.62	3.43
MgO	2.03	1.67	1.61	1.75	6.78	2.31	3.44	1.89	1.99	4.77	3.84	1.82
Na_2O	2.11	2.29	2.14	2.34	2.03	2.25	4.04	1.24	2.91	2.24	2.11	2.34
K_2O	.95	.64	.62	.68	.79	1.05	1.45	1.37	1.57	1.04	1.52	.59
CO_2	.21	.23	.30	.60	.41	.25	.13	2.90	.42	3.30	.31	.48
P_2O_5	.76	.98	.96	1.13	1.50	.99	.93	17.32	1.45	.71	.17	1.07
H_2O+	9.3	8.4	9.3	9.5	8.0	8.4	3.3	5.4	8.2	6.4	8.6	9.0
H_2O-	10.1	8.4	11.2	14.7	7.1	14.7	3.5	3.4	20.9	6.2	5.0	14.4
Sum	101.3	99.0	100.1	100.4	97.9	97.0	99.2	93.9	97.5	98.2	99.1	99.3
As(ppm)	122	218	214	199	151	246	35	10	139	181	55	350
Ba	1600	1200	1600	1500	470	1400	400	14000	10000	330	13000	1400
Cd	2.8	2.6	2.9	3.5	3.9	3.2	1.2	1.6	1.8	.6	62.1	2.7
Ce	1400	1300	1100	1400	226	960	135	65	1200	224	60	1300
Cr	-	-	-	-	550	106	30	37	23	1100	43	8
Mo	78	340	370	330	162	360	51	30	228	<4	211	500
Pb	1200	1900	1900	1900	570	1800	176	176	680	480	95	2200
Sr	1000	1400	1500	1500	450	1200	820	1400	1400	590	1400	1800
V	460	600	610	520	510	590	238	124	440	550	232	710
Y	156	218	214	223	108	141	52	340	290	50	24	234
Zn	700	610	680	640	1400	680	340	560	560	410	1700	600
γ	.974	.996	.985	.982	1.007	1.017	.994	1.050	1.011	1.004	.995	.993
Sampled	Bulk	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	0-5mm	-	75-85mm	10-15mm

Sequence#	089041	089045	089046	089047	089048	089049	089050	089051	089052	089053	089054	089055
Latitude	23.672	25.728	25.260	25.783	25.454	25.489	25.783	25.783	24.322	25.489	25.489	25.454
Longitude	-164.891	-160.201	-162.046	-167.733	-168.683	-168.672	-167.733	-167.733	-168.083	-168.672	-168.672	-168.683
Depth	1650	2600	2300	1600	1115	1200	1600	1600	1225	1200	1200	1115
Lab#	W-234354	W-234329	W-234330	W-228572	W-228580	W-228581	W-228582	W-228583	W-228584	W-228585	W-228586	W-228587
SiO_2(wt.%)	11.6	5.82	9.50	6.74	8.00	6.76	8.35	4.65	34.3	7.15	16.9	6.94
TiO_2	1.79	1.50	1.92	.89	1.79	1.91	.85	.55	2.50	1.59	2.09	1.55
MnO_2	33.8	42.2	36.8	62.6	40.5	43.0	62.1	68.4	2.03	40.4	5.62	39.5
Fe_2O_3	28.2	25.8	27.2	6.58	21.8	22.3	5.29	3.78	29.2	26.6	14.3	25.1
Al_2O_3	1.94	.96	1.80	3.03	5.97	2.38	3.60	2.40	10.3	1.99	8.89	2.96
Co_3O_4	.975	1.27	1.12	.204	1.69	2.18	.141	.124	.096	1.70	.185	1.68
NiO	.377	.531	.461	.354	.459	.583	.377	.417	.078	.433	.186	.485
CuO	.083	.022	.094	.174	.080	.043	.172	.132	.021	.043	.044	.060
CaO	3.14	3.70	3.27	1.80	3.00	3.37	1.77	1.63	3.29	3.34	23.0	3.45
MgO	1.80	1.91	1.78	3.55	2.43	2.28	3.68	3.68	4.61	2.26	2.60	1.86
Na_2O	2.26	2.40	2.43	2.14	2.25	2.63	2.22	2.11	2.03	2.50	1.46	2.46
K_2O	.70	1.13	.65	1.42	.65	.63	1.53	1.40	1.55	.57	.44	.55
CO_2	.12	.32	.31	.30	.42	.33	.24	.22	1.01	.39	2.40	.43
P_2O_5	1.05	1.25	.97	.25	.93	1.00	.22	.19	.78	1.25	13.65	1.28
H_2O+	9.8	10.0	10.1	8.4	9.8	8.9	8.4	8.2	6.8	8.9	5.6	9.5
H_2O-	19.0	20.9	20.0	6.5	11.3	12.7	5.4	5.4	6.5	11.9	4.3	10.7
Sum	97.6	98.8	98.4	98.5	99.7	98.3	98.9	98.0	98.7	99.1	97.4	97.9
As(ppm)	330	400	300	86	300	330	61	51	193	390	52	390
Ba	1400	1200	1400	12000	1800	1100	12000	12000	139	1100	320	1200
Cd	2.2	3.7	3.1	43.9	4.6	4.6	51.8	60.3	.3	3.3	1.3	3.6
Ce	1200	1000	1200	225	940	1400	127	93	118	1200	136	1200
Cr	16	6	14	54	670	138	70	50	1100	81	3800*	224
Mo	440	700	440	214	740	580	190	222	<4	660	25	710
Pb	2100	2400	2100	360	2100	2600	201	169	246	2600	290	2600
Sr	1500	1800	1500	1400	1400	1500	1300	1400	280	1700	850	1700
V	680	780	700	270	650	650	233	243	610	780	330	820
Y	222	240	200	32	102	160	25	28	50	204	250	190
Zn	570	560	630	1400	540	550	1700	1700	400	490	320	540
γ	1.010	.998	1.002	1.001	.989	1.003	.997	1.007	.999	.995	1.012	1.007
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	4-6mm	-	5-7mm	75-85mm	8-10mm	2-22mm	75-85mm	75-85mm	0-1mm	3-18mm	1-2mm	10-15mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	089056	089058	089059	089061	089063	089067	089071	089077	089082	089083	089096	089097
Latitude	24.322	25.489	25.489	23.915	25.926	24.322	25.685	25.260	25.980	25.980	25.303	23.979
Longitude	-168.083	-168.672	-168.672	-164.408	-167.710	-168.083	-160.180	-162.046	-164.379	-164.379	-162.094	-164.363
Depth	1225	1200	1200	800	3250	1225	3000	2300	1800	1800	3500	2200
Lab#	W-228588	W-228590	W-228591	W-234331	W-234333	W-234334	W-234335	W-234338	W-234340	W-234341	W-234343	W-234347
SiO_2(wt.%)	11.9	9.53	17.9	14.4	24.5	30.9	2.14	8.59	11.7	8.08	14.7	22.2
TiO_2	1.86	1.61	2.21	2.62	1.86	2.55	.89	3.07	1.97	1.63	1.93	2.08
MnO_2	32.1	38.1	25.9	30.4	22.2	10.7	39.9	38.4	30.6	35.8	29.9	24.0
Fe_2O_3	26.6	25.6	25.3	27.1	22.9	23.1	26.1	25.3	31.3	29.1	28.1	22.5
Al_2O_3	3.16	3.60	6.69	3.54	5.96	8.99	.94	1.25	2.78	1.57	3.20	6.06
Co_3O_4	1.41	1.15	1.05	.795	.497	.362	1.82	1.46	.773	.983	.753	.864
NiO	.354	.642	.366	.403	.269	.183	.526	.484	.292	.405	.281	.404
CuO	.046	.079	.046	.132	.191	.028	.059	.071	.042	.035	.065	.082
CaO	3.43	3.14	2.79	3.35	5.10	4.95	5.79	3.88	3.36	3.31	3.18	2.86
MgO	2.40	2.42	3.30	1.75	4.10	4.99	2.38	1.91	1.82	1.83	1.71	2.36
Na_2O	2.56	2.24	2.21	2.47	2.47	2.42	2.20	1.77	2.31	2.30	2.24	3.13
K_2O	.68	.66	.75	.94	.68	1.07	.50	.64	.64	.60	.98	1.43
CO_2	.40	.47	.38	.27	.15	.69	.72	.43	.24	.33	.32	.16
P_2O_5	1.17	1.18	1.14	.95	.65	.71	2.76	.93	1.25	1.23	.90	.73
H_2O+	7.9	8.6	8.1	8.9	8.1	7.1	7.7	9.4	9.9	9.4	9.5	8.5
H_2O-	10.2	10.8	9.6	17.8	15.0	9.6	17.8	18.5	17.2	18.3	18.6	14.9
Sum	96.0	99.1	98.1	98.0	99.6	98.6	94.3	97.6	98.9	96.6	97.8	97.3
As(ppm)	360	360	300	249	188	188	460	280	370	400	280	217
Ba	1100	1300	750	1800	1200	450	1600	2000	1600	1600	1200	1200
Cd	2.9	5.2	2.8	2.4	1.5	1.1	4.9	3.2	2.1	3.2	2.0	2.6
Co	1300	1100	950	1200	910	420	850	1700	1200	1200	1600	990
Cr	167	660	1300	22	247	750	29	37	41	23	11	103
Mo	430	580	380	300	224	133	780	370	420	560	330	247
Pb	2500	2200	1800	1700	1400	910	3300	2100	2100	2300	2000	1500
Sr	1400	1600	1100	1600	1000	650	1700	1600	1600	1700	1400	1100
V	710	800	700	560	530	550	950	550	750	800	590	510
Y	178	179	155	170	111	84	219	245	205	220	197	141
Zn	490	650	500	680	530	370	670	610	580	610	540	590
γ	1.028	.995	1.005	1.006	.990	1.000	1.045	1.010	.997	1.020	1.008	1.013
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	1-10mm	15-20mm	1-5mm	3-12mm	4-8mm	1-3mm	1-2mm	38-45mm	30-35mm	35-40mm	5-8mm	2-5mm

Sequence#	089099	090001	090002	090003	090011	090011	090011	090012	090012	090012	090013	090014
Latitude	25.135	27.868	29.835	27.917	20.133	20.133	20.133	20.133	20.133	20.133	20.222	20.222
Longitude	-162.010	-177.883	-177.883	-171.062	-170.681	-170.681	-170.681	-170.681	-170.681	-170.681	-170.600	-170.600
Depth	2175	3443	3443	847	1476	1476	1476	1476	1476	1476	-	-
Lab#	W-234348	W-222572	W-222573	W-224384	W-228984	W-228986	W-228987	W-228953	W-228985	W-228993	W-228989	W-228957
SiO_2(wt.%)	8.93	12.7	7.78	15.8	5.93	2.67	4.27	8.08	8.19	2.44	10.2	9.84
TiO_2	1.83	1.62	1.37	1.71	1.69	1.20	2.08	1.73	2.24	1.40	2.06	2.18
MnO_2	39.8	33.7	44.3	26.7	42.1	37.8	46.8	38.9	40.0	40.6	36.3	35.5
Fe_2O_3	24.5	27.9	20.4	16.3	26.9	12.5	22.0	26.4	25.9	13.0	27.4	27.8
Al_2O_3	1.90	2.09	1.82	6.06	.75	.66	.61	1.16	1.52	.57	1.87	1.42
Co_3O_4	1.13	.679	1.79	.727	1.52	.581	1.45	1.35	1.29	.809	.982	.914
NiO	.592	.360	.612	.571	.577	.986	.838	.485	.610	.913	.592	.442
CuO	.072	.118	.050	.084	.033	.103	.084	.033	.081	.168	.247	.070
CaO	3.57	3.58	4.55	10.8	3.63	17.3	3.73	3.44	3.52	15.1	3.61	3.35
MgO	1.88	2.23	3.05	2.83	1.87	1.75	1.97	1.84	1.84	1.77	1.85	1.71
Na_2O	2.43	3.64	3.39	2.35	2.50	2.21	2.54	2.48	2.51	2.19	2.26	2.30
K_2O	.73	.57	.65	1.24	.56	.61	.65	.60	.70	.63	.63	.63
CO_2	-	.09	.44	1.07	.49	2.02	.47	.40	.47	1.68	.59	.54
P_2O_5	1.01	1.02	.97	5.88	1.23	9.26	.93	1.19	1.02	7.97	1.17	.98
H_2O+	10.4	5.9	5.7	7.5	8.6	7.1	9.1	8.3	8.5	6.8	9.7	9.7
H_2O-	20.5	25.8	29.3	6.4	14.0	10.9	13.4	13.4	14.5	10.8	14.0	13.6
Sum	-	96.2	96.9	99.6	98.4	96.7	97.5	96.5	98.4	96.1	99.4	97.4
As(ppm)	290	229	310	139	135	208	300	123	222	280	244	243
Ba	1300	1200	1000	1800	1800	1700	1300	2200	1600	1300	1500	1600
Cd	3.5	2.3	6.5	5.1	4.3	4.5	3.5	4.3	3.6	3.3	3.1	3.1
Co	930	1600	1400	740	1100	1300	1100	1700	1300	1100	1100	1100
Cr	21	20	177	290	6	8	13	6	20	16	15	13
Mo	520	460	790	410	590	720	700	640	500	540	400	440
Pb	2100	2000	2800	1400	1300	2100	2300	1600	2100	2300	2000	2000
Sr	1500	1500	1400	1400	1700	1700	1900	1800	1600	1700	1600	1600
V	680	610	650	460	490	730	810	580	690	720	670	680
Y	201	202	141	350	310	162	233	430	175	208	151	232
Zn	650	500	510	740	910	820	630	1000	660	590	800	640
γ	-	1.025	1.018	.990	1.002	1.019	1.011	1.022	1.002	1.027	.992	1.012
Sampled	nodule	Bulk	Bulk	Bulk	Young	Old	Middle	Young	Middle	Old	-	-
Interval	-	0-6mm	0-5mm	0-9mm	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	090015	090016	090016	090016	090018	090019	090020	090021	090022	090023	090024	090025
Latitude	20.218	20.218	20.218	20.218	28.895	28.895	29.106	29.167	29.106	29.167	29.208	28.895
Longitude	-170.589	-170.589	-170.589	-170.589	-178.868	-178.868	-173.948	-174.067	-173.948	-174.067	-174.112	-178.868
Depth	1480	1480	1480	1480	1280	1280	1850	1425	1850	1425	2200	1280
Lab#	W-228981	W-228960	W-228982	W-228988	W-228561	W-228562	W-228563	W-228564	W-228565	W-228566	W-228567	W-228556
SiO_2(wt.%)	13.1	7.37	2.17	8.57	19.6	25.4	8.12	5.22	6.91	6.19	11.6	7.05
TiO_2	2.09	2.40	1.27	1.76	1.33	1.59	1.77	1.50	1.58	2.25	2.08	1.21
MnO_2	33.7	41.6	41.9	39.4	38.9	30.4	40.9	45.8	43.9	42.1	37.4	44.8
Fe_2O_3	26.8	22.7	11.7	27.5	7.67	8.99	24.7	24.3	24.9	23.3	24.3	19.5
Al_2O_3	2.49	1.57	.66	1.18	7.15	9.43	1.32	1.03	1.04	1.64	2.36	1.74
Co_3O_4	.961	1.16	.987	1.44	.874	.635	1.08	1.18	1.31	.951	1.14	1.55
NiO	.442	.700	.908	.523	.575	.290	.524	.574	.566	.774	.506	.680
CuO	.067	.129	.170	.044	.058	.037	.082	.049	.057	.094	.171	.047
CaO	3.89	3.60	15.5	3.51	3.83	2.28	3.52	3.82	3.60	4.25	3.49	4.14
MgO	1.69	1.96	1.86	1.83	4.53	2.88	1.78	1.91	1.90	2.05	1.88	3.02
Na_2O	2.43	2.50	2.20	2.39	3.15	4.23	2.40	2.49	2.46	2.36	2.50	2.73
K_2O	.70	.75	.68	.59	1.77	3.14	.66	.63	.63	.73	.94	.60
CO_2	.51	.44	1.70	.49	.89	.64	.42	.42	.43	.42	.39	.33
P_2O_5	1.38	.94	8.05	1.21	.55	.40	1.15	1.20	1.15	1.55	1.01	1.04
H_2O+	8.1	8.7	6.8	7.9	7.8	7.2	8.6	7.5	8.4	9.1	8.7	6.8
H_2O-	13.6	14.5	11.7	14.8	4.9	7.8	12.6	15.7	14.6	11.2	11.9	12.1
Sum	98.3	96.6	96.6	98.3	98.7	97.5	97.1	97.5	98.9	97.8	98.5	95.3
As(ppm)	232	113	234	270	51	48	320	390	370	290	250	360
Ba	1600	2400	1800	1300	630	560	1600	1500	1300	2100	2600	1000
Cd	2.9	5.0	4.4	2.9	27.3	16.3	3.5	4.4	4.2	5.7	3.5	5.6
Cs	1000	1700	1300	1100	44	43	1600	1700	1400	2000	1800	1300
Cr	21	14	15	15	350	163	11	5	12	34	23	87
Mo	430	740	510	580	260	217	630	900	700	710	540	940
Pb	2000	1700	1900	2200	84	87	2400	2700	2600	2500	2000	2500
Sr	1600	1700	1600	1800	380	280	1700	1900	1600	1700	1600	1500
V	670	570	620	760	320	228	760	830	770	770	640	740
Y	197	570	164	211	35	22	183	178	199	203	182	159
Zn	650	1100	780	620	1600	970	630	580	600	820	620	520
γ	1.003	1.021	1.021	1.003	.999	1.012	1.016	1.011	.997	1.008	1.001	1.034
Sampled	Bulk	Middle	Old	Young	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	3-5mm	1-3mm	10-20mm	14-40mm	25-33mm	15-20mm	15-20mm	1-2mm

Sequence#	090026	090027	090028	090029	090030	090031	090032	090033	090034	090040	090046	090047
Latitude	28.895	29.167	29.167	29.167	29.185	29.208	29.167	29.062	29.208	29.106	29.106	29.106
Longitude	-178.868	-174.067	-174.067	-174.067	-174.010	-174.112	-174.067	-174.022	-174.112	-173.948	-173.948	-173.948
Depth	1280	1425	1425	1425	985	2200	1425	1150	2200	1850	1850	1850
Lab#	W-228559	W-228568	W-228570	W-228571	W-228574	W-228575	W-228576	W-228578	W-228577	W-234332	W-234345	W-234346
SiO_2(wt.%)	5.36	12.1	6.09	6.11	3.45	11.8	5.15	4.78	18.7	17.2	6.63	9.56
TiO_2	1.26	2.10	1.40	1.56	1.76	2.09	1.82	1.67	1.77	2.05	1.37	1.29
MnO_2	46.1	33.5	45.8	45.2	44.2	36.9	44.0	45.5	31.5	23.8	41.8	43.6
Fe_2O_3	20.5	28.8	22.7	23.9	24.0	25.0	24.4	23.7	23.4	30.2	23.0	16.0
Al_2O_3	1.19	2.38	1.22	1.04	1.04	2.16	.89	1.07	4.02	3.42	1.09	2.94
Co_3O_4	1.74	1.09	1.22	1.36	1.57	1.06	1.23	1.08	.731	1.20	1.32	.863
NiO	.667	.378	.702	.601	.556	.508	.583	.521	.484	.228	.547	1.407
CuO	.061	.090	.065	.045	.068	.143	.046	.051	.168	.037	.045	.159
CaO	3.58	3.20	3.70	3.71	4.34	3.35	4.49	3.82	3.60	2.25	3.92	3.72
MgO	2.51	1.89	2.10	1.91	2.10	1.82	1.90	1.89	1.85	2.09	1.87	2.87
Na_2O	2.79	2.40	2.41	2.30	2.41	2.40	2.52	2.62	2.57	2.47	2.94	2.82
K_2O	.73	.69	.66	.64	.61	.87	.61	.71	1.09	.93	.74	1.10
CO_2	.47	.40	.38	.35	.47	.41	.49	.38	.39	-	.29	.51
P_2O_5	1.09	1.47	1.16	1.19	1.66	.92	.17	1.23	1.08	1.23	1.41	1.06
H_2O+	8.4	8.5	9.5	9.3	9.2	9.0	9.4	9.0	8.4	9.7	9.6	9.8
H_2O-	14.1	12.5	13.0	13.2	13.0	12.4	12.7	12.1	10.6	16.1	18.6	13.2
Sum	96.4	98.9	99.2	99.2	97.4	98.3	97.7	98.1	99.7	-	96.6	97.6
As(ppm)	380	320	360	380	390	250	370	400	213	330	380	207
Ba	1100	3000	1600	1400	2000	2200	1500	2200	2500	1900	2100	2400
Cd	5.5	3.2	5.3	4.1	4.5	3.8	3.9	3.6	3.4	1.8	3.5	10.5
Cs	1500	2100	1600	1600	1600	1700	1700	2000	1300	1700	1200	1000
Cr	30	16	9	7	13	23	13	14	29	20	8	31
Mo	870	420	890	790	850	470	780	600	360	155	820	650
Pb	2700	2700	2600	2700	3000	1900	2500	2700	1700	3000	2600	1600
Sr	1500	1900	1700	1700	1800	1500	1700	1900	1300	1500	1600	1100
V	700	720	790	760	870	620	780	880	560	580	740	540
Y	163	206	172	184	149	171	206	137	157	143	197	111
Zn	540	620	630	560	640	640	610	590	640	490	520	1100
γ	1.023	.997	.994	.994	1.012	1.003	1.009	1.005	.989	-	1.021	1.010
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	10-25mm	25-35mm	15-20mm	-	15-25mm	4-12mm	90-110mm	20-25mm	4-10mm	3-5mm	4-8mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	090048	091001	091002	091003	091004	091005	091006	091007	091008	091009	091010	091011
Latitude	28.881	20.752	20.750	20.767	29.813	29.857	29.643	29.857	29.839	29.839	29.634	29.641
Longitude	-179.745	173.440	173.667	173.347	179.043	179.083	179.282	179.083	179.065	179.065	179.288	179.282
Depth	2000	1834	3816	1337	989	2250	1300	2250	2100	2100	1865	1300
Lab#	W-234349	W-222591	W-222592	W-222593	W-222574	W-228557	W-228560	W-228589	W-228553	W-228554	W-228555	W-228569
SiO_2(wt.%)	7.75	6.01	5.68	6.91	3.12	10.7	3.30	13.8	21.2	9.06	6.29	7.86
TiO_2	1.46	1.62	1.59	1.82	1.31	1.95	1.18	1.66	2.05	1.63	1.32	1.74
MnO_2	42.0	44.1	47.3	43.3	48.1	37.5	50.4	32.5	23.0	39.4	41.5	37.1
Fe_2O_3	21.8	24.2	22.6	24.7	16.5	23.9	20.9	27.8	25.0	24.3	27.3	29.0
Al_2O_3	1.60	1.14	1.15	1.20	.77	1.83	.62	2.74	5.08	2.17	.77	1.15
Co_3O_4	1.09	1.30	1.24	1.88	2.03	.953	1.83	.866	.763	1.30	1.05	1.83
NiO	.704	.678	.899	.598	.795	.505	.792	.398	.470	.511	.489	.329
CuO	.091	.109	.127	.033	.037	.137	.055	.070	.088	.055	.036	.039
CaO	3.41	4.21	4.65	4.64	3.61	3.43	3.59	2.97	4.07	3.37	3.59	3.30
MgO	3.24	2.11	2.20	1.92	2.21	1.82	2.23	2.22	3.53	1.90	1.82	1.86
Na_2O	2.40	3.28	2.49	2.62	2.85	2.57	2.93	2.46	2.69	2.64	2.45	2.47
K_2O	.67	.67	.60	.60	.51	.80	.68	.85	1.09	.87	.58	.61
CO_2	.25	.55	.57	.86	.42	.42	.49	.41	.25	.34	.50	.36
P_2O_5	1.04	1.38	1.49	1.71	1.00	1.07	1.20	1.13	1.03	1.31	1.26	1.41
H_2O+	9.5	6.6	5.7	4.7	10.5	8.4	9.5	8.8	7.1	8.4	9.0	9.0
H_2O-	18.7	26.8	27.8	27.6	26.4	14.3	18.1	10.4	10.7	12.8	14.2	10.9
Sum	97.0	97.9	98.3	97.4	93.8	96.0	99.8	98.7	97.3	97.2	97.9	98.1
As(ppm)	320	270	249	280	231	280	420	310	213	340	410	420
Ba	1600	1400	1500	1100	1100	2600	1200	1500	2200	1100	1300	2000
Cd	7.0	4.8	5.1	4.0	5.4	4.3	7.0	3.2	3.8	3.8	3.5	3.4
Ce	1100	890	1100	1300	1500	2000	1600	1500	1300	1600	1400	1800
Cr	37	14	15	11	14	19	5	28	168	24	5	10
Mo	760	740	710	540	800	530	1100	460	157	680	730	580
Pb	2100	2300	2400	2600	2900	2000	3100	2500	2200	2500	2800	2700
Sr	1600	1600	1500	1500	1300	1800	1700	1600	1200	2400	1700	2000
V	740	750	690	680	570	680	810	660	500	720	850	740
Y	123	164	249	221	129	175	171	167	134	195	233	191
Zn	840	680	800	620	580	680	620	590	670	500	560	490
γ	1.016	1.007	1.003	1.012	1.051	1.028	.988	.999	1.013	1.015	1.007	1.005
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	6-8mm	0-3mm	0-5mm	0-5mm	0-7mm	-	2-12mm	1-6mm	2-6mm	5-15mm	7-8mm	-

Sequence#	091012	091013	091021	092001	092002	092003	093001	093002	093003	093004	093005	093006
Latitude	29.869	29.820	29.820	21.145	21.160	21.678	21.483	21.480	23.703	24.017	29.490	29.522
Longitude	179.098	179.103	179.104	163.397	163.147	161.870	159.538	159.248	159.547	159.450	153.348	153.407
Depth	2900	1700	1700	1777	1468	1715	1273	1602	2812	4079	1991	1825
Lab#	W-228592	W-228558	W-234344	W-222594	W-222595	W-222596	W-222597	W-222598	W-222599	W-222600	W-222601	W-222602
SiO_2(wt.%)	11.1	12.9	29.3	21.5	5.12	8.64	17.0	12.2	20.0	19.2	7.95	14.2
TiO_2	2.26	2.09	3.41	1.78	1.61	1.53	1.65	1.53	1.80	1.46	1.42	.95
MnO_2	37.2	34.5	14.2	27.5	47.3	41.0	30.1	37.7	28.4	33.4	42.2	39.7
Fe_2O_3	25.7	23.3	19.7	23.4	24.8	24.9	25.0	28.2	27.1	25.4	27.3	21.5
Al_2O_3	2.11	2.80	8.03	6.57	.81	1.63	3.40	1.82	3.69	3.70	1.19	3.50
Co_3O_4	1.25	.994	.381	.877	1.45	1.19	.753	.977	.602	.728	.684	.521
NiO	.546	.537	.228	.361	.670	.601	.393	.430	.348	.398	.568	.990
CuO	.090	.041	.021	.037	.055	.068	.077	.047	.150	.075	.052	.155
CaO	3.63	3.99	5.79	3.79	4.18	4.91	5.93	3.79	3.28	3.10	3.71	2.42
MgO	1.87	2.27	4.62	2.01	2.05	2.24	1.75	1.84	1.83	1.90	1.87	2.87
Na_2O	2.48	2.62	3.20	2.45	2.56	2.97	2.70	2.71	2.86	2.61	2.51	2.22
K_2O	.82	1.07	2.05	1.13	.55	.39	1.05	.60	.70	.82	.59	.94
CO_2	.51	.58	.03	.43	.57	.65	1.17	.62	.43	.43	.61	.46
P_2O_5	.96	1.12	.85	1.36	1.34	2.04	2.45	1.36	1.07	.96	1.21	.82
H_2O+	8.6	9.2	6.5	5.9	6.0	5.0	4.4	3.8	4.9	4.2	4.7	8.5
H_2O-	11.4	12.3	10.6	22.4	29.7	25.9	22.2	26.1	23.1	23.3	28.3	19.0
Sum	99.0	98.0	98.2	99.2	99.0	97.7	97.8	97.6	97.3	98.3	96.6	99.7
As(ppm)	248	320	145	206	310	280	206	310	195	248	320	198
Ba	2000	970	540	910	1300	1200	1200	1200	1400	1100	1400	2300
Cd	3.5	4.3	1.6	3.4	3.8	3.8	2.4	3.0	3.8	3.0	3.6	4.2
Ce	2100	1300	550	820	970	970	1100	1000	1200	1300	1700	1100
Cr	31	81	340	55	6	19	30	15	33	35	11	17
Mo	380	580	190	370	770	670	310	570	300	460	820	210
Pb	2300	2200	930	1700	2500	2400	2000	2400	1900	1600	2700	1600
Sr	1500	1400	700	1500	1700	1600	1300	1600	1200	1300	1700	1200
V	590	700	450	520	730	700	570	700	520	630	740	540
Y	214	171	91	142	213	216	193	162	176	170	195	99
Zn	650	550	380	460	630	650	690	530	550	460	590	860
γ	.996	1.015	1.004	.994	.996	1.009	1.009	1.010	1.014	1.003	1.021	.989
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	5-6mm	-	0-4mm	0-9mm	0-4mm	0-2mm	0-12mm	0-10mm	0-6mm	0-8mm	0-12mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	093007	093008	093009	094002	094003	094004	094006	095001	095002	095003	114004	114006
Latitude	21.367	21.375	21.350	28.383	26.850	20.912	27.050	23.633	20.001	20.938	37.510	34.810
Longitude	153.287	153.272	153.333	148.250	148.783	142.532	148.683	133.283	138.816	138.033	-59.870	-57.223
Depth	2083	1787	3835	2423	2234	3112	1749	2630	2519	2508	1523	3310
Lab#	W-229875	W-229876	W-229878	W-222686	W-222687	W-222585	W-229871	W-229880	W-229858	W-229857	W-228418	W-228417
SiO_2(wt.%)	14.6	5.24	10.2	6.25	17.3	25.5	15.1	24.3	23.2	22.4	8.40	24.2
TiO_2	1.89	1.66	1.95	1.44	1.67	1.56	1.06	.79	1.64	1.80	.90	.62
MnO_2	37.4	45.9	38.6	44.6	28.1	16.7	26.7	29.6	18.0	19.5	30.6	20.1
Fe_2O_3	24.9	22.7	25.1	23.2	19.2	23.0	18.4	16.0	31.0	32.0	31.2	17.1
Al_2O_3	2.75	.80	2.35	.95	5.24	7.70	4.25	8.69	6.49	6.22	3.79	9.46
Co_3O_4	.781	1.04	.599	.706	.722	.108	.623	.214	.228	.293	.512	.396
NiO	.628	.830	.576	.914	.534	.145	.552	1.141	.198	.167	.511	.459
CuO	.187	.093	.189	.097	.059	.057	.100	.674	.147	.109	.100	.233
CaO	3.63	4.12	4.34	3.61	6.90	5.87	12.0	2.27	2.61	2.69	2.98	3.58
MgO	1.88	2.06	1.85	1.92	2.47	2.19	2.20	3.31	2.26	2.10	2.70	2.70
Na_2O	1.62	3.08	2.35	2.53	2.61	2.88	3.87	2.44	3.43	2.87	1.63	2.91
K_2O	.87	.71	.83	.72	.89	1.21	.79	2.20	1.02	.85	.50	2.58
CO_2	.49	.49	.49	.51	.69	2.04	1.17	.20	.19	.23	.83	.92
P_2O_5	.95	1.17	1.32	.91	3.48	.80	6.26	.49	.77	.77	.98	1.41
H_2O+	9.4	8.3	8.5	9.0	7.8	7.9	6.3	9.3	7.8	8.1	11.3	9.1
H_2O-	12.8	21.8	20.4	24.8	18.9	16.6	14.7	10.8	16.5	16.4	20.3	14.1
Sum	102.0	98.2	99.3	97.4	97.6	97.7	99.5	101.7	99.0	100.1	96.9	95.8
As(ppm)	250	310	239	280	210	168	188	123	192	227	600	221
Ba	1700	1700	2000	1700	880	1000	1100	1500	1200	1200	1600	1000
Cd	4.5	5.8	3.4	5.5	3.6	2.5	5.2	8.1	2.9	2.3	3.1	2.3
Ce	1300	1400	1600	1300	950	310	860	360	900	1100	1600	1200
Cr	9	<2	28	3	58	17	14	7	14	11	20	16
Mo	450	730	460	740	410	22	290	224	97	144	440	210
Pb	1600	2200	1600	2000	1600	470	1400	660	970	1200	1400	470
Sr	1500	1800	1600	1600	1200	1100	1100	620	930	970	1500	690
V	600	700	620	720	530	350	470	360	490	530	1100	520
Y	184	192	239	186	185	12	116	75	144	156	125	90
Zn	610	720	690	840	580	460	590	1300	540	510	880	630
γ	.967	1.004	.993	1.012	1.010	1.009	.991	.969	.996	.985	1.017	1.029
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	0-7mm	-	-	-	-	0-25mm	0-11mm

Sequence#	115005	115007	115009	115015	116008	116009	116010	116011	116012	116013	116014	116015
Latitude	33.947	39.383	39.450	38.067	30.798	30.798	30.798	31.075	32.195	31.310	30.970	31.075
Longitude	-65.783	-67.233	-65.455	-60.217	-78.160	-78.160	-78.495	-78.172	-77.460	-77.307	-78.818	-78.172
Depth	4892	3040	2240	3007	840	840	860	817	690	1090	794	817
Lab#	W-228416	W-228419	W-228420	W-229864	W-229289	W-229287	W-229298	W-229300	W-229291	W-229293	W-229286	W-229296
SiO_2(wt.%)	22.3	38.1	8.31	21.2	2.56	4.52	5.78	4.85	6.89	1.59	6.42	8.65
TiO_2	.83	.48	1.13	1.59	.78	.66	.62	.45	.56	.64	.59	.22
MnO_2	19.2	14.0	22.9	18.1	32.6	30.1	33.4	37.8	29.6	23.9	22.1	7.99
Fe_2O_3	28.3	23.8	38.0	30.0	20.5	21.4	22.4	16.4	20.8	16.7	21.2	14.6
Al_2O_3	7.34	6.08	3.14	7.05	3.62	5.43	6.66	5.73	4.56	2.85	5.83	3.68
Co_3O_4	.225	.115	.470	.413	.717	.615	.587	.553	.594	.417	.437	.119
NiO	.285	.310	.211	.297	.807	.826	1.183	1.248	.789	.571	.701	.328
CuO	.177	.250	.032	.190	.093	.145	.170	.183	.158	.051	.113	.052
CaO	2.80	1.16	3.76	3.85	10.2	8.76	1.84	6.47	10.8	20.4	13.2	27.5
MgO	2.34	2.76	2.12	2.78	4.90	5.61	6.39	6.54	5.23	4.15	4.91	3.19
Na_2O	1.88	1.66	1.66	1.81	1.56	1.26	1.59	1.33	1.26	1.16	1.07	.91
K_2O	1.01	1.60	.60	.86	.40	.47	.55	.64	.54	.26	.54	.83
CO_2	1.18	.41	1.53	.51	7.89	8.57	5.78	4.40	7.58	7.22	4.70	5.66
P_2O_5	.94	.61	1.20	2.06	1.01	1.09	1.09	.85	1.00	8.53	5.97	15.58
H_2O+	7.1	5.7	10.4	8.9	8.9	9.6	11.0	10.5	8.8	7.7	9.6	6.9
H_2O-	15.1	9.8	21.8	14.2	16.4	13.7	11.8	11.3	12.9	8.6	12.8	2.9
Sum	95.8	97.0	95.4	99.5	96.5	99.0	99.0	98.0	99.2	96.1	97.4	96.2
As(ppm)	340	260	690	330	410	450	480	340	460	300	310	185
Ba	680	1100	1200	970	1100	1900	1900	2600	2000	1900	1500	310
Cd	3.7	1.3	1.9	3.8	7.2	7.1	6.2	7.1	5.1	3.4	5.0	1.8
Ce	1600	520	1500	1300	1100	1100	1100	720	940	1100	870	270
Cr	38	36	41	37	19	21	28	23	26	12	29	38
Mo	189	67	330	187	370	390	340	360	300	270	206	134
Pb	920	370	1100	820	1200	1100	1200	790	940	1300	880	270
Sr	750	410	1400	860	1400	1300	950	1000	1100	1600	1100	950
V	790	620	1400	830	770	790	850	730	760	660	710	430
Y	130	44	230	152	179	139	113	99	109	219	241	460
Zn	2600	450	540	590	660	650	690	710	640	510	630	320
γ	1.029	1.016	1.033	.990	1.022	.996	.996	1.006	.994	1.026	1.013	1.025
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-12mm	0-4mm	0-25mm	-	0-18mm	0-25mm	0-17mm	0-17mm	0-15mm	0-4mm	0-14mm	0-3mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	116016	116017	116018	116019	116020	116021	116022	116023	116024	116025	116027	116028
Latitude	31.075	32.632	30.990	30.990	31.075	30.798	30.798	30.798	30.798	31.075	31.295	31.075
Longitude	-78.172	-77.515	-78.522	-78.522	-78.172	-78.495	-78.495	-78.495	-78.495	-78.172	-78.172	-78.172
Depth	817	399	780	780	817	860	860	860	860	817	690	817
Lab#	W-229290	W-229283	W-229288	W-229297	W-229304	W-229295	W-229302	W-229305	W-229284	W-229285	W-229294	W-229292
SiO_2(wt.%)	6.32	6.09	4.70	2.76	2.26	2.50	3.13	4.12	3.10	7.85	3.77	2.79
TiO_2	.51	.55	.59	.58	.53	.58	.63	.67	.65	.30	.51	.52
MnO_2	12.2	35.4	22.3	26.3	26.3	27.9	33.0	30.0	33.1	18.5	22.4	22.9
Fe_2O_3	17.5	21.1	27.5	23.0	20.5	22.2	19.2	21.5	20.6	13.0	20.4	21.2
Al_2O_3	4.02	5.91	4.36	3.23	3.74	2.89	4.28	4.67	4.43	4.41	3.09	3.89
Co_3O_4	.186	.523	.406	.472	.402	.489	.546	.609	.612	.274	.327	.331
NiO	.509	1.077	.496	.544	.665	.546	.810	.734	.813	.715	.436	.577
CuO	.057	.155	.093	.064	.063	.057	.162	.146	.136	.090	.057	.062
CaO	23.6	4.90	11.4	14.1	14.3	13.8	11.1	10.7	9.27	21.7	17.7	15.9
MgO	3.39	5.99	4.35	4.31	5.52	4.09	5.04	4.90	5.06	4.71	3.85	5.48
Na_2O	1.18	1.42	1.08	1.21	1.00	1.25	1.39	1.22	1.38	1.28	1.23	.86
K_2O	.53	.72	.44	.39	.30	.39	.53	.51	.53	.65	.43	.35
CO_2	3.37	3.84	9.17	11.3	11.5	10.4	6.84	7.53	6.51	2.76	14.3	13.3
P_2O_5	14.72	1.01	1.29	1.03	.91	1.01	.89	1.02	.98	12.15	1.02	.94
H_2O+	7.9	9.6	8.5	8.3	10.5	8.3	8.6	8.9	9.6	8.0	7.4	8.8
H_2O-	5.0	11.4	12.8	13.4	12.0	13.7	15.2	15.0	15.5	5.7	12.5	9.6
Sum	95.9	98.3	96.7	97.5	98.4	96.4	96.2	97.3	96.9	96.3	97.0	98.0
As(ppm)	250	440	540	490	450	480	390	440	410	223	410	460
Ba	490	2600	1700	1300	1400	1500	2200	1800	2400	730	880	1200
Cd	2.3	5.8	4.9	4.6	5.2	4.9	5.9	5.9	6.5	3.4	4.0	5.0
Ce	860	860	950	1000	990	950	960	1000	1000	420	890	1000
Cr	97	31	34	32	27	29	20	22	21	79	31	37
Mo	158	360	310	330	310	390	410	360	450	180	320	250
Pb	470	990	960	1200	1100	1200	1200	1200	1200	450	940	980
Sr	1100	1000	1300	1500	1600	1700	1400	1600	1400	1000	1300	1300
V	480	820	970	850	820	870	750	800	850	450	720	800
Y	590	93	161	185	216	209	142	141	166	320	183	188
Zn	350	690	600	470	520	500	670	620	690	450	430	510
γ	1.029	1.003	1.019	1.011	1.002	1.022	1.025	1.014	1.018	1.024	1.016	1.006
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-2mm	0-15mm	0-14mm	0-16mm	0-9mm	0-8mm	0-15mm	0-22mm	0-18mm	0-2mm	0-1mm	0-4mm

Sequence#	116029	120001	120002†	121002	125001	125002	125003	125004	125005	125006	125007	125008
Latitude	30.990	31.250	31.283	33.733	33.490	34.077	33.863	33.828	32.468	33.627	31.802	31.660
Longitude	-78.522	-117.583	-118.467	-120.750	-166.535	-166.502	-166.515	-166.993	-165.800	-165.098	-165.843	-163.017
Depth	780	2120	650	1719	3220	4400	3410	3050	3150	2740	2500	2350
Lab#	W-229301	W-222553	W-222554	W-231371	W-224408	W-224409	W-224410	W-224411	W-224413	W-224414	W-224415	W-224416
SiO_2(wt.%)	2.52	33.6	50.7	13.4	26.0	15.8	33.8	22.2	18.7	15.6	12.1	18.8
TiO_2	.62	.50	1.48	.63	1.56	2.04	1.38	1.25	1.46	1.61	1.70	1.50
MnO_2	28.5	17.8	.36	22.1	26.0	30.5	14.1	19.2	31.3	32.4	37.9	27.4
Fe_2O_3	24.9	22.6	8.68	22.1	20.9	26.4	12.1	30.8	19.5	24.1	25.1	24.0
Al_2O_3	2.97	5.48	17.3	2.09	6.50	4.62	10.6	6.75	4.69	3.23	2.36	4.29
Co_3O_4	.554	.088	.009	.341	.585	.470	.234	.236	.618	.900	.911	.721
NiO	.562	.399	.007	.261	.396	.340	.451	.248	.742	.435	.592	.440
CuO	.060	.023	.001	.023	.202	.209	.202	.230	.243	.098	.156	.230
CaO	12.4	2.11	10.1	9.55	2.55	3.42	6.76	3.48	4.84	4.62	3.49	3.18
MgO	4.14	2.50	4.78	5.68	2.67	2.03	3.03	1.97	2.51	1.89	2.07	1.97
Na_2O	1.19	3.60	3.81	1.77	2.79	2.22	2.15	2.49	2.59	2.85	2.61	2.81
K_2O	.38	1.24	.71	.62	1.16	1.17	2.33	1.12	1.43	.71	.79	1.30
CO_2	9.07	.30	.06	11.3	.49	.57	1.07	.71	1.51	.69	.65	.42
P_2O_5	1.12	.69	.50	1.04	.62	1.07	3.45	1.07	1.24	.17	.88	1.14
H_2O+	8.5	8.1	2.2	7.3	9.0	9.8	6.9	10.5	6.9	8.3	5.1	12.5
H_2O-	14.0	13.8	2.8	12.1	6.9	10.1	6.9	7.6	7.4	12.2	11.8	7.5
Sum	97.5	99.1	100.6	98.2	101.4	100.6	98.6	102.2	98.2	97.7	96.4	100.7
As(ppm)	530	174	17	250	118	167	41	173	119	182	215	184
Ba	1400	1300	103	1100	1400	1800	19000	2100	3800	1700	4200	3100
Cd	5.0	3.7	<.1	1.5	2.9	2.2	2.3	1.7	5.5	3.2	3.6	3.1
Ce	990	600	23	980	1500	2200	520	740	1000	1300	1500	1400
Cr	30	74	206	47	16	15	64	15	30	14	13	15
Mo	380	174	<4	480	260	340	129	217	300	390	460	290
Pb	1300	570	<9	1600	1300	1200	400	770	1200	1800	1600	1500
Sr	1700	750	247	1300	1100	1200	1600	1100	1100	1400	1600	1300
V	970	450	247	580	420	1800	193	670	400	540	560	520
Y	221	93	35	159	150	245	247	151	238	216	193	173
Zn	550	630	82	430	580	520	490	650	730	520	620	640
γ	1.011	.995	.980	1.004	.972	.980	1.000	.965	1.004	1.010	1.023	.979
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-9mm	0-10mm	-	0-25mm	0-6mm	0-38mm	0-4mm	0-32mm	0-14mm	0-10mm	0-20mm	0-11mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	125009	125010	125011	125014	126001	127003	127004	127006‡	127007	127008	127012	128001
Latitude	31.935	33.928	33.217	33.828	33.473	33.693	33.666	32.292	32.137	31.020	37.762	39.385
Longitude	-162.240	-162.095	-162.338	-166.993	-178.012	177.552	171.602	172.792	172.262	175.873	170.280	165.868
Depth	2460	2550	2160	3050	5063	1558	1002	645	1360	598	1629	3537
Lab#	W-224417	W-224418	W-224420	W-224412	W-224381	W-222609	W-222610	W-222611	W-222612	W-222613	W-224382	W-224383
SiO_2(wt.%)	15.1	14.5	15.1	42.0	24.5	3.13	6.47	.56	10.7	6.60	18.6	26.4
TiO_2	1.35	1.42	1.61	2.29	2.84	1.11	1.16	.01	1.10	1.23	1.58	1.44
MnO_2	22.6	33.3	31.3	7.69	21.4	48.2	44.8	.12	40.0	40.3	25.4	26.1
Fe_2O_3	21.4	22.5	24.5	10.4	21.7	22.2	21.4	.19	21.7	23.8	21.8	21.1
Al_2O_3	2.84	3.18	3.22	13.0	7.23	.41	1.92	.27	2.53	1.22	4.76	6.23
Co_3O_4	.586	.811	.804	.187	.593	1.20	1.38	.002	.106	1.04	.529	.217
NiO	.301	.615	.477	.128	.379	.658	.484	.003	.511	.470	.294	.676
CuO	.089	.155	.115	.034	.041	.024	.081	<.001	.079	.041	.045	.266
CaO	12.0	4.56	3.65	8.13	5.65	3.81	3.55	51.5	3.74	3.32	8.08	2.68
MgO	1.62	1.86	1.88	1.31	4.58	1.94	2.52	1.58	2.82	2.19	2.44	2.64
Na_2O	2.58	2.58	2.61	3.17	2.76	2.86	2.92	.66	3.16	4.49	2.21	2.44
K_2O	.91	1.10	1.03	3.35	.86	.57	.72	.06	.50	.72	1.10	1.54
CO_2	1.29	.54	.47	.83	.35	.45	.49	42.9	1.16	.50	.99	.23
P_2O_5	6.90	1.88	1.22	3.87	.80	1.12	1.19	.14	.98	1.21	3.85	.66
H_2O+	9.2	10.2	11.5	5.0	7.2	9.0	9.0	.8	10.3	8.8	8.8	9.0
H_2O-	7.0	11.0	11.9	5.3	5.9	26.5	21.2	.5	17.8	24.2	4.8	5.9
Sum	98.8	99.2	99.4	101.4	100.9	96.7	98.1	98.9	99.5	95.9	100.5	101.6
As(ppm)	151	169	193	51	170	350	330	3	231	340	158	117
Ba	1700	3900	2400	2300	770	1000	2200	13	2700	1600	6500	1400
Cd	2.0	4.4	2.6	.6	2.3	4.2	4.1	2.0	2.7	4.4	3.2	4.5
Co	1100	1200	1200	390	620	1500	1300	<9	1300	1600	1100	1000
Cr	12	9	27	41	270	8	33	3	39	16	280	28
Mo	226	360	390	94	310	1100	1100	<4	195	830	250	290
Pb	1500	1500	1500	390	1200	2600	2700	<9	2300	2600	1700	1200
Sr	1300	1500	1400	610	1000	1600	1700	930	1600	1700	1600	910
V	440	480	540	380	610	800	760	8	610	740	540	440
Y	247	169	204	232	117	191	127	6	146	172	168	128
Zn	480	660	590	410	560	530	650	20	730	570	550	970
γ	.998	.994	.992	.973	.977	1.020	1.005	.997	.991	1.028	.981	.971
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-23mm	0-15mm	0-14mm	-	0-14mm	0-10mm	0-6mm	-	0-2mm	0-3mm	-	0-11mm

Sequence#	128002	129002	129003	130001	130002	130003	130004	130005	146001	147001	147003	157001
Latitude	37.267	31.557	32.018	38.017	32.758	34.267	34.220	34.253	43.613	43.003	42.332	45.821
Longitude	162.400	151.222	149.273	145.983	148.225	145.945	144.185	143.853	-15.690	-28.220	-27.005	-129.504
Depth	1110	1768	1697	2785	2262	2046	1830	1898	5740	-	3193	-
Lab#	W-222684	W-222603	W-222604	W-222695	W-222605	W-222606	W-222607	W-222608	W-229853	W-222734	W-229854	W-230116
SiO_2(wt.%)	3.09	12.2	15.0	24.2	11.6	17.2	23.3	18.8	18.7	11.2	9.66	35.3
TiO_2	1.18	1.03	1.23	.86	.29	1.21	1.30	1.35	1.83	2.26	2.42	.82
MnO_2	54.8	38.0	32.5	22.1	15.3	31.1	22.2	29.6	24.4	19.5	24.1	14.0
Fe_2O_3	17.5	15.1	24.9	31.7	51.5	27.2	28.5	22.5	26.4	32.1	33.8	22.7
Al_2O_3	.41	3.52	4.34	3.21	1.78	3.32	4.54	3.72	8.27	6.28	5.59	8.04
Co_3O_4	.739	.571	.675	.180	.051	.307	.294	.268	.565	.501	.740	.133
NiO	.639	.859	.831	.230	.131	.542	.336	.595	.352	.227	.292	.110
CuO	.053	.175	.151	.050	.233	.188	.071	.185	.187	.048	.138	.046
CaO	3.85	7.66	2.03	2.46	2.09	2.81	3.02	4.13	3.32	4.52	3.77	5.17
MgO	1.71	2.70	3.21	1.48	1.73	2.02	1.87	2.24	3.32	4.57	3.62	3.30
Na_2O	2.80	1.98	2.30	2.31	1.61	2.26	2.28	2.71	1.91	3.18	2.14	2.78
K_2O	.83	1.12	.82	.73	.34	.59	.90	1.05	.92	.73	.65	.90
CO_2	.37	.92	.21	.25	.41	.40	.32	.65	.46	.62	.82	.17
P_2O_5	.96	4.00	.94	.86	1.25	.83	1.24	1.55	.92	1.55	1.25	.80
H_2O+	8.1	8.6	10.4	7.0	10.3	8.9	8.9	8.0	10.6	9.0	9.5	6.4
H_2O-	26.3	14.1	17.3	17.0	19.5	20.2	16.7	18.7	13.2	15.8	17.2	10.7
Sum	97.0	98.5	99.5	97.6	98.6	98.9	99.1	97.4	102.1	96.3	98.6	100.7
As(ppm)	310	140	169	229	390	175	132	160	310	550	470	168
Ba	3400	3600	2500	1300	1200	1600	1900	3000	820	1100	1200	1000
Cd	4.2	4.3	2.9	2.7	1.5	4.1	2.3	2.6	7.0	5.1	5.8	1.5
Co	2800	1300	1500	1000	174	1100	1100	1600	1600	1200	1700	310
Cr	3	34	12	11	8	14	17	15	31	105	79	71
Mo	1500	360	73	250	174	330	72	340	161	214	280	157
Pb	2400	1400	2200	1700	174	1800	1700	1700	1300	1100	1100	350
Sr	1900	1200	1200	1100	1000	1400	1200	1400	880	1800	1300	850
V	790	440	460	600	1000	600	520	500	700	1100	1000	460
Y	107	140	85	157	137	125	132	62	184	260	230	123
Zn	680	830	850	720	820	830	660	840	500	640	620	400
γ	1.017	1.001	.990	1.010	1.000	.997	.995	1.013	.966	1.024	1.000	.980
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	0-8mm	0-7mm	-	0-3mm	0-10mm	0-10mm	0-5mm	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	157002	157003	157004	157005	157006	157007†	157008†	157009	157011†	157012	158001	158003
Latitude	45.821	45.821	45.821	45.821	45.821	45.733	45.733	45.821	44.000	44.000	46.069	46.153
Longitude	-129.504	-129.504	-129.504	-129.504	-129.504	-129.912	-129.928	-129.504	-129.000	-129.000	-130.387	-130.335
Depth	-	-	-	-	-	-	-	-	2616	2302	-	-
Lab#	W-230106	W-230107	W-230111	W-230097	W-230115	W-230102	W-230101	W-230099	W-231368	W-231367	W-230110	W-230109
SiO_2(wt.%)	32.0	31.6	43.6	27.3	37.5	49.1	47.9	33.4	41.4	38.9	36.3	41.6
TiO_2	.76	.75	1.03	.68	.92	1.38	.96	.74	.49	.65	.87	1.29
MnO_2	15.6	16.2	5.90	20.0	11.3	1.00	3.50	13.5	3.64	7.56	11.6	6.97
Fe_2O_3	23.4	23.5	16.9	26.8	20.1	13.8	23.1	22.7	33.6	28.1	19.5	16.9
Al_2O_3	7.58	7.39	11.5	5.86	9.56	13.5	9.36	8.61	5.42	6.07	12.0	11.4
Co_3O_4	.128	.132	.068	.163	.096	.008	.004	.112	.034	.091	.059	.051
NiO	.136	.146	.043	.152	.099	.011	.024	.122	.091	.141	.122	.068
CuO	.054	.058	.043	.057	.044	.011	.013	.040	.034	.029	.022	.016
CaO	5.61	5.47	8.95	3.91	7.70	12.0	7.86	6.37	1.22	1.63	7.46	8.12
MgO	3.63	3.59	5.83	2.55	4.87	7.01	5.66	4.49	2.19	2.71	3.59	5.32
Na_2O	2.66	2.78	2.56	2.80	2.62	2.68	2.51	2.48	2.37	2.52	2.76	3.01
K_2O	.75	.78	.63	.91	.65	.21	1.66	.67	1.00	1.46	.78	.75
CO_2	.21	.21	.06	.26	.13	.04	.04	.19	.04	.07	.17	.09
P_2O_5	.84	.87	.39	1.04	.63	.16	.20	.81	.63	.66	.66	.52
H_2O+	6.4	7.2	4.2	8.5	5.4	1.7	4.6	6.4	6.8	7.0	5.7	4.2
H_2O-	12.7	13.1	6.2	16.2	9.1	.7	9.2	10.0	8.6	10.0	10.0	6.9
Sum	99.7	100.8	101.7	101.0	101.7	102.6	107.5	100.8	98.9	97.6	101.6	100.2
As(ppm)	195	196	63	239	132	9	20	178	164	167	133	84
Ba	870	930	430	1000	610	111	121	790	800	1100	740	630
Cd	1.6	2.0	1.0	1.8	1.9	.5	2.1	1.3	.4	1.1	1.2	1.0
Co	270	280	96	380	198	<9	12	290	300	360	167	150
Cr	104	99	203	64	154	59	53	156	270	260	122	183
Mo	195	207	35	260	132	<4	<5	178	<5	38	99	46
Pb	390	370	171	490	280	<49	<54	290	470	430	156	183
Sr	850	870	410	1100	640	161	143	800	320	540	720	570
V	480	480	350	530	430	350	250	480	490	390	370	340
Y	126	127	64	155	99	34	28	122	58	67	98	70
Zn	420	410	300	430	350	131	231	340	450	390	290	280
γ	.989	.978	.970	.976	.970	.961	.917	.978	.997	1.010	.970	.984
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	158004	158005†	158006†	158007†	158008	158009	158010	158011†	158012	158013	158014	158015
Latitude	46.153	46.125	46.125	46.125	48.475	48.475	48.475	45.654	45.953	45.953	45.953	46.069
Longitude	-130.335	-130.000	-130.000	-130.000	-133.133	-133.133	-133.133	-130.075	-130.274	-130.274	-130.274	-130.387
Depth	-	-	-	-	1245	1245	1245	-	-	-	-	-
Lab#	W-230108	W-230103	W-230091	W-230104	W-230114	W-230095	W-230092	W-230089	W-230090	W-230098	W-230096	W-230112
SiO_2(wt.%)	39.9	48.6	47.9	44.5	6.18	5.92	4.22	48.9	26.3	22.4	30.8	36.4
TiO_2	1.46	1.96	1.80	1.69	1.30	1.18	1.43	1.51	.64	.47	.71	.71
MnO_2	9.56	.76	1.36	3.58	42.7	43.8	47.3	.44	20.2	24.9	16.5	13.2
Fe_2O_3	19.0	14.2	15.0	17.1	24.7	25.9	20.8	12.9	25.9	27.8	24.3	22.1
Al_2O_3	10.2	13.5	12.5	11.5	1.12	.93	.87	13.5	7.07	4.69	7.86	8.88
Co_3O_4	.059	.008	.014	.020	1.22	1.17	1.49	.006	.091	.114	.099	.080
NiO	.114	.012	.014	.035	.497	.449	.632	.008	.193	.219	.137	.131
CuO	.028	.009	.013	.014	.043	.035	.061	.011	.029	.051	.039	.032
CaO	7.40	11.4	10.3	9.24	3.48	3.63	3.68	12.2	4.65	3.21	5.01	4.52
MgO	4.60	6.50	5.92	5.30	1.88	1.80	1.95	6.99	2.25	1.87	3.39	2.66
Na_2O	3.12	3.01	3.16	2.86	3.40	3.16	3.64	2.90	2.62	2.89	2.92	2.92
K_2O	.79	.39	.55	.58	.65	.62	.69	.21	.79	.99	.81	.97
CO_2	.11	.01	.03	.04	.37	.45	.37	.02	.26	.34	.23	.21
P_2O_5	.57	.23	.23	.35	1.30	1.39	1.11	.16	1.10	1.27	.90	.81
H_2O+	4.9	1.9	2.3	4.7	9.3	10.2	12.4	1.6	8.0	9.0	6.5	6.4
H_2O-	7.3	.6	2.0	3.1	20.7	20.6	19.4	.4	14.5	18.6	13.5	12.8
Sum	101.7	102.5	101.1	101.6	98.2	100.7	100.6	101.4	100.1	100.1	100.1	100.1
As(ppm)	94	7	17	41	400	420	400	5	260	310	208	172
Ba	690	64	290	340	1200	1400	1700	47	1300	1600	1400	1400
Cd	1.8	.3	.1	.8	4.8	4.4	5.7	<.1	2.2	2.0	1.7	1.8
Co	162	14	29	78	1900	1900	2000	<9	260	310	250	280
Cr	82	131	122	114	6	6	8	241	59	30	86	83
Mo	78	<4	<4	<4	790	880	1400	<4	234	450	173	95
Pb	173	<49	<50	62	2300	2400	2400	<49	290	330	300	201
Sr	550	201	270	350	1500	1800	1500	161	1100	1500	1100	860
V	400	360	360	360	720	780	710	340	530	600	460	410
Y	80	37	40	55	189	202	149	31	152	184	139	109
Zn	350	151	163	227	540	490	580	110	430	450	430	390
γ	.969	.962	.975	.971	1.004	.979	.980	.973	.985	.985	.985	.985
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	158016	158017	158018	158020	158021	158023	163001	300001	301001	302001†	310001	315001
Latitude	46.041	46.041	46.041	46.125	48.475	44.750	40.267	-9.960	-4.100	-2.367	-2.177	-7.588
Longitude	-130.367	-130.367	-130.367	-130.000	-133.133	-130.500	170.333	-5.387	-12.150	-22.767	-101.960	-151.543
Depth	-	-	-	-	-	2995	2037	1561	1640	3217	3108	1800
Lab#	W-230093	W-230105	W-230100	W-230088	W-230113	W-231370	W-222685	W-231346	W-222733	W-222711	W-231373	W-224398
SiO_2(wt.%)	39.1	39.5	41.9	39.4	5.19	28.3	4.58	5.04	12.7	49.1	8.43	9.65
TiO_2	.74	.75	.84	1.17	1.10	.59	1.08	1.85	.80	1.59	.43	1.63
MnO_2	8.01	8.65	6.14	9.24	43.8	19.7	46.9	37.3	9.45	.64	33.1	22.6
Fe_2O_3	19.2	19.1	14.9	21.3	25.1	25.4	23.7	25.8	50.1	12.2	33.5	17.2
Al_2O_3	11.4	10.9	12.9	8.99	.79	5.51	.61	2.74	4.81	15.5	.77	2.57
Co_3O_4	.035	.039	.030	.050	1.13	.097	.843	1.89	.133	.009	.074	.371
NiO	.078	.085	.087	.081	.479	.233	.651	.513	.102	.022	.315	.390
CuO	.018	.022	.014	.030	.041	.064	.045	.055	.073	.018	.126	.135
CaO	7.68	6.88	8.96	6.05	3.63	2.43	3.84	3.74	2.37	7.69	3.69	21.3
MgO	5.53	5.18	6.78	3.57	1.77	1.88	1.72	2.67	2.50	6.36	1.75	1.54
Na_2O	2.98	3.05	2.85	2.81	3.27	3.01	2.53	3.11	2.41	3.53	2.12	1.93
K_2O	.62	.71	.43	.81	.61	1.06	.65	.49	.39	1.25	.40	.74
CO_2	.46	.16	.12	.13	.45	.09	.50	.50	.88	.02	.40	2.84
P_2O_5	.57	.53	.36	.62	1.37	.84	1.17	1.15	1.64	.19	1.33	11.71
H_2O+	5.5	5.4	4.6	5.8	9.7	7.2	8.3	8.9	10.6	1.8	9.5	6.1
H_2O-	7.1	8.5	4.7	7.5	23.0	12.6	25.7	20.6	16.3	3.6	19.3	11.9
Sum	101.9	100.9	100.8	100.1	98.4	96.4	97.1	95.7	98.9	99.8	96.0	100.7
As(ppm)	103	103	68	119	420	195	360	400	650	6	330	100
Ba	1100	840	410	890	1300	1300	1500	1200	880	187	1200	2300
Cd	.9	1.1	.7	1.3	4.7	2.2	3.9	3.7	1.8	.6	1.7	2.7
Co	162	153	91	184	1800	390	1900	2500	930	35	186	830
Cr	129	131	189	71	5	23	2	33	30	239	0	64
Mo	23	38	28	24	940	183	1200	500	<5	<4	470	260
Pb	194	175	100	141	2500	310	2600	2000	440	57	290	810
Sr	580	560	410	640	1700	970	1800	1600	740	249	1700	1500
V	320	320	270	390	820	430	850	930	1200	228	760	490
Y	80	79	59	91	195	149	202	239	143	25	235	790
Zn	310	280	220	360	560	470	610	540	670	239	590	700
γ	.967	.977	.978	.985	1.002	1.023	1.016	1.030	.997	.988	1.027	.979
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	0-8mm	-	<1mm	0-10mm	0-30mm

Sequence#	315002	316001	316002	316003	325001	330001	334001	335001	337002	337003	343001	344001
Latitude	-7.588	-9.990	-1.300	-1.158	-9.383	-9.650	-5.750	-5.383	-12.933	-13.303	-19.562	-19.975
Longitude	-151.543	-164.222	-168.388	-168.003	109.267	56.417	-11.350	97.483	-14.252	-15.528	-70.425	-80.042
Depth	1800	4430	6890	7117	1390	2800	2380	4119	2544	3199	658	3109
Lab#	W-231399	W-222526	W-222520	W-222528	W-222701	W-222538	W-222530	W-222539	W-231366	W-231364	W-224378	W-222715
SiO_2(wt.%)	8.91	15.3	10.3	35.2	10.4	8.78	7.94	10.5	8.95	6.42	18.1	9.77
TiO_2	1.92	1.58	.56	1.88	.82	1.89	1.66	.94	1.09	1.25	2.01	1.74
MnO_2	36.8	33.4	38.7	13.6	23.1	33.6	24.5	34.1	18.8	24.7	25.9	26.0
Fe_2O_3	21.1	23.1	26.3	19.7	33.2	28.0	34.2	32.7	31.6	37.1	19.3	31.8
Al_2O_3	2.00	4.89	2.49	9.47	2.13	2.21	4.34	2.43	3.91	2.77	4.98	2.71
Co_3O_4	.695	.537	.072	.138	.224	.953	.811	.210	.348	.495	.568	.638
NiO	.680	.581	.856	.156	.226	.453	.221	.392	.192	.216	.503	.298
CuO	.238	.463	.065	.223	.127	.145	.043	.135	.079	.105	.247	.158
CaO	6.81	3.55	3.73	4.99	8.51	5.87	5.73	3.05	11.2	4.82	8.29	5.28
MgO	1.89	2.09	2.19	3.88	1.66	1.84	2.80	1.79	2.27	2.13	2.18	1.77
Na_2O	2.47	2.56	2.88	2.92	2.56	2.49	2.80	2.16	1.81	2.40	2.85	2.21
K_2O	.79	1.25	.59	.74	.53	.69	.49	.62	.32	.35	1.45	.60
CO_2	.52	.35	.28	.09	4.82	.67	2.11	.45	6.86	1.70	1.21	2.21
P_2O_5	2.91	.93	.80	.56	1.05	2.36	1.39	.91	1.25	1.36	4.03	.90
H_2O+	9.0	9.1	8.0	6.6	7.5	8.4	7.3	8.5	8.8	8.6	9.3	10.2
H_2O-	15.8	18.9	22.7	10.2	21.1	21.4	19.4	22.1	14.0	17.5	8.9	23.2
Sum	96.8	99.7	97.9	100.1	96.8	98.4	96.4	98.9	97.5	94.5	101.0	96.3
As(ppm)	190	160	246	75	290	250	670	300	400	470	121	290
Ba	1900	1700	1200	490	1100	1500	1000	1300	980	1200	2700	1400
Cd	3.1	6.5	5.8	1.3	4.7	3.2	3.6	3.2	3.0	2.4	2.5	1.8
Co	1200	860	246	310	580	2000	1600	1300	830	1300	990	1100
Cr	7	26	14	78	10	11	53	7	22	4	35	4
Mo	510	280	440	74	250	340	260	440	244	330	250	182
Pb	1500	790	207	400	620	1700	1500	1800	630	870	1000	1000
Sr	1300	1200	1400	480	1500	1500	1500	1300	1500	1600	1200	1400
V	570	510	560	450	610	690	1200	730	800	990	420	590
Y	214	148	155	85	165	140	260	193	198	218	198	182
Zn	710	760	780	320	620	700	670	650	550	560	660	660
γ	1.019	.989	1.008	.985	1.019	1.002	1.022	.997	1.011	1.044	.977	1.024
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	0-10mm	0-8mm	0-7mm	0-10mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	345001	346001	347001	350001†	350003	350004	350005	351001	351002	351003	351004†	351006
Latitude	-16.010	-16.420	-14.088	-15.018	-18.733	-14.342	-14.300	-11.051	-12.874	-10.030	-11.052	-14.483
Longitude	-95.662	-101.332	-110.815	-149.032	-140.433	-149.625	-149.533	-152.097	-150.773	-152.362	-152.097	-150.017
Depth	4240	3416	3778	3350	1474	2536	1937	4250	3200	2500	4250	1082
Lab#	W-222522	W-222523	W-222524	W-224401	W-222696	W-229848	W-229849	W-224399	W-224400	W-231403	W-231401	W-229866
SiO_2(wt.%)	14.5	10.9	14.3	44.7	11.2	7.88	6.94	26.4	35.8	23.8	47.0	5.21
TiO_2	.80	.86	.53	3.08	1.57	1.90	1.58	3.61	1.97	1.73	2.21	1.95
MnO_2	48.5	34.6	18.8	2.11	25.2	37.0	39.3	18.2	9.86	15.7	.20	39.2
Fe_2O_3	19.5	26.5	42.2	14.7	34.3	28.8	25.8	25.7	16.6	25.0	12.7	28.9
Al_2O_3	5.69	2.74	3.13	15.1	3.50	1.68	2.00	7.37	10.4	4.82	14.5	1.34
Co_3O_4	.364	.370	.090	.046	.572	.903	.910	.280	.123	.246	.006	1.28
NiO	1.969	.724	.203	.042	.378	.494	.738	.248	.219	.158	.010	.647
CuO	.757	.194	.169	.019	.248	.105	.189	.149	.161	.044	.009	.140
CaO	3.44	3.08	3.50	10.3	4.58	4.27	4.43	2.43	6.31	3.03	6.09	4.05
MgO	3.87	2.02	2.03	4.60	1.95	2.10	2.09	2.16	2.14	10.29	9.45	2.04
Na_2O	3.64	2.61	2.19	2.67	2.37	2.28	2.26	2.60	3.11	2.26	2.98	2.47
K_2O	1.14	.78	.55	.89	.70	.50	.62	2.48	3.01	.53	.97	.54
CO_2	.27	.49	.78	.22	1.36	.88	.95	.24	1.06	.02	.01	.60
P_2O_5	.74	.86	1.15	.64	1.27	1.06	1.01	.77	.30	.80	.31	1.11
H_2O+	11.0	7.4	9.6	2.6	8.8	8.5	8.7	8.6	8.1	8.5	3.5	9.0
H_2O-	28.9	22.7	18.4	2.6	19.1	20.1	20.7	7.7	6.9	11.4	3.5	21.3
Sum	116.2	94.0	99.3	101.7	98.1	98.4	97.5	101.2	99.0	96.9	100.0	98.5
As(ppm)	183	270	290	16	300	300	227	65	46	169	<1	320
Ba	1500	1100	1600	123	1400	1300	1400	850	470	850	197	1800
Cd	12.8	4.9	2.3	.1	2.5	2.9	4.2	1.6	1.2	1.5	<.1	3.7
Co	660	820	208	91	560	630	440	550	172	760	<9	950
Cr	11	13	29	440	21	18	7	430	430	226	85	9
Mo	480	360	123	<4	223	400	440	228	76	86	<4	440
Pb	870	720	320	51	1000	910	1100	420	183	1100	36	1800
Sr	1000	1200	1100	490	1400	1800	1600	790	530	850	280	1800
V	520	600	720	350	700	650	630	430	280	470	300	830
Y	141	155	147	49	198	213	189	173	236	124	21	178
Zn	1400	700	740	175	840	680	720	620	370	470	145	880
γ	.849	1.049	.993	.970	1.006	1.002	1.011	.974	.996	1.017	.986	1.001
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	<1mm	-	-	-	0-20mm	0-25mm	-	-	-

Sequence#	351016	353001	353002	353006	362001	362002	364003	365001††	365002	365005‡	373001	373002
Latitude	-17.867	-16.203	-16.548	-16.338	-17.883	-18.617	-18.800	-18.033	-17.583	-13.528	-22.100	-21.888
Longitude	-154.133	-176.257	-178.442	-173.247	99.100	99.067	78.150	65.617	65.650	66.642	-11.450	-11.875
Depth	1994	1352	1499	2340	5588	6030	4934	1423	2720	2154	2300	1480
Lab#	W-229868	W-222559	W-222560	W-222529	W-231342	W-229879	W-229870	W-222689	W-222690	W-222694	W-222729	W-222726
SiO_2(wt.%)	16.6	16.2	16.1	5.06	38.3	26.4	13.4	37.0	11.3	.95	12.0	5.43
TiO_2	2.65	1.34	1.23	.10	1.46	1.55	1.12	1.67	1.01	.02	1.96	1.41
MnO_2	25.4	21.6	19.9	.83	14.2	23.9	35.8	.69	24.8	.33	18.4	29.2
Fe_2O_3	30.6	34.1	34.5	29.1	19.8	23.1	25.2	13.2	35.9	.83	40.9	32.1
Al_2O_3	5.23	6.32	6.19	2.65	8.60	8.12	3.71	11.7	2.37	.29	3.71	2.43
Co_3O_4	.533	.313	.171	.004	.151	.269	.389	.036	.262	.006	.445	.671
NiO	.296	.293	.243	.012	.155	.281	.632	.016	.245	.008	.117	.257
CuO	.169	.067	.091	.003	.093	.189	.233	.009	.143	.003	.058	.032
CaO	2.86	4.65	5.51	24.4	2.16	2.18	2.92	15.5	5.27	53.2	2.88	6.01
MgO	1.95	2.33	2.06	7.71	2.65	1.89	2.16	5.64	1.81	.75	2.15	2.43
Na_2O	2.57	2.81	2.54	.51	2.29	2.24	3.12	3.30	2.10	1.06	4.00	3.02
K_2O	.90	.94	.61	.51	1.60	1.16	.75	.94	.49	.08	.23	.27
CO_2	.26	1.28	1.78	18.2	.07	.14	.31	5.32	2.05	40.9	.47	2.15
P_2O_5	.87	1.23	1.14	6.56	.51	.64	.74	.21	1.15	<.05	1.17	1.30
H_2O+	8.7	6.3	5.6	6.1	5.5	8.5	8.7	3.2	9.2	1.7	10.0	10.5
H_2O-	18.3	21.7	21.3	3.2	9.9	13.9	19.5	6.0	22.0	.6	17.4	20.8
Sum	99.6	99.8	97.7	101.8	97.6	100.5	99.2	98.4	98.1	100.1	98.5	97.2
As(ppm)	220	310	290	420	144	186	236	20	330	8	480	470
Ba	1600	980	1000	54	1400	1400	1100	69	1200	28	1200	900
Cd	3.3	4.5	4.8	1.5	.8	2.4	4.6	.2	1.9	2.3	1.9	3.4
Co	1300	260	241	44	2300	1400	2000	25	600	<9	1500	1300
Cr	20	31	32	720	86	14	9	138	22	12	18	6
Mo	208	217	191	<4	260	340	420	<4	270	<4	206	250
Pb	1200	1100	750	186	830	590	1600	<52	630	<49	1000	970
Sr	1200	1300	1300	490	640	820	1100	390	1500	800	1100	1600
V	600	660	600	500	550	580	560	234	670	11	1000	1000
Y	171	195	178	33	37	64	174	32	180	15	182	215
Zn	580	690	670	155	420	550	560	181	590	63	580	560
γ	.990	.988	1.009	.969	1.010	.981	.994	1.002	1.005	.985	1.001	1.014
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	0-1mm	0-10mm	-	0-2.5mm	-	-	-	-	-	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	373003	373004	375001	375002	375003	376001	379001*	380001	380002	380003	380004	381001
Latitude	-22.278	-22.922	-20.967	-20.567	-21.017	-28.417	-23.800	-21.253	-25.643	-21.070	-21.283	-25.443
Longitude	-12.072	-13.510	-31.800	-31.800	-31.900	-40.750	-78.483	-80.925	-83.522	-81.913	-80.960	-97.565
Depth	2000	1700	4141	3715	4331	4388	392	2300	2067	2560	3282	3721
Lab#	W-222727	W-222725	W-231347	W-231363	W-231360	W-229872	W-222580	W-222712	W-224377	W-222714	W-222713	W-222716
SiO_2(wt.%)	6.28	8.10	29.1	21.4	29.2	20.9	28.1	12.8	8.99	14.2	10.4	8.21
TiO_2	1.39	1.43	3.15	1.02	1.84	1.59	2.59	1.37	2.11	1.34	1.38	1.21
MnO_2	28.4	25.2	10.4	18.1	16.4	19.4	13.1	18.8	34.3	23.5	32.0	15.1
Fe_2O_3	33.5	33.0	23.7	29.7	22.5	28.8	15.2	30.4	27.0	30.1	27.2	31.1
Al_2O_3	1.94	3.08	9.51	9.43	7.81	6.22	10.5	3.75	2.83	4.04	2.36	2.21
Co_3O_4	.646	.535	.198	.355	.203	.482	.241	.413	1.54	.531	.661	.230
NiO	.228	.203	.171	.260	.234	.270	.211	.241	.396	.304	.484	.184
CuO	.083	.046	.073	.170	.073	.103	.018	.128	.026	.121	.081	.113
CaO	6.28	6.70	5.32	1.55	3.23	4.03	6.35	11.1	3.87	5.11	5.14	15.2
MgO	2.10	2.42	4.49	2.71	3.05	2.27	3.67	1.80	2.10	1.67	2.83	1.50
Na_2O	2.97	2.79	2.65	1.98	2.94	3.54	6.53	2.65	3.34	2.52	3.54	2.05
K_2O	.34	.35	1.63	1.07	1.62	.88	.87	.87	.58	.92	.55	.39
CO_2	2.82	-	.50	.17	.22	1.42	.31	6.95	.50	2.14	1.25	10.7
P_2O_5	1.20	1.21	.72	.88	.68	.97	1.50	.99	1.45	.92	1.02	.83
H_2O+	10.5	11.9	4.3	9.3	6.5	8.0	6.5	4.8	8.4	10.6	4.6	7.5
H_2O-	22.0	18.5	10.6	11.8	12.9	15.2	9.7	20.9	13.2	20.5	23.8	17.2
Sum	98.8	-	95.9	98.1	96.4	98.9	95.8	97.1	97.4	98.0	93.4	96.6
As(ppm)	380	390	168	270	172	340	111	228	310	260	290	270
Ba	940	930	590	880	720	870	510	1300	1000	1100	1000	990
Cd	2.6	3.3	1.7	2.2	2.0	3.2	4.7	1.8	3.3	2.3	3.1	1.3
Co	1400	1400	1000	1800	1300	1400	270	630	1100	720	710	310
Cr	5	16	246	24	115	27	7	10	15	13	37	4
Mo	244	209	73	270	126	165	133	152	500	176	249	81
Pb	960	990	580	670	930	1100	340	1000	3200	1100	920	540
Sr	1500	1500	590	600	770	980	840	1300	1700	1300	1400	1300
V	970	910	500	650	460	730	330	520	840	550	600	540
Y	192	196	87	91	106	142	122	139	219	139	171	133
Zn	470	560	400	440	400	480	390	560	550	790	660	560
γ	.998	-	1.029	1.005	1.022	.997	1.030	1.016	1.012	1.006	1.055	1.021
Sampled	Bulk	Bulk	Porous	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	0-7mm	0-8mm	-	0-1mm	0-20mm	0-3mm	0-11mm	0-3mm	0-20mm

Sequence#	383001†	389001	390001	391001	397002	400001	401001	401002†	401003	402001	409003	409005
Latitude	-26.498	-27.467	-24.017	-23.033	-26.200	-23.267	-27.983	-29.300	-29.300	-23.433	-37.833	-37.187
Longitude	-110.337	-174.362	170.050	169.600	-106.300	74.983	60.800	60.650	60.617	50.817	-17.142	-17.515
Depth	2446	3593	1175	1143	3003	4520	5698	5699	4688	4993	2723	2454
Lab#	W-224376	W-222525	W-222698	W-222699	W-231365	W-222537	W-222691	W-222692	W-222693	W-231354	W-222724	W-222735
SiO_2(wt.%)	48.5	15.5	2.71	4.96	14.4	20.5	28.8	40.4	20.7	17.4	17.7	10.5
TiO_2	2.70	1.98	1.59	1.34	2.26	.66	1.73	.41	1.73	2.01	1.45	.93
MnO_2	.64	27.9	40.9	36.4	22.8	29.8	15.1	2.58	20.4	26.2	16.8	20.8
Fe_2O_3	12.9	25.8	29.6	31.1	30.5	20.6	22.3	10.2	26.9	30.0	34.1	38.1
Al_2O_3	14.7	5.36	.83	2.33	4.25	6.77	8.06	5.69	3.45	3.74	7.77	3.35
Co_3O_4	.007	.824	1.11	.849	.363	.180	.298	.039	.341	.575	.313	.253
NiO	.015	.321	.575	.567	.340	1.007	.138	.231	.243	.292	.200	.189
CuO	.010	.158	.058	.081	.099	.615	.058	.063	.115	.107	.044	.061
CaO	9.75	4.69	4.27	4.09	4.93	2.23	3.82	1.36	2.25	2.78	4.13	5.38
MgO	6.70	2.11	2.16	2.53	1.87	3.32	6.31	22.82	8.50	1.68	2.59	2.20
Na_2O	3.13	2.57	2.39	2.14	2.34	2.66	2.62	2.23	1.73	2.05	2.21	2.56
K_2O	.50	1.25	.45	.44	.73	1.40	.85	.98	.53	.68	.76	.49
CO_2	.13	.50	.83	.93	1.51	.18	.20	.02	.29	.30	.39	2.23
P_2O_5	.32	1.76	1.18	1.40	.90	.63	.56	.15	.68	.94	1.25	1.45
H_2O+	1.4	8.6	9.4	8.9	8.8	8.6	7.8	9.8	11.6	8.6	7.3	9.6
H_2O-	1.0	20.7	22.6	21.4	13.8	16.6	13.3	6.3	16.1	17.1	17.3	19.4
Sum	101.4	99.3	98.0	98.1	96.1	99.2	98.7	97.1	99.4	97.3	96.9	98.2
As(ppm)	<1	214	430	420	197	156	150	25	155	270	340	480
Ba	92	1200	1600	1400	1100	950	750	117	1100	1400	920	1200
Cd	<.1	2.4	3.5	4.8	3.8	8.4	1.4	.2	2.7	2.4	3.4	2.5
Co	36	1100	790	600	560	670	1300	117	1300	2300	770	810
Cr	212	30	18	18	21	29	400	2500	540	13	71	19
Mo	<4	280	610	430	151	280	127	<4	79	290	133	174
Pb	<4	840	2700	2700	580	740	910	101	1200	1400	1500	1000
Sr	300	1200	2100	1700	1200	700	730	117	980	1300	1100	1400
V	310	550	960	900	480	400	450	149	490	630	770	1000
Y	35	330	207	204	186	132	99	17	119	157	157	186
Zn	131	540	890	890	600	820	360	213	560	540	740	770
γ	.973	.993	1.006	1.005	1.026	.994	.999	1.016	.991	1.014	1.017	1.005
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-4mm	-	-	-	0-1mm	-	-	-	-	0-10mm	-	-

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	409006	411001	411002	411003	416002	416003	417001	421001	423001	424001	424002	439001
Latitude	-36.073	-30.500	-38.433	-30.433	-33.000	-32.967	-39.850	-35.967	-38.967	-38.643	-36.950	-36.750
Longitude	-18.083	-35.933	-36.017	-36.017	-85.900	-88.000	-96.867	-134.300	-150.367	-167.885	-169.833	44.767
Depth	2623	1357	1445	1522	3883	3640	3639	4727	5066	1418	775	2479
Lab#	W-222723	W-229865	W-229874	W-229873	W-222661	W-222662	W-222663	W-222673	W-222670	W-222527	W-229856	W-231358
SiO_2(wt.%)	10.2	3.45	3.54	16.5	13.3	16.5	8.63	42.7	23.3	3.79	21.2	14.6
TiO_2	1.20	1.77	2.30	2.18	.57	.83	.32	2.99	.85	1.37	1.89	1.16
MnO_2	21.9	39.4	40.3	28.0	38.2	29.6	45.3	5.34	36.8	36.9	23.8	30.9
Fe_2O_3	35.8	31.0	28.2	23.6	13.9	24.7	13.9	19.4	11.7	26.3	21.3	17.2
Al_2O_3	3.07	1.35	1.60	6.34	6.05	5.36	3.80	11.7	7.17	1.62	7.20	5.78
Co_3O_4	.360	1.08	1.84	.882	.187	.193	.155	.067	.355	.962	.458	.520
NiO	.176	.455	.467	.500	1.454	.782	1.956	.094	1.223	.562	.713	1.315
CuO	.050	.070	.048	.093	.730	.340	.695	.055	.639	.062	.140	.352
CaO	6.70	3.82	3.91	4.46	4.48	2.65	2.81	7.22	2.16	6.18	3.81	5.66
MgO	1.90	2.08	2.22	3.30	3.03	2.74	3.53	3.32	3.15	2.36	2.94	3.91
Na_2O	2.15	2.26	2.25	2.46	2.06	1.89	2.60	3.27	2.85	3.67	2.39	2.61
K_2O	.55	.54	.56	1.69	.70	1.14	.84	.88	.96	.53	1.74	1.07
CO_2	3.53	.61	.59	.53	.38	.35	.37	.17	.30	.79	.67	.49
P_2O_5	1.33	1.17	1.13	1.67	1.44	.79	.54	.82	.44	2.63	1.54	2.91
H_2O+	8.3	8.8	9.2	8.2	9.8	9.9	11.2	2.4	5.2	10.2	10.4	8.0
H_2O-	20.6	21.7	21.0	13.5	12.5	15.4	15.4	5.1	15.7	20.8	10.8	11.0
Sum	97.3	97.9	98.2	100.5	96.2	97.8	96.5	100.5	97.0	98.0	100.2	96.5
As(ppm)	470	450	390	290	149	236	166	42	116	320	247	180
Ba	1100	2200	1600	1700	1300	1300	1300	221	900	1800	1200	1200
Cd	2.5	3.2	4.8	5.7	10.3	4.7	13.0	.6	7.6	4.7	6.3	7.1
Ce	1000	2400	2300	1600	370	520	310	300	790	1600	670	820
Cr	15	24	14	60	13	23	12	7	8	14	67	49
Mo	227	570	490	360	450	380	560	25	450	580	260	310
Pb	1600	3200	3200	2100	410	630	350	200	970	2800	1200	1200
Sr	1500	2000	1900	1400	890	1000	830	300	640	1900	900	850
V	940	1300	940	740	450	570	480	420	390	910	570	480
Y	189	100	203	127	171	166	109	126	96	189	179	191
Zn	740	720	630	670	1300	820	1700	280	950	900	820	1100
γ	1.014	1.007	1.004	.981	1.025	1.008	1.021	.981	1.016	1.006	.984	1.022
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	0-9mm	0-8mm	0-11mm	<1mm	-	-	-	0-15mm

Sequence#	441001	441002	441003	442001	448001	448002	449001	449002	449003	449004	452001	452002
Latitude	-39.121	-39.771	-37.867	-37.550	-49.567	-49.600	-44.350	-47.933	-48.467	-47.967	-49.950	-42.083
Longitude	24.054	24.755	26.683	18.100	-48.400	-47.567	-57.350	-57.100	-55.233	-57.017	-89.983	-86.050
Depth	4775	2963	2942	3147	3929	4080	4605	2620	2915	3338	4390	3054
Lab#	W-229883	W-229885	W-231356	W-229851	W-231350	W-231353	W-229855	W-229867	W-231355	W-231357	W-222675	W-222674
SiO_2(wt.%)	26.3	14.5	19.4	13.1	40.7	31.0	37.2	17.2	18.6	24.4	19.8	14.5
TiO_2	1.16	1.18	1.16	1.40	.55	1.19	.48	1.12	1.25	.99	1.58	.88
MnO_2	29.2	28.6	24.3	28.1	19.6	19.9	19.2	29.4	23.7	27.8	22.4	20.8
Fe_2O_3	21.4	33.3	26.6	34.1	16.6	22.6	19.4	30.9	33.9	23.1	30.8	38.4
Al_2O_3	4.30	2.18	4.24	1.82	6.06	6.47	7.10	2.42	3.27	3.70	5.22	3.24
Co_3O_4	.392	.557	.506	.605	.057	.204	.114	.399	.270	.372	.246	.200
NiO	.641	.237	.517	.236	.376	.220	.408	.311	.297	.522	.260	.203
CuO	.165	.062	.145	.039	.096	.074	.318	.070	.095	.157	.150	.109
CaO	2.30	3.50	4.29	3.59	1.99	3.05	1.79	2.96	2.53	2.42	2.69	2.57
MgO	2.19	1.73	2.46	2.05	2.03	1.97	2.75	1.80	1.65	2.40	1.71	1.79
Na_2O	2.28	1.82	2.07	2.38	2.74	2.98	2.80	2.97	2.04	2.07	2.52	2.21
K_2O	1.10	.60	.90	.25	1.56	1.14	1.92	.63	.51	1.34	1.42	.53
CO_2	.25	.87	.69	.62	.08	.21	.10	.32	.28	.22	.41	.37
P_2O_5	.55	1.05	2.00	1.22	.33	.63	.43	.95	.99	.84	.91	1.15
H_2O+	7.3	9.3	7.1	8.4	5.8	1.3	6.4	8.5	7.9	8.0	7.2	10.5
H_2O-	16.6	19.3	13.9	19.0	8.7	13.3	9.5	18.1	14.4	12.2	16.8	18.4
Sum	99.6	99.5	96.3	97.9	98.6	92.9	100.5	100.0	97.3	98.3	97.4	97.4
As(ppm)	156	400	290	470	94	196	84	320	330	205	240	390
Ba	1200	1400	1300	1400	960	990	1300	1600	1800	1700	1100	1300
Cd	5.3	3.7	3.5	3.1	8.4	2.0	5.1	2.6	2.2	5.7	2.0	1.5
Ce	1900	1700	1300	1900	270	830	166	1000	1000	720	880	540
Cr	16	11	16	12	19	50	21	7	13	43	13	8
Mo	310	480	310	430	208	300	166	550	470	330	144	310
Pb	1300	2200	1500	2200	320	1300	177	1800	1400	1400	900	560
Sr	910	1500	1100	1600	530	990	450	1500	1300	990	1100	1300
V	500	920	700	960	310	510	280	810	840	540	610	780
Y	95	198	197	210	54	115	44	183	175	114	156	184
Zn	650	730	720	680	710	470	630	710	810	880	640	660
γ	.990	.991	1.024	1.007	1.000	1.061	.981	.986	1.014	1.003	1.013	1.013
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	0-20mm	-	0-20mm	0-25mm	-	-	0-35mm	0-25mm	0-16mm	0-15mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	455001	457001	462001†	477001	479001	483001†	483003	483004†	483005†	484001	484002	484003
Latitude	-40.133	-43.000	-49.667	-41.264	-43.117	-59.867	-58.708	-52.875	-59.417	-59.017	-53.058	-58.033
Longitude	-119.583	-139.933	178.942	28.314	2.117	-32.317	-33.500	-33.858	-31.208	-48.992	-48.950	-45.067
Depth	4252	5141	1344	4314	3967	613	3328	2853	2396	3868	3041	2861
Lab#	W-222664	W-222671	W-222677	W-229886	W-231345	W-222645	W-222633	W-222634	W-222644	W-222630	W-222631	W-222632
SiO_2(wt.%)	13.6	14.5	48.0	22.1	11.9	50.6	55.9	64.6	66.9	49.6	29.7	14.2
TiO_2	.99	1.56	3.05	1.67	1.89	1.76	.64	.69	.65	.79	.79	1.37
MnO_2	37.3	37.4	.55	27.1	30.5	.21	7.45	.80	1.74	12.3	23.8	30.7
Fe_2O_3	19.7	20.4	13.4	24.1	31.5	12.1	14.1	2.58	7.28	15.4	22.9	29.3
Al_2O_3	4.27	4.72	15.7	4.55	3.25	11.0	8.29	18.2	10.2	7.95	5.08	4.75
Co_3O_4	.340	.494	.008	.583	.464	.005	.042	.003	.012	.091	.221	.220
NiO	1.165	1.002	.012	.373	.326	.022	.127	.019	.019	.288	.501	.586
CuO	.447	.485	.015	.112	.090	.006	.086	.020	.020	.123	.096	.280
CaO	2.66	2.45	10.1	2.62	3.02	9.85	2.07	.68	3.70	2.07	2.72	3.13
MgO	2.76	2.69	3.87	2.05	1.90	8.00	1.63	1.33	2.30	1.66	1.88	2.23
Na_2O	2.62	2.50	3.05	3.02	2.18	2.47	2.73	1.85	1.26	3.03	2.92	1.82
K_2O	1.00	.75	1.35	.96	.75	.38	2.06	4.08	1.94	1.51	1.02	.54
CO_2	.44	.45	.02	.34	.41	.05	.10	.01	.04	.12	.25	.41
P_2O_5	.63	.63	.47	.70	.95	.15	.29	<.06	.54	.40	.64	.97
H_2O+	6.9	6.5	1.1	7.9	1.2	4.2	3.9	4.1	2.2	5.0	6.5	8.5
H_2O-	15.9	20.0	1.5	18.2	17.9	.5	6.5	1.2	1.8	7.3	13.7	19.6
Sum	94.7	96.5	100.7	98.3	90.4	100.8	99.4	98.9	98.8	100.3	99.0	99.0
As(ppm)	226	200	2	245	290	<1	60	<1	15	84	197	270
Ba	1200	1200	370	1000	1500	52	920	930	6000	780	1400	1600
Cd	6.3	6.0	<.1	3.1	2.6	.3	2.1	.3	.4	2.3	7.4	5.5
Co	1300	1600	90	2800	1900	<9	225	71	83	370	590	920
Cr	13	6	52	16	9	480	26	37	32	30	16	8
Mo	420	390	<4	280	410	<4	37	<4	<4	84	250	300
Pb	1000	1400	74	1600	1700	10	400	33	101	680	960	860
Sr	1000	1000	560	1100	1500	88	410	243	183	490	980	1200
V	520	500	310	510	760	320	203	132	92	280	560	630
Y	143	138	31	135	195	24	47	23	28	46	100	199
Zn	900	750	142	530	550	171	400	122	163	560	850	750
γ	1.041	1.022	.979	1.004	1.091	.979	.992	.997	.998	.983	.996	.996
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-10mm	0-8mm	0-2mm	-	0-35mm	-	0-5mm	-	0-7mm	0-4mm	0-9mm	0-10mm

Sequence#	485001†	485002†	485003	485004	485005	485006†	485007†	485008	485009	486001†	486002	487001
Latitude	-57.117	-58.100	-58.150	-53.942	-55.100	-57.767	-56.995	-55.902	-56.250	-55.300	-59.033	-59.027
Longitude	-59.117	-59.400	-59.883	-55.917	-55.833	-55.967	-59.083	-58.860	-58.333	-64.755	-67.300	-74.633
Depth	4115	4358	3917	1887	2890	4084	4023	4023	4115	2149	3475	4697
Lab#	W-222622	W-222623	W-222624	W-222625	W-222626	W-222627	W-222628	W-222629	W-222621	W-222642	W-222618	W-222639
SiO_2(wt.%)	62.6	66.5	52.1	36.6	28.2	61.0	55.4	45.6	52.7	59.6	45.1	45.5
TiO_2	.48	.57	.98	.81	.78	.75	.76	.81	.82	.76	1.31	1.21
MnO_2	3.12	.38	5.74	14.1	21.5	2.79	2.95	8.38	5.39	.04	11.0	10.1
Fe_2O_3	8.59	5.78	16.3	22.8	25.9	11.2	18.6	22.1	16.6	8.86	16.7	18.4
Al_2O_3	11.0	14.5	9.27	6.06	3.96	11.0	9.27	7.92	9.86	16.5	9.27	8.54
Co_3O_4	.038	.006	.080	.292	.255	.033	.042	.111	.059	.001	.135	.117
NiO	.028	.008	.023	.331	.357	.029	.023	.125	.068	.005	.096	.084
CuO	.017	.006	.028	.083	.056	.025	.033	.098	.052	.004	.059	.059
CaO	2.13	.72	2.45	1.74	2.50	2.46	2.52	2.61	2.94	1.29	3.52	2.98
MgO	.89	1.98	1.66	2.87	2.15	1.50	1.50	1.99	1.75	2.85	2.24	1.85
Na_2O	3.73	1.93	3.04	2.68	2.77	3.23	2.92	2.98	3.30	2.59	2.99	2.94
K_2O	2.00	3.14	1.49	1.76	1.07	1.96	1.73	1.26	1.26	1.71	1.68	1.63
CO_2	.08	.02	.17	.19	.30	.09	.14	.14	.10	.38	.26	.18
P_2O_5	.19	.07	.42	.67	.72	.24	.34	.43	.32	.10	.45	.45
H_2O+	4.6	3.7	5.1	6.3	6.4	3.0	3.5	5.0	3.8	5.1	4.3	5.0
H_2O-	3.5	1.1	6.2	11.5	14.5	4.0	6.2	9.3	6.1	1.6	8.3	9.3
Sum	99.4	99.4	98.9	97.3	96.9	99.4	99.8	99.5	99.1	99.7	99.1	99.1
As(ppm)	54	9	107	215	260	50	107	132	117	12	92	110
Ba	670	520	630	1000	1300	590	590	750	590	450	850	800
Cd	.4	.2	1.0	3.7	6.1	.4	.6	.1	2.3	.1	1.5	1.3
Co	270	99	510	640	750	250	330	430	330	50	490	510
Cr	12	45	33	50	18	21	29	35	30	62	40	34
Mo	<4	<4	<4	158	234	<4	<4	28	27	<4	19	38
Pb	390	111	800	1500	1400	410	690	840	540	23	800	860
Sr	390	95	640	700	1000	410	440	600	510	183	770	770
V	145	142	300	570	600	188	330	400	300	163	290	320
Y	34	26	57	87	109	34	44	54	44	18	68	70
Zn	197	142	300	660	820	208	260	410	280	122	400	340
γ	.992	.992	.997	1.013	1.017	.992	.988	.991	.995	.989	.994	.995
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-5mm	0-3mm	0-13mm	0-10mm	0-21mm	0-2mm	0-5mm	0-3mm	0-6mm	-	0-8mm	0-7mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	487002	487003	487004	487005	488001	489001	489002	489004	489005	489006	490001	491001
Latitude	-59.017	-57.083	-57.083	-58.293	-58.102	-57.737	-50.483	-52.017	-59.017	-56.867	-57.850	-54.100
Longitude	-70.750	-70.983	-70.983	-78.460	-82.872	-90.782	-94.917	-99.950	-99.593	-99.417	-108.420	-119.317
Depth	3841	3790	3790	4938	4206	5093	4664	2479	4901	4737	4682	3219
Lab#	W-222619	W-222679	W-222620	W-222641	W-222635	W-222646	W-222676	W-222660	W-222650	W-222657	W-222652	W-222665
SiO_2(wt.%)	49.9	48.6	42.7	51.8	24.6	35.2	18.4	30.8	52.2	48.4	23.9	43.7
TiO_2	1.00	1.00	.99	.77	1.49	1.15	1.14	.99	.78	2.21	1.49	1.05
MnO_2	9.44	10.6	13.6	10.0	23.4	20.0	34.5	23.2	11.0	4.78	27.3	3.90
Fe_2O_3	16.0	15.2	18.1	11.7	27.9	19.2	20.1	16.6	10.4	11.7	25.7	13.2
Al_2O_3	8.61	9.92	7.72	9.97	4.52	7.20	4.86	5.59	9.85	12.7	3.47	16.6
Co_3O_4	.096	.116	.122	.073	.321	.148	.234	.131	.061	.020	.236	.041
NiO	.097	.167	.309	.151	.363	.288	.920	.663	.221	.134	.410	.038
CuO	.064	.073	.105	.084	.186	.164	.583	.356	.121	.092	.186	.043
CaO	3.04	2.30	2.95	3.04	2.43	2.47	2.40	2.48	2.80	5.89	2.58	8.69
MgO	1.56	1.72	1.72	1.52	1.65	1.80	2.44	2.55	1.53	3.07	1.58	2.84
Na_2O	3.02	3.61	3.07	3.44	2.66	3.27	2.70	3.20	3.80	3.47	2.69	2.25
K_2O	1.53	2.50	1.38	1.65	1.03	1.74	1.03	1.57	1.96	1.98	1.21	1.03
CO_2	.04	.20	.19	.13	.29	.17	.34	.40	.09	.68	.29	.49
P_2O_5	.37	.30	.43	.27	.65	.41	.48	.49	.21	.70	.60	.18
H_2O+	4.3	3.9	4.7	4.2	7.1	3.7	6.7	7.1	3.6	1.8	6.7	3.1
H_2O-	7.8	8.6	9.4	7.1	19.4	16.0	18.4	15.5	7.9	4.9	19.3	6.6
Sum	99.1	100.2	98.2	98.8	98.4	96.9	96.9	96.1	98.6	97.6	98.3	97.1
As(ppm)	100	88	110	62	161	131	123	102	48	17	186	58
Ba	720	830	940	670	1500	950	1200	1400	710	800	1200	520
Cd	1.2	1.4	2.8	1.6	3.2	2.6	5.9	3.9	1.1	1.1	2.7	.5
Co	430	390	450	300	1100	610	830	460	270	168	870	171
Cr	32	23	29	32	10	57	4	19	27	53	11	97
Mo	14	56	60	38	107	106	260	142	43	18	149	<4
Pb	650	680	920	530	1200	1000	960	600	460	179	1200	270
Sr	660	690	740	600	1100	850	980	770	610	770	1200	400
V	260	260	330	205	430	300	380	300	163	200	460	150
Y	58	58	64	50	137	87	112	89	45	43	123	28
Zn	400	350	470	290	670	460	890	600	330	290	630	290
γ	.995	.984	1.004	.998	1.002	1.017	1.017	1.026	1.000	1.010	1.003	1.016
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk
Interval	0-8mm	0-8mm	0-15mm	0-7mm	0-8mm	0-4mm	0-8mm	0-6mm	0-9mm	0-1mm	0-5mm	0-1mm

Sequence#	491002	494001	501001	518001†	523001	523002	523003	523004†	525001	525002	525003	525004
Latitude	-57.150	-59.800	-57.338	-60.610	-62.037	-61.045	-61.963	-60.093	-61.450	-61.033	-62.200	-61.700
Longitude	-119.550	-144.750	149.678	-29.978	-75.172	-75.063	-79.083	-75.288	-94.967	-95.033	-94.767	-99.867
Depth	4517	3259	2000	1079	4389	4471	4700	4590	4800	4993	4898	4893
Lab#	W-222653	W-222659	W-222678	W-222643	W-222636	W-222637	W-222640	W-222638	W-222667	W-222649	W-222655	W-222658
SiO_2(wt.%)	44.3	40.9	28.2	68.2	42.0	45.2	40.2	67.0	33.9	56.4	44.9	63.5
TiO_2	.62	.72	1.39	.65	1.19	1.06	1.29	.33	1.41	.73	.84	.59
MnO_2	18.6	23.6	27.2	.22	13.7	11.3	14.1	.11	20.6	7.99	17.5	5.94
Fe_2O_3	10.7	12.2	21.7	3.22	17.4	16.7	18.8	3.97	21.2	9.52	11.5	7.45
Al_2O_3	7.18	5.47	3.56	16.5	8.30	9.05	7.86	14.8	6.14	10.4	9.33	11.8
Co_3O_4	.061	.080	.209	.005	.179	.120	.230	<.001	.221	.059	.111	.040
NiO	.594	.863	.749	.008	.224	.132	.127	.001	.236	.096	.419	.133
CuO	.435	.487	.324	.004	.133	.093	.058	.001	.138	.082	.261	.099
CaO	2.89	2.02	2.64	.35	2.84	2.96	2.42	.29	2.60	2.43	2.29	2.04
MgO	2.20	1.51	1.82	1.30	1.80	1.55	1.86	.12	1.52	1.39	1.44	1.18
Na_2O	3.91	3.34	2.71	2.66	2.99	3.23	3.01	5.71	2.90	3.97	3.62	2.82
K_2O	1.62	2.14	1.19	3.33	1.57	1.68	1.78	4.71	1.40	2.19	1.96	2.84
CO_2	.14	.30	.31	.04	.18	.14	.26	.05	.32	.10	.14	.04
P_2O_5	.15	.22	.43	.11	.40	.36	.49	.07	.45	.21	.28	.21
H_2O+	4.8	4.6	5.4	3.2	5.3	4.0	5.6	1.3	5.8	3.0	4.5	1.5
H_2O-	7.9	10.1	15.1	.5	8.9	10.2	11.1	.3	13.8	6.9	8.9	4.1
Sum	98.1	98.5	97.8	99.8	98.3	97.6	98.1	98.4	98.8	98.5	99.1	100.2
As(ppm)	35	51	108	4	103	94	135	3	128	47	62	22
Ba	990	1300	1200	620	1100	940	800	610	1000	780	990	650
Cd	4.2	5.9	4.8	.2	3.7	2.0	1.7	.6	1.9	.9	3.7	.8
Co	217	380	790	101	590	490	720	201	800	280	400	177
Cr	21	16	20	52	31	32	56	0	14	23	14	19
Mo	96	134	110	<4	44	43	53	<4	87	25	121	16
Pb	300	590	1300	68	970	840	1100	65	1300	450	700	330
Sr	490	600	1000	89	800	770	780	74	1000	550	630	440
V	174	211	320	111	310	280	350	10	350	140	209	115
Y	36	56	85	15	74	70	81	37	95	42	55	32
Zn	650	1200	1000	141	440	320	380	80	480	215	440	219
γ	1.005	1.001	1.008	.987	1.003	1.010	1.005	1.002	.998	1.001	.995	.984
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-3mm	0-6mm	0-7mm	-	0-3mm	0-6mm	0-1mm	-	0-8mm	0-2mm	0-10mm	<1mm

Table 1. Composition of crusts analyzed by USGS Reston Labs (cont'd).

Sequence#	526001	526002	527001	528001	528002	528003	529001
Latitude	-61.400	-61.100	-60.400	-63.608	-65.617	-61.183	-64.050
Longitude	-101.233	-104.967	-115.017	-129.897	-123.917	-120.333	-135.000
Depth	4911	-	5040	4819	-	4987	-
Lab#	W-222668	W-222651	W-222669	W-222648	W-222647	W-222666	W-222654
SiO_2(wt.%)	52.3	45.6	38.5	45.3	53.2	40.0	39.2
TiO_2	.77	.94	1.20	.93	.71	1.13	1.36
MnO_2	12.2	15.1	19.5	15.5	9.54	18.6	16.3
Fe_2O_3	10.7	14.4	18.1	14.3	9.67	17.9	19.4
Al_2O_3	10.0	7.94	6.80	8.63	11.2	6.74	7.06
Co_3O_4	.080	.117	.158	.114	.066	.132	.185
NiO	.239	.239	.340	.283	.215	.264	.231
CuO	.152	.152	.160	.167	.146	.158	.140
CaO	2.32	2.23	2.60	2.35	2.50	2.42	2.06
MgO	1.32	1.41	1.69	1.44	1.42	1.66	1.56
Na_2O	3.53	3.32	2.90	3.56	3.70	3.11	3.05
K_2O	2.26	1.88	1.82	2.20	2.22	1.66	1.80
CO_2	.18	.15	.27	.16	.07	.25	.18
P_2O_5	.20	.30	.37	.28	.19	.34	.44
H_2O+	2.3	4.6	4.1	4.7	3.7	4.4	5.9
H_2O-	9.4	9.6	13.8	10.2	5.4	13.1	11.7
Sum	98.6	98.4	98.4	100.0	98.5	98.8	98.9
As(ppm)	42	75	95	69	36	85	111
Ba	760	850	970	870	760	870	1100
Cd	1.3	1.5	2.2	2.1	1.4	1.7	1.7
Co	290	440	640	460	250	560	820
Cr	19	19	19	18	18	27	20
Mo	43	68	107	66	38	74	56
Pb	620	860	1100	850	520	990	1400
Sr	600	720	880	710	570	810	880
V	155	221	300	200	137	250	290
Y	46	64	77	59	40	74	83
Zn	310	370	460	380	250	440	460
γ	.999	1.002	1.002	.986	1.001	.998	.997
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-9mm	0-7mm	0-10mm	0-1mm	0-3mm	0-10mm	0-1mm

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories

Sequence#	017002	017003	017004	017006	017008	017010	017012	017014	017016
Latitude	5.872	9.333	8.330	8.414	8.414	8.398	8.353	8.308	8.308
Longitude	-160.848	-163.167	-164.362	-164.289	-164.289	-164.359	-164.317	-164.346	-164.346
Depth	1604	1563	1519	1850	1850	2400	1150	1400	1400
Lab#	W-222564	W-222565	W-222566	38	40	42	44	46	48
Si(wt.%)	1.82	3.25	1.22	2.77	3.14	4.01	1.27	1.25	1.36
Ti	1.32	1.16	.74	1.12	1.40	1.07	.81	.90	1.23
Mn	27.0	29.9	27.3	27.2	24.6	22.6	35.2	31.2	32.7
Fe	14.1	14.2	9.94	16.3	18.9	17.7	9.14	13.4	12.7
Al	.54	1.11	.45	.59	1.15	1.01	.47	.27	.49
Co	.496	1.19	.865	1.05	.925	.993	2.56	1.22	1.93
Ni	.482	.800	1.036	.539	.384	.412	.887	.691	.756
Ca	8.80	4.40	9.22	2.54	2.55	2.71	2.71	2.73	2.67
Mg	1.33	1.66	1.95	1.10	1.12	1.02	1.67	1.09	1.12
K	.47	.69	.53	.49	.49	.54	.72	.49	.50
P	2.61	1.08	3.17	.40	.44	.56	.44	.38	.40
H_2O-	25.3	28.7	17.9	18.4	11.4	5.3	12.0	10.3	14.0
500°C	-	-	-	-	10.4	10.8	7.2	13.9	11.1
1000°C	-	-	-	-	8.9	6.9	8.0	9.8	10.1
Sampled	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Top	Bulk	Top
Interval	0-8mm	0-4mm	0-4mm	-	-	-	-	-	-

Sequence#	017030	017030	017035	017035	017036	017036	017036	017036	017037
Latitude	9.081	9.081	9.148	9.148	9.148	9.148	9.148	9.148	9.148
Longitude	-164.727	-164.727	-164.808	-164.808	-164.808	-164.808	-164.808	-164.808	-164.808
Depth	4301	4301	2600	2600	2600	2600	2600	2600	2600
Lab#	MP1-CKB-11	MP1-CKB-11*	MP1-CKB-18	MP1-CKB-18*	MP1-CKB-19	MP1-CKB-19	MP1-CKB-19*	MP1-CKB-19*	MP1-CKB-20
Si(wt.%)	-	-	-	-	-	-	-	-	-
Ti	1.28	1.10	1.13	.96	1.39	1.42	-	1.26	.99
Mn	24.6	-	28.0	-	28.2	28.8	-	-	22.6
Fe	15.5	-	17.6	-	17.7	18.1	-	-	14.1
Al	-	-	-	-	-	-	-	-	-
Co	.340	.390	.920	1.000	1.29	1.09	1.26	1.13	.400
Ni	.530	-	.540	-	.550	.530	-	-	.350
Ca	1.89	-	2.52	-	2.63	2.69	-	-	9.94
Mg	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-
P	.23	-	.38	-	.31	.36	-	-	3.39
H_2O-	15.5	15.5	16.0	16.0	28.4	30.5	28.4	30.5	24.3
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-

Sequence#	017037	017037	017037	017038	017038	017041	017041	017042	017042
Latitude	9.148	9.148	9.148	9.148	9.148	9.142	9.142	9.142	9.142
Longitude	-164.808	-164.808	-164.808	-164.808	-164.808	-164.784	-164.784	-164.784	-164.784
Depth	2600	2600	2600	2600	2600	2465	2465	2465	2465
Lab#	MP1-CKB-20	MP1-CKB-20*	MP1-CKB-20*	MP1-CKB-21	MP1-CKB-21*	MP1-CKB-24	MP1-CKB-24*	MP1-CKB-25	MP1-CKB-25*
Si(wt.%)	-	-	-	-	-	-	-	-	-
Ti	1.73	-	.94	1.87	1.22	.71	-	1.64	.98
Mn	23.4	-	-	26.5	-	30.5	-	28.8	-
Fe	14.6	-	-	16.7	-	19.3	-	18.1	-
Al	-	-	-	-	-	-	-	-	-
Co	.440	.460	.480	.780	.840	1.91	1.77	1.09	1.26
Ni	.380	-	-	.460	-	.880	-	.760	-
Ca	9.96	-	-	2.53	-	2.91	-	3.46	-
Mg	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-
P	3.57	-	-	.46	-	.45	-	.66	-
H_2O-	25.8	24.3	25.8	13.5	13.5	30.4	30.4	27.9	27.9
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	017043	017043	017047	017048	017049	017049	017050	017051	017051	017051
Latitude	9.142	9.142	9.694	9.694	9.694	9.694	9.694	9.696	9.696	9.696
Longitude	-164.784	-164.784	-162.178	-162.178	-162.178	-162.178	-162.178	-162.181	-162.181	-162.181
Depth	2465	2465	1993	1993	1993	1993	1993	1927	1927	1927
Lab#	MP1-CKB-26	MP1-CKB-26*	CKB-30	CKB-31	CKB-32	CKB-32GR/SVD	CKB-33	CKB-34	CKB-34GR/SVD	CKB-35
Si(wt.%)	-	-	2.87	2.18	3.36	3.12	2.45	2.01	1.37	1.75
Ti	.42	.45	1.06	1.28	1.28	1.30	1.42	.84	.83	.92
Mn	24.2	-	26.4	30.3	25.7	26.7	27.3	21.2	21.5	31.3
Fe	15.2	-	16.0	13.1	16.0	16.4	15.4	12.3	12.5	13.9
Al	-	-	.88	1.14	1.44	1.38	1.19	.06	.44	.56
Co	.640	.750	.900	1.49	1.01	1.05	1.40	.410	.385	1.30
Ni	.990	-	.470	.690	.480	.520	.540	.280	.280	.590
Ca	10.0	-	2.82	2.62	2.65	2.74	2.82	10.6	10.7	2.61
Mg	-	-	.92	1.02	.88	1.06	1.03	1.07	1.04	.98
K	-	-	.47	.52	.53	.55	.50	.37	.36	.49
P	3.82	-	.49	.31	.42	.43	.29	3.42	3.43	.37
H_2O-	21.7	21.7	10.1	12.0	11.3	16.2	11.2	10.0	11.9	12.3
500°C	-	-	14.4	13.6	12.7	6.7	11.8	8.6	6.0	8.2
1000°C	-	-	5.2	-	4.7	9.9	-	7.7	9.4	10.7
Sampled	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Porous	Old	Old	Young
Interval	-	-	-	-	-	-	-	-	-	-

Sequence#	017053	017059	017059	017059	017059	017059	017060	017062	017063	017064
Latitude	9.696	9.716	9.716	9.716	9.716	9.716	9.716	9.682	9.705	9.705
Longitude	-162.181	-162.167	-162.167	-162.167	-162.167	-162.167	-162.167	-162.184	-162.184	-162.184
Depth	1927	1602	1602	1602	1602	1602	1602	2706	1940	1940
Lab#	CKB-38	CKB-40	CKB-41	CKB-42	CKB-43	CKB-43GR/SVD	CKB-44	CKB-45	CKB-46	CKB-47
Si(wt.%)	2.72	1.57	1.48	1.61	1.31	.79	1.38	6.80	1.98	1.97
Ti	1.14	.81	.78	.83	.55	.58	.82	.93	.87	.58
Mn	28.1	32.3	23.8	27.4	28.8	30.2	33.3	17.3	22.6	12.7
Fe	15.8	12.6	11.1	12.1	7.80	8.18	11.8	11.9	13.1	8.28
Al	1.01	.48	.57	.56	.71	.71	.42	2.30	.90	.92
Co	1.000	1.54	.470	.960	1.07	1.11	1.65	.980	.410	.460
Ni	.560	.590	.450	.570	1.250	1.320	.710	.350	.350	.590
Ca	2.71	2.61	9.72	6.29	6.64	6.93	2.59	6.70	7.33	16.1
Mg	1.08	1.04	1.12	1.05	1.55	1.64	1.07	1.02	1.04	1.39
K	.47	.49	.41	.46	.60	.62	.52	.83	.39	.24
P	.49	.41	3.20	1.82	2.17	2.17	.38	2.09	2.19	6.80
H_2O-	12.0	10.7	8.3	10.4	7.8	11.5	12.2	9.5	5.9	3.8
500°C	8.3	9.3	7.7	8.3	7.5	6.7	9.6	6.4	9.7	6.6
1000°C	9.6	9.5	8.6	9.0	10.1	9.8	10.0	7.6	8.5	6.6
Sampled	Bulk	Young	Old	Bulk	Bulk	Bulk	Top	Top	Bulk	Old
Interval	-	-	-	-	-	-	-	-	-	-

Sequence#	017064	017083	017083	017084	017085	017085	017085	017085	017086	017087
Latitude	9.705	6.263	6.263	6.263	6.290	6.290	6.290	6.290	9.164	9.172
Longitude	-162.184	-162.963	-162.963	-162.963	-162.970	-162.970	-162.970	-162.970	-164.842	-164.826
Depth	1940	2887	2887	2887	2486	2486	2486	2486	2291	1853
Lab#	CKB-48	CKB-59	CKB-59GR/SVD	CKB-60	CKB-61	CKB-62	CKB-63	CKB-64	CKB-65	CKB-66
Si(wt.%)	2.08	3.87	3.67	4.49	2.64	2.37	1.29	2.44	4.08	2.82
Ti	.80	1.00	1.07	1.09	1.04	.96	1.07	1.10	.85	1.18
Mn	31.6	24.0	25.3	22.0	25.3	25.9	23.0	24.5	24.5	29.5
Fe	11.9	17.7	18.7	18.5	18.4	18.2	19.3	20.6	18.7	13.2
Al	.69	1.06	.95	1.37	.92	.76	.88	.79	.54	1.10
Co	1.55	.770	.800	.680	.630	.550	.470	.560	.780	1.53
Ni	.640	.470	.410	.420	.400	.420	.320	.410	.380	.580
Ca	3.17	2.37	2.50	2.95	2.46	2.41	2.39	2.48	2.50	2.83
Mg	1.08	.82	1.02	.92	.98	.87	.84	.95	.95	1.16
K	.59	.48	.50	.52	.39	.40	.35	.36	.46	.66
P	.59	.36	.37	.58	.39	.39	.39	.41	.49	.45
H_2O-	11.1	10.5	15.4	11.5	8.0	9.3	14.8	13.9	18.0	18.5
500°C	11.0	11.0	6.6	9.8	11.4	10.9	12.0	18.6	12.7	11.7
1000°C	8.5	9.2	8.9	9.9	11.4	10.2	7.0	6.9	6.3	7.6
Sampled	Young	Bulk	Bulk	Bulk	Bulk	Top	Bottom	Middle	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	017087	017088	017088	017088	017089	017093	017093	017095	017095	017096
Latitude	9.172	9.179	9.179	9.179	9.166	9.225	9.225	9.247	9.247	9.247
Longitude	-164.826	-164.830	-164.830	-164.830	-164.798	-164.780	-164.780	-164.846	-164.846	-164.846
Depth	1853	1263	1263	1263	1427	1456	1456	-	-	-
Lab#	CKB-67	CKB-69	CKB-71	CKB-72	CKB-73	CKB-75	CKB-76	CKB-79	CKB-80	CKB-81
Si(wt.%)	20.5	1.76	1.38	1.37	1.57	1.50	1.76	1.77	1.57	1.27
Ti	1.36	1.04	.99	.82	.65	1.05	1.00	1.01	.95	1.04
Mn	.28	29.9	32.5	30.7	29.9	31.1	28.2	31.6	24.9	33.6
Fe	7.82	14.1	13.4	11.9	11.2	14.1	13.4	13.5	12.4	14.2
Al	9.84	.59	.60	.33	.97	.53	.69	.62	.57	.59
Co	-	1.34	1.38	1.02	1.37	1.30	.980	1.42	.810	1.49
Ni	-	.560	.740	.710	.590	.530	.540	.750	.540	.630
Ca	8.02	2.73	2.74	5.25	5.33	2.70	4.74	2.82	7.25	2.83
Mg	1.09	1.10	1.12	1.10	1.16	1.00	1.02	1.03	1.12	1.20
K	2.70	.48	.50	.50	.58	.46	.46	.49	.42	.51
P	2.47	.44	.40	1.31	1.40	.38	1.11	.47	2.18	.40
H_2O-	2.1	13.7	14.6	17.3	13.2	13.2	16.5	14.9	11.3	18.0
500°C	3.1	23.5	9.3	9.1	6.5	11.0	9.9	9.3	8.7	8.8
1000°C	2.0	8.4	9.3	8.0	9.1	8.2	7.4	9.0	7.8	11.0
Sampled	Bulk	Old	Bulk	Young	Bulk	Young	Old	Young	Old	Young
Interval	-	-	-	-	-	-	-	-	-	-

Sequence#	017096	017097	017098	017098	017099	017099	017101	017102	019001	019002
Latitude	9.247	9.247	9.247	9.247	9.200	9.200	9.716	9.223	6.667	7.333
Longitude	-164.846	-164.846	-164.846	-164.846	-164.929	-164.929	-162.167	-164.858	172.417	172.333
Depth	-	-	-	-	-	-	1602	1420	1700	1260
Lab#	CKB-82	CKB-83	CKB-84	CKB-85	CKB-87	CKB-88	CKB-49	CKB-78	KK810626-RD9	KK810626-RD10
Si(wt.%)	.96	1.74	1.35	.92	1.39	.88	1.75	1.05	6.04	1.95
Ti	.87	.89	1.18	.80	.93	.71	.88	.94	1.41	.83
Mn	26.0	33.5	31.5	26.2	33.2	30.4	26.6	35.2	19.2	24.7
Fe	11.7	12.1	14.9	11.9	11.4	10.7	11.8	10.7	13.8	11.4
Al	.45	.70	.85	.45	.50	.27	.87	.39	2.77	-
Co	.790	1.91	1.32	.650	1.78	.720	1.22	1.80	.973	.852
Ni	.540	.730	.610	.610	.620	.750	.520	.880	.415	.561
Ca	8.83	2.68	2.76	8.62	2.47	7.11	5.74	2.47	3.65	7.03
Mg	1.15	1.41	1.00	1.13	1.03	1.11	1.05	1.11	1.14	1.18
K	.41	.58	.49	.42	.51	.51	.47	.55	.87	-
P	2.67	.36	.40	2.54	.31	1.96	1.58	.27	.93	2.20
H_2O-	11.9	15.7	15.1	15.9	15.0	15.1	9.0	18.0	8.5	7.3
500°C	8.6	8.5	9.8	8.3	10.9	8.7	9.1	9.0	9.3	9.3
1000°C	6.5	8.2	7.3	7.8	8.2	7.3	8.6	9.5	8.0	9.1
Sampled	Old	Top	Young	Old	Young	Old	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	0-15mm	0-25mm

Sequence#	019003	020001	020002	052003	052003	052005	052005	052005	052005	052005
Latitude	7.250	8.747	8.755	18.699	18.699	18.643	18.643	18.643	18.643	18.643
Longitude	171.008	169.738	169.792	-158.380	-158.380	-158.295	-158.295	-158.295	-158.295	-158.295
Depth	2250	3550	2900	3261	3261	1924	1924	1924	1924	1924
Lab#	D-1	D-4-2	D-6-1	CKB-2	CKB-2GR/SVD	CKB-4AM	CKB-4G	CKB-5	CKB-5GR/SVD	CKB-6
Si(wt.%)	2.60	2.99	1.93	6.58	6.64	6.69	6.88	5.23	5.24	5.57
Ti	.97	1.13	1.24	1.78	1.77	1.42	1.29	1.38	1.39	1.44
Mn	26.5	23.8	28.8	14.6	14.7	17.6	18.1	17.5	17.7	19.9
Fe	14.7	18.0	13.4	23.0	23.1	19.1	18.5	22.8	23.0	18.0
Al	.57	.70	.93	2.72	2.66	2.54	2.59	1.73	1.59	2.08
Co	1.27	.837	1.33	.360	.350	.550	.487	.480	.470	.480
Ni	.550	.304	.655	.070	.069	.240	.270	.120	.120	.285
Ca	2.47	2.23	2.28	2.11	2.10	2.24	2.22	2.05	2.05	2.17
Mg	.97	.90	1.03	.95	.86	.96	.95	.86	.82	.79
K	.49	.42	.52	.54	.53	.66	.74	.43	.43	.06
P	.37	.36	.29	.44	.43	.40	.41	.43	.43	.34
H_2O-	19.9	21.1	11.4	9.1	13.8	11.1	7.6	10.2	14.3	9.0
500°C	18.2	12.2	17.3	9.0	5.0	9.5	9.4	9.9	5.5	11.2
1000°C	6.4	9.1	6.2	5.5	9.2	8.6	7.6	6.7	10.0	6.7
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Top	Bottom
Interval	0-10mm	0-3mm	0-20mm	-	-	-	-	-	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	052006	052006	052006	052007	052007	052007	052008	052009	052010	052010	052011
Latitude	18.643	18.643	18.643	18.643	18.643	18.643	18.643	18.637	18.637	18.637	18.637
Longitude	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.313	-158.313	-158.313	-158.313
Depth	1924	1924	1924	1924	1924	1924	1924	2002	2002	2002	2002
Lab#	CKB-7	CKB-8	CKB-9	CKB-10	CKB-10GR/SVD	CKB-11	CKB-12	CKB-13	CKB-17	CKB-18	CKB-19
Si(wt.%)	5.69	5.77	6.00	6.43	6.27	4.73	6.75	4.81	4.46	4.99	5.47
Ti	1.11	1.26	.80	1.43	1.18	1.43	1.23	1.20	1.33	1.71	1.60
Mn	19.6	19.1	19.9	18.8	18.8	19.8	20.4	19.2	20.3	20.7	17.9
Fe	18.4	19.6	18.1	18.7	18.7	21.7	17.1	21.5	20.4	19.5	21.6
Al	2.00	1.89	2.14	2.55	2.10	1.66	2.45	1.44	1.73	2.20	2.10
Co	.470	.520	.350	.540	.550	.570	.530	.450	.520	.630	.480
Ni	.275	.210	.370	.250	.250	.210	.310	.180	.220	.290	.160
Ca	2.23	2.22	2.29	2.13	2.09	2.25	2.49	2.11	2.29	2.21	2.13
Mg	.86	.97	.87	.80	.82	.95	.99	.96	.88	.92	.92
K	.66	.56	.88	.89	.88	.46	.67	.42	.49	.51	.50
P	.38	.42	.38	.39	.38	.45	.35	.40	.43	.42	.42
H_2O-	9.1	11.3	6.4	9.7	12.9	10.2	9.7	7.6	6.6	6.8	5.7
500°C	9.6	10.2	9.6	9.6	5.7	10.8	9.9	10.1	11.6	10.6	11.3
1000°C	9.1	10.8	7.0	5.6	10.2	6.1	1.9	6.4	7.2	5.9	6.2
Sampled	Bulk	Top	Bottom	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052012	052015	052015	052015	052016	052016	052016	052017	052017	052017	052023
Latitude	18.637	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.637
Longitude	-158.313	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.313
Depth	2002	1047	1047	1047	1047	1047	1047	1047	1047	1047	2002
Lab#	CKB-20	CKB-21	CKB-22	CKB-23	CKB-24	CKB-25	CKB-26	CKB-27	CKB-28	CKB-29	CKB-16
Si(wt.%)	4.39	2.94	3.30	2.65	4.16	3.48	4.39	3.16	3.22	2.31	5.71
Ti	1.18	.98	1.23	.89	1.20	1.21	.74	1.30	1.10	.76	1.56
Mn	20.6	23.5	25.5	22.1	24.6	25.8	16.6	22.0	25.4	19.9	18.6
Fe	19.9	14.5	16.0	12.6	15.4	15.7	11.4	14.0	15.5	11.1	19.7
Al	1.37	1.13	1.39	1.01	1.65	1.42	1.68	1.60	1.29	.81	2.33
Co	.530	.560	.750	.440	.740	.730	.310	.520	.640	.370	.500
Ni	.225	.385	.400	.400	.500	.440	.450	.400	.500	.350	.290
Ca	2.14	5.72	2.53	7.75	2.75	2.45	8.83	6.72	3.77	11.1	2.00
Mg	.85	.96	.88	.91	.91	.91	.94	1.00	1.01	1.04	.90
K	.46	.48	.54	.51	.63	.52	.82	.48	.54	.44	.62
P	.37	1.67	.50	2.42	.54	.39	2.93	2.01	.87	3.64	.34
H_2O-	6.8	6.5	6.8	6.1	7.4	6.1	5.1	8.5	11.6	8.1	5.9
500°C	10.0	11.3	12.1	10.8	9.9	11.4	7.8	10.7	10.1	8.7	11.5
1000°C	7.3	7.6	5.6	8.5	7.5	7.2	6.7	6.8	7.2	-	2.5
Sampled	Bulk	Bulk	Young	Old	Bulk	Young	Old	Bulk	Young	Old	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052023	053001	053002	053003	053004	053005	053006	053007	053008	053009	053018
Latitude	18.637	18.300	18.783	18.783	19.367	19.350	10.293	14.458	18.135	19.117	19.369
Longitude	-158.313	-161.767	-162.050	-162.050	-162.317	-162.167	-165.995	-168.978	-169.067	-169.733	-168.695
Depth	2002	3111	4629	3147	4868	4209	1790	1750	2139	1805	2000
Lab#	CKB-16GR/SVD	W-222532	W-222533	W-222534	W-222535	W-222536	W-222567	W-222568	W-222569	W-222570	21
Si(wt.%)	5.46	3.65	5.71	10.6	4.36	11.8	2.87	1.76	5.21	4.41	5.07
Ti	1.28	1.41	1.44	1.93	1.55	1.46	1.25	1.18	1.23	1.14	1.29
Mn	19.8	27.1	20.2	13.2	23.5	13.0	30.1	32.9	25.7	23.8	21.4
Fe	20.0	20.9	23.1	20.4	21.4	17.7	14.9	14.9	21.7	17.5	17.0
Al	1.92	.77	1.45	4.02	1.21	4.34	.81	.40	.96	1.20	1.86
Co	.485	1.02	.558	.249	.674	.357	.679	1.27	.910	.784	1.05
Ni	.310	.351	.122	.174	.243	.098	.790	.704	.367	.506	.309
Ca	2.07	2.58	2.55	2.08	2.35	1.88	3.32	2.85	2.63	2.49	3.05
Mg	.87	1.11	1.05	1.20	1.03	1.03	1.50	1.43	1.20	1.24	1.15
K	.64	.49	.36	1.04	.40	1.43	.53	.54	.52	.46	.61
P	.35	.41	.46	.42	.41	.41	.47	.40	.53	.53	.42
H_2O-	13.5	31.6	26.5	19.8	25.9	18.7	27.8	27.6	26.4	20.9	9.5
500°C	5.7	-	-	-	-	-	-	-	-	-	11.3
1000°C	10.0	-	-	-	-	-	-	-	-	-	8.5
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	0-12mm	0-10mm	0-7mm	0-5mm	0-12mm	0-7mm	0-9mm	0-14mm	0-10mm	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	053020	053025	053026	053027	053029	053030	053032	053037	053037
Latitude	19.511	19.511	19.695	19.553	19.515	19.515	19.515	13.115	13.115
Longitude	-168.835	-168.835	-168.995	-168.832	-168.855	-168.855	-168.855	-165.552	-165.552
Depth	1800	1800	4500	2400	1790	1790	1790	4774	4774
Lab#	23	28	29	30	32	33	35	MP1-CKB-28	MP1-CKB-28*
Si(wt.%)	5.42	3.43	8.15	4.99	3.08	2.17	1.85	-	-
Ti	1.14	1.17	1.55	1.20	.92	1.10	.84	2.15	1.37
Mn	23.2	26.0	16.4	23.1	25.1	25.1	26.9	15.1	-
Fe	19.1	15.9	19.1	18.9	15.8	14.0	13.2	9.90	-
Al	1.25	1.00	3.24	1.40	.55	.65	.33	-	-
Co	.889	.912	.339	.940	.707	.676	.657	.290	.320
Ni	.324	.431	.397	.348	.362	.408	.445	.140	-
Ca	2.32	2.87	1.74	2.40	4.67	5.62	5.58	1.41	-
Mg	1.01	1.05	1.11	1.14	1.05	1.00	1.07	-	-
K	.54	.55	.71	.56	.46	.44	.45	-	-
P	.44	.46	.28	.43	1.23	1.44	1.43	.28	-
H_2O-	16.8	18.9	14.4	13.8	14.4	6.9	10.2	12.3	12.3
500°C	8.8	12.1	9.3	8.6	8.9	10.3	11.6	-	-
1000°C	3.3	7.9	6.2	6.8	7.8	10.7	9.2	-	-
Sampled	Top	Bulk	Top	Bulk	Bulk	Top	Bottom	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-

Sequence#	053043	053043	053044	053044	053046	053046	053047	053047	053048
Latitude	13.001	13.001	12.987	12.987	13.151	13.151	13.200	13.200	13.200
Longitude	-164.968	-164.968	-164.958	-164.958	-165.485	-165.485	-165.462	-165.462	-165.462
Depth	3040	3040	2055	2055	4150	4150	1508	1508	1508
Lab#	MP1-CKB-34	MP1-CKB-34*	MP1-CKB-35	MP1-CKB-35*	MP1-CKB-37	MP1-CKB-37*	MP1-CKB-38	MP1-CKB-38*	MP1-CKB-39
Si(wt.%)	-	-	-	-	-	-	-	-	-
Ti	1.31	1.02	1.89	.94	1.61	.98	.98	.92	1.03
Mn	25.9	-	27.3	-	24.4	-	28.8	-	28.4
Fe	16.3	-	17.1	-	15.6	-	18.0	-	17.8
Al	-	-	-	-	-	-	-	-	-
Co	.590	.680	.850	.820	.570	.680	1.29	1.39	1.31
Ni	.530	-	.580	-	.280	-	.670	-	.690
Ca	2.64	-	2.54	-	2.37	-	2.75	-	2.62
Mg	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-
P	.44	-	.41	-	.49	-	.49	-	.36
H_2O-	14.6	14.6	14.5	14.5	25.9	25.9	17.6	17.6	28.4
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-

Sequence#	053048	053048	053048	053049	053049	053049	053049	053103	053103
Latitude	13.200	13.200	13.200	13.200	13.200	13.200	13.200	14.462	14.462
Longitude	-165.462	-165.462	-165.462	-165.462	-165.462	-165.462	-165.462	-169.017	-169.017
Depth	1508	1508	1508	1508	1508	1508	1508	2110	2110
Lab#	MP1-CKB-39	MP1-CKB-39*	MP1-CKB-39*	MP1-CKB-40	MP1-CKB-40	MP1-CKB-40*	MP1-CKB-40*	CKB-141	CKB-142
Si(wt.%)	-	-	-	-	-	-	-	2.30	1.77
Ti	2.46	-	1.00	.79	.80	-	.80	1.14	1.11
Mn	28.8	-	-	22.7	18.8	-	-	28.0	25.8
Fe	18.1	-	-	14.1	11.4	-	-	15.0	12.5
Al	-	-	-	-	-	-	-	.74	.74
Co	1.16	1.23	1.31	.540	.360	.570	.440	1.20	.922
Ni	.690	-	-	.650	.560	-	-	.632	.607
Ca	3.77	-	-	10.1	13.1	-	-	2.66	5.37
Mg	-	-	-	-	-	-	-	1.16	1.37
K	-	-	-	-	-	-	-	.51	.50
P	.88	-	-	3.47	5.44	-	-	.39	1.24
H_2O-	30.5	28.4	30.5	24.5	23.1	24.5	23.1	9.7	7.8
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Young-Top	Old-Bottom
Interval	-	-	-	-	-	-	-	0-20mm	0-20mm

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	053104	053104	053104	053104	053109	053109	053109	053110	053110	053113	053116
Latitude	14.456	14.456	14.456	14.456	15.597	15.597	15.597	15.563	15.563	15.675	15.544
Longitude	-169.003	-169.003	-169.003	-169.003	-169.232	-169.232	-169.232	-169.224	-169.224	-169.124	-169.238
Depth	1770	1770	1770	1770	1630	1630	1630	1651	1651	3443	1769
Lab#	CKB-149	CKB-150	CKB-151	CKB-151	CKB-206	CKB-207	CKB-208	CKB-211	CKB-212	CKB-213	CKB-214
Si(wt.%)	3.62	2.62	1.92	2.14	2.05	.86	1.38	2.54	3.53	3.73	2.43
Ti	.96	1.13	1.26	1.23	.91	.55	.73	.82	.72	1.31	1.08
Mn	24.6	26.8	29.0	28.2	27.3	24.6	26.7	28.9	12.2	22.7	27.1
Fe	15.6	14.7	13.4	13.0	14.9	7.01	9.61	12.5	11.6	19.0	14.9
Al	.80	.79	.66	.84	.47	.09	.75	.79	1.19	1.03	.62
Co	1.35	1.16	1.07	1.21	1.34	.507	.829	1.21	.400	.947	1.26
Ni	.465	.597	.664	.697	.504	.848	1.061	.681	.346	.293	.585
Ca	2.52	2.51	2.79	2.72	2.58	12.9	7.76	3.22	12.2	2.53	2.75
Mg	1.11	1.16	1.17	1.20	1.11	2.14	1.97	1.33	1.91	1.09	1.10
K	.50	.53	.56	.55	.46	.46	.56	.67	.70	.48	.54
P	.43	.38	.35	.37	.45	3.84	2.17	.54	3.79	.42	.46
H_2O-	9.6	9.6	9.7	9.7	8.8	9.2	9.5	11.9	7.5	11.3	11.2
500°C	-	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-	-
Sampled	Young	Middle	Old	Old	Young-Top	Old-Top	Bottom	Young	Old	Bulk	Top
Interval	0-10mm	0-10mm	0-10mm	0-10mm	0-20mm	20-30mm	5mm	0-5mm	5-15mm	0-15mm	15mm

Sequence#	053116	053116	053117	053117	053118	053118	053119	053119	053119	053129	053130
Latitude	15.544	15.544	15.615	15.615	15.584	15.584	15.628	15.628	15.628	14.456	15.597
Longitude	-169.238	-169.238	-169.227	-169.227	-169.205	-169.205	-169.239	-169.239	-169.239	-169.003	-169.232
Depth	1769	1769	1498	1498	1605	1605	1552	1552	1552	1770	1630
Lab#	CKB-214	CKB-215	CKB-224	CKB-225	CKB-228	CKB-229	CKB-230	CKB-231	CKB-231	CKB-152	CKB-209
Si(wt.%)	2.48	2.66	1.97	1.09	2.06	1.64	1.52	.75	.92	2.63	2.20
Ti	1.08	1.17	.97	.85	.91	.76	.88	.72	.73	1.00	1.07
Mn	27.5	26.4	29.5	27.6	29.4	18.1	30.6	27.3	27.3	26.9	29.2
Fe	15.0	12.1	13.6	8.83	14.9	11.0	14.2	8.11	8.04	12.5	14.0
Al	.62	1.00	.59	.32	.37	.55	.27	.11	.15	1.11	.61
Co	1.33	.761	1.28	.832	1.34	.336	1.48	.829	.739	1.10	1.26
Ni	.405	.716	.756	.943	.624	.401	.660	.873	.941	.753	.548
Ca	2.78	5.73	2.64	6.80	2.67	14.1	2.70	10.1	10.3	2.77	2.81
Mg	1.13	1.49	1.25	1.56	1.17	2.16	1.22	1.84	1.97	1.27	1.15
K	.55	.59	.54	.52	.51	.38	.50	.53	.52	.61	.56
P	.46	1.36	.39	1.72	.43	4.56	.42	2.74	2.89	.46	.45
H_2O-	11.2	10.6	10.1	9.9	13.4	7.8	13.6	10.7	10.7	8.4	12.4
500°C	-	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-	-
Sampled	Top	Bottom	Young	Old	Young	Old	Young-Top	Old-Bottom	Old-Bottom	Top	Young
Interval	15mm	15mm	10mm	20mm	25mm	20mm	20mm	30mm	30mm	10mm	15mm

Sequence#	053130	053130	053131	053131	053131	053131	053131	053132	053132	053132	053133
Latitude	15.597	15.597	15.544	15.544	15.544	15.544	15.544	15.544	15.544	15.544	15.615
Longitude	-169.232	-169.232	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.227
Depth	1630	1630	1769	1769	1769	1769	1769	1769	1769	1769	1498
Lab#	CKB-209	CKB-210	CKB-216	CKB-217	CKB-218	CKB-219	CKB-219	CKB-221	CKB-222	CKB-223	CKB-226
Si(wt.%)	2.32	1.92	2.50	2.12	.99	1.38	1.49	2.26	1.77	1.15	1.42
Ti	1.07	.60	.99	1.08	.83	.56	.57	.91	1.06	.75	1.10
Mn	29.0	18.6	27.8	29.2	27.0	16.5	16.7	27.3	28.9	23.8	32.3
Fe	14.0	7.31	12.0	14.2	9.14	9.45	9.48	15.4	13.3	9.12	12.3
Al	.69	.60	.58	.60	.31	.33	.40	.49	.45	.29	.46
Co	1.44	.433	1.30	1.17	.661	.298	.266	1.40	1.19	.574	1.52
Ni	.674	.707	.582	.697	.958	.414	.436	.530	.656	.725	.789
Ca	2.83	16.8	2.76	2.64	9.47	16.2	16.3	2.61	2.57	10.8	2.73
Mg	1.20	2.67	1.21	1.20	1.83	2.31	2.36	1.17	1.14	1.90	1.32
K	.54	.48	.51	.54	.50	.34	.34	.47	.50	.45	.58
P	.46	5.55	.49	.38	2.58	5.25	5.33	.45	.36	3.13	.35
H_2O-	12.4	12.3	14.1	11.0	9.2	5.9	5.9	9.5	8.6	7.6	13.8
500°C	-	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-	-
Sampled	Young	Old	Young-Top	-	Old-Top	Old-Bottom	Old-Bottom	Young	Middle	Old	Young-Top
Interval	15mm	15mm	-	-	10mm	10mm	10mm	15mm	15mm	40mm	20mm

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	053135	053135	053135	053135	053136	053136	053136	053137	053137
Latitude	15.628	15.628	15.628	15.628	15.628	15.628	15.628	15.628	15.628
Longitude	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239
Depth	1552	1552	1552	1552	1552	1552	1552	1552	1552
Lab#	CKB-232	CKB-233	CKB-234	CKB-235	CKB-236	CKB-236	CKB-237	CKB-239	CKB-240
Si(wt.%)	1.85	.95	1.20	.91	1.40	1.58	.90	1.69	1.36
Ti	1.03	.57	1.04	.54	.93	.92	.71	.94	.98
Mn	30.3	22.2	31.7	18.8	30.5	30.3	26.0	29.6	27.1
Fe	13.5	7.78	12.2	7.47	13.6	13.5	8.04	14.4	10.8
Al	.54	.14	.62	.16	.36	.37	.20	.34	.45
Co	1.21	.439	1.29	.399	1.41	1.55	.712	1.44	.723
Ni	.750	.691	.859	.603	.667	.702	.898	.623	.766
Ca	2.89	14.3	2.81	15.7	2.71	2.69	10.7	2.67	6.69
Mg	1.26	2.24	1.24	2.34	1.15	1.17	2.04	1.24	1.52
K	.53	.41	.55	.38	.52	.52	.49	.49	.52
P	.43	4.37	.37	4.91	.38	.39	3.10	.42	1.64
H_2O-	10.6	8.8	12.7	7.2	13.1	13.1	8.7	11.8	7.3
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Young-Top	Old-Top	Young-Bottom	Old-Bottom	Young-Top	Young-Top	Old-Bottom	Young	Old
Interval	10mm	10mm	7mm	7mm	15mm	15mm	25mm	15mm	15mm

Sequence#	053140	054001	054003	054003	054005	054005	054006	054006	054007
Latitude	14.456	19.243	19.402	19.402	19.361	19.361	19.373	19.373	19.373
Longitude	-169.003	-179.668	-171.173	-171.173	-171.064	-171.064	-170.991	-170.991	-170.991
Depth	1770	3224	2856	2856	2010	2010	1190	1190	1190
Lab#	10DK-SEM-63	W-222588	MP1-CKB-42	MP1-CKB-42*	MP1-CKB-45	MP1-CKB-45*	MP1-CKB-46	MP1-CKB-46*	MP1-CKB-47
Si(wt.%)	2.23	6.02	-	-	-	-	-	-	-
Ti	1.09	1.00	1.89	1.11	2.31	1.28	.92	-	.86
Mn	26.2	17.1	21.0	-	25.0	-	27.1	-	24.5
Fe	13.4	15.9	13.8	-	15.8	-	17.1	-	15.3
Al	.54	1.51	-	-	-	-	-	-	-
Co	1.12	.441	.450	.460	.780	.900	1.08	1.04	.590
Ni	.567	.245	.210	-	.460	-	.400	-	.520
Ca	4.23	7.26	2.24	-	2.43	-	2.60	-	6.90
Mg	1.18	1.27	-	-	-	-	-	-	-
K	.54	.67	-	-	-	-	-	-	-
P	.90	2.37	.48	-	.44	-	.45	-	2.12
H_2O-	18.9	18.4	9.5	9.5	13.3	13.3	28.8	28.8	26.3
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	38mm	0-8mm	-	-	-	-	-	-	-

Sequence#	054007	054008	054008	054012	054012	054013	054013	054014	054014
Latitude	19.373	19.373	19.373	19.408	19.408	19.408	19.408	19.408	19.408
Longitude	-170.991	-170.991	-170.991	-171.391	-171.391	-171.391	-171.391	-171.391	-171.391
Depth	1190	1190	1190	1925	1925	1925	1925	1925	1925
Lab#	MP1-CKB-47*	MP1-CKB-48	MP1-CKB-48*	MP1-CKB-52	MP1-CKB-52*	MP1-CKB-53	MP1-CKB-53*	MP1-CKB-54	MP1-CKB-54*
Si(wt.%)	-	-	-	-	-	-	-	-	-
Ti	.76	.97	.94	.63	.59	1.04	-	.98	-
Mn	-	29.2	-	26.3	-	26.1	-	17.0	-
Fe	-	18.3	-	16.5	-	15.4	-	10.4	-
Al	-	-	-	-	-	-	-	-	-
Co	.660	1.70	1.56	.470	.520	.540	.610	.430	.420
Ni	-	.600	-	.440	-	.530	-	.400	-
Ca	-	2.64	-	8.17	-	2.67	-	5.58	-
Mg	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-
P	-	.39	-	2.64	-	.40	-	1.88	-
H_2O-	26.3	32.2	32.2	24.2	24.2	21.5	21.5	26.8	26.8
500°C	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	054019	054023	054023	054024	054024	054025	054025	054033	054033	054034
Latitude	15.696	15.671	15.671	15.664	15.664	15.673	15.673	15.658	15.658	15.665
Longitude	-170.344	-170.413	-170.413	-170.397	-170.397	-170.381	-170.381	-170.385	-170.385	-170.386
Depth	2260	1815	1815	1433	1433	1117	1117	1186	1186	1520
Lab#	CKB-154	CKB-171	CKB-172	CKB-180	CKB-181	CKB-184	CKB-186	CKB-194	CKB-194	CKB-198
Si(wt.%)	4.50	3.11	2.94	2.14	.98	4.05	1.10	.92	1.08	1.25
Ti	1.07	.96	1.22	.86	.50	.77	.71	.86	.85	.75
Mn	22.8	26.3	26.2	28.1	16.8	30.7	29.2	32.4	31.6	30.3
Fe	15.3	15.1	13.8	12.9	6.64	10.1	12.3	12.1	11.7	13.7
Al	1.30	.68	1.03	.61	.21	.76	.34	.19	.37	.33
Co	.857	1.18	.953	1.25	.402	1.33	1.44	1.47	1.74	1.74
Ni	.499	.562	.625	.609	.507	.845	.670	.721	.710	.591
Ca	2.60	2.62	3.45	4.29	17.6	3.59	2.92	2.77	2.70	2.65
Mg	1.07	1.11	1.19	1.32	2.33	1.39	1.15	1.29	1.17	1.19
K	.61	.50	.57	.50	.35	.69	.51	.53	.50	.47
P	.44	.44	.59	.94	5.85	.69	.51	.38	.37	.45
H_2O-	7.9	9.2	8.7	9.6	5.4	8.9	9.0	12.7	12.7	12.0
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Top	Bottom	Top	Bottom	Young-Top	Young-Bottom	Top	Top	Young
Interval	10mm	20mm	20mm	25mm	25mm	15mm	.8mm	20mm	20mm	-

Sequence#	054036	054036	054037	054037	054041	054041	054041	054041	054044	054045
Latitude	15.696	15.696	15.683	15.683	15.671	15.671	15.671	15.671	15.658	15.665
Longitude	-170.344	-170.344	-170.359	-170.359	-170.413	-170.413	-170.413	-170.413	-170.385	-170.386
Depth	2260	2260	1628	1628	1815	1815	1815	1815	1186	1520
Lab#	CKB-155	CKB-156	CKB-161	CKB-161	CKB-177	CKB-178	CKB-179	CKB-179	CKB-196	CKB-201
Si(wt.%)	2.82	3.28	2.15	2.46	2.94	3.03	1.53	1.99	2.18	1.13
Ti	1.04	1.13	.93	.91	.98	1.14	.87	.84	.86	.89
Mn	24.7	24.2	27.4	27.1	26.5	26.3	24.2	23.4	28.6	31.2
Fe	15.9	15.0	15.9	15.7	15.8	14.7	11.6	11.2	13.1	12.9
Al	.60	.96	.40	.43	.64	.92	.49	.57	.70	.48
Co	1.10	.991	1.41	1.27	1.17	.944	.530	.487	1.31	1.34
Ni	.507	.544	.538	.415	.554	.597	.584	.606	.591	.686
Ca	2.62	2.45	2.69	2.63	2.60	2.86	8.92	8.67	2.62	2.96
Mg	1.09	1.03	1.14	1.12	1.03	1.12	1.70	1.84	1.13	1.19
K	.51	.57	.47	.48	.50	.55	.49	.47	.56	.51
P	.42	.38	.49	.49	.42	.43	2.42	2.34	.39	.44
H_2O-	7.4	8.2	10.8	10.8	8.0	7.8	7.6	7.6	10.2	11.1
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Top	Bottom	Old-Top	Old-Top	Top	Middle	Bottom	Bottom	Top	Top
Interval	10mm	10mm	20mm	20mm	10mm	10mm	30mm	30mm	15mm	20mm

Sequence#	054046	054046	054046	054046	054049	054049	054049	054049	055001	055005
Latitude	15.665	15.665	15.665	15.665	15.683	15.683	15.683	15.683	19.355	11.020
Longitude	-170.386	-170.386	-170.386	-170.386	-170.359	-170.359	-170.359	-170.359	176.780	170.177
Depth	1520	1520	1520	1520	1628	1628	1628	1628	3672	1575
Lab#	CKB-203	CKB-203	CKB-204	CKB-205	17DS-SEM-64	17DS-SEM-65	17DS-SEM-66	17DS-SEM-67	W-222589	D-12-1
Si(wt.%)	1.65	1.79	.87	1.66	1.93	1.78	2.40	1.43	4.47	3.71
Ti	.80	.80	.57	.74	.93	1.09	1.17	.89	1.06	1.14
Mn	31.0	30.9	24.1	29.1	28.5	28.6	28.3	28.6	24.3	24.3
Fe	10.2	10.1	6.56	11.5	13.9	12.9	12.3	8.59	17.6	16.0
Al	.74	1.07	.24	.75	1.10	.34	.71	.38	.69	1.03
Co	1.09	1.10	.698	1.32	1.42	1.15	.970	1.02	.907	.762
Ni	1.057	1.113	.840	.814	.555	.667	.753	.936	.428	.504
Ca	3.44	3.43	11.3	3.23	2.54	2.50	2.78	6.17	3.20	2.17
Mg	1.63	1.55	1.97	1.39	1.11	1.02	1.22	1.58	1.03	.88
K	.65	.64	.55	.60	.53	.54	.59	.68	.52	.50
P	.70	.69	3.33	.66	.39	.34	.43	1.56	.73	.33
H_2O-	11.0	11.0	8.3	10.3	22.5	23.6	21.6	17.7	22.8	18.6
500°C	-	-	-	-	-	-	-	-	-	18.6
1000°C	-	-	-	-	-	-	-	-	-	4.7
Sampled	Top	Top	Old-Top	Old-Bottom	Top	Top	Top	Top	Bulk	Bulk
Interval	10mm	10mm	20mm	10mm	0-5mm	5-10mm	10-15mm	15-20mm	0-2mm	25mm

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	055006	055007	056006	056008	056009	079001	080002	080003	080004
Latitude	11.008	11.005	12.183	13.905	13.900	24.277	22.333	22.570	22.642
Longitude	170.203	170.230	168.995	167.627	167.653	-68.107	-72.085	-72.375	-72.850
Depth	2000	1800	1300	1600	1600	5668	2250	3420	2390
Lab#	D-13-4	D-14-3	D-15	D-17	D-18	W-222722	W-222703	W-222704	W-222705
Si(wt.%)	3.27	1.36	2.06	2.43	3.70	12.6	2.68	5.13	5.14
Ti	1.14	1.20	.93	1.03	1.01	.92	1.07	.87	.56
Mn	25.8	28.4	25.9	26.8	23.9	9.46	14.7	11.1	9.30
Fe	16.0	13.2	15.8	14.6	17.2	16.5	27.2	25.5	21.3
Al	.94	.74	.47	.65	.91	4.79	2.28	3.28	3.50
Co	1.11	1.10	.872	.956	.890	.184	.689	.390	.282
Ni	.489	.619	.461	.546	.410	.034	.119	.110	.106
Ca	2.19	3.21	2.40	2.46	2.31	.92	2.12	4.24	7.93
Mg	.91	1.00	.85	.98	.89	1.45	1.56	1.76	1.91
K	.51	.46	.44	.48	.50	.94	.37	.57	.55
P	.33	.55	.39	.35	.41	.03	.62	.69	.53
H_2O-	18.3	11.2	19.8	19.4	14.6	12.9	15.9	17.9	14.8
500°C	11.5	22.2	18.5	21.0	19.7	-	-	-	-
1000°C	11.0	3.8	7.4	4.9	3.5	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	30mm	10mm	30mm	20mm	30mm	0-12mm	0-17mm	0-4mm	0-28mm

Sequence#	080005	080006	080007	089001	089013	089014	089016	089017	089020
Latitude	23.157	23.183	23.487	21.670	22.208	22.256	22.316	21.718	21.718
Longitude	-73.752	-73.973	-74.200	-167.953	-166.882	-166.854	-166.899	-167.578	-167.578
Depth	3126	1315	2910	1690	2402	1970	2350	2400	2400
Lab#	W-222706	W-222707	W-222708	W-222571	2	3	5	6	9
Si(wt.%)	3.73	2.30	1.67	7.87	7.12	5.93	4.17	5.53	3.93
Ti	.58	.95	.98	1.18	1.42	1.39	1.35	1.77	1.50
Mn	6.44	16.8	18.2	23.2	17.1	19.9	22.4	21.2	23.8
Fe	15.6	25.7	25.9	11.9	18.3	20.0	20.8	16.9	17.4
Al	1.76	2.61	2.23	2.94	2.86	2.01	1.38	2.20	1.74
Co	.198	.722	.775	.317	.497	.659	.734	.562	1.22
Ni	.011	.253	.305	.915	.307	.266	.287	.387	.392
Ca	15.3	2.59	2.14	1.43	2.32	2.42	2.43	2.33	2.99
Mg	2.19	1.82	1.78	1.73	1.05	1.04	.99	.91	1.23
K	.40	.33	.33	.91	.61	.51	.48	.67	.53
P	.41	.59	.58	.20	.38	.40	.46	.34	.48
H_2O-	9.1	21.0	21.3	14.8	5.5	13.5	12.9	19.9	5.6
500°C	-	-	-	-	10.3	7.4	8.9	11.6	9.5
1000°C	-	-	-	-	9.6	8.6	3.6	8.9	10.1
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bottom	Top
Interval	0-5mm	0-30mm	0-40mm	0-3mm	-	<1mm	-	-	<1mm

Sequence#	089022	089025	089026	089029	089031	090001	090002	090006	090006
Latitude	21.796	20.209	20.209	20.335	20.335	27.868	29.835	20.078	20.078
Longitude	-167.624	-169.506	-169.506	-169.575	-169.575	-177.883	-177.883	-170.642	-170.642
Depth	2100	4500	4500	2400	2400	3443	3443	1332	1332
Lab#	11	13	14	17	19	W-222572	W-222573	MP1-CKB-57	MP1-CKB-57*
Si(wt.%)	6.33	7.55	11.0	5.13	3.81	5.62	3.78	-	-
Ti	1.67	2.27	1.74	1.16	1.66	.95	.81	.99	1.00
Mn	17.8	14.9	12.5	20.0	23.4	20.7	27.0	27.9	-
Fe	21.7	20.9	18.9	20.9	18.7	18.7	13.8	17.6	-
Al	2.49	3.73	4.57	1.14	1.50	.92	.55	-	-
Co	.496	.361	.300	.666	.986	.505	1.30	1.30	1.42
Ni	.188	.074	.067	.196	.321	.220	.450	.420	-
Ca	2.40	1.90	1.93	2.10	2.55	2.30	3.12	2.74	-
Mg	.98	.91	1.10	.91	1.00	1.11	1.73	-	-
K	.54	.33	.96	.49	.53	.52	.49	-	-
P	.46	.32	.27	.43	.40	.37	.44	.64	-
H_2O-	9.4	5.8	10.0	8.4	15.8	22.8	24.5	30.2	30.2
500°C	10.0	-	-	12.5	11.4	-	-	-	-
1000°C	12.8	-	-	5.9	8.6	-	-	-	-
Sampled	Bulk	Bulk	Top	Top	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	0-6mm	0-5mm	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	090007	090007	090007	090007	090008	090008	090009	090009	090011
Latitude	20.078	20.078	20.078	20.078	20.078	20.078	20.220	20.220	20.133
Longitude	-170.642	-170.642	-170.642	-170.642	-170.642	-170.642	-170.568	-170.568	-170.681
Depth	1332	1332	1332	1332	1332	1332	2573	2573	1476
Lab#	MP1-CKB-58	MP1-CKB-58	MP1-CKB-58*	MP1-CKB-58*	MP1-CKB-59	MP1-CKB-59*	MP1-CKB-60	MP1-CKB-60*	CKB-124
Si(wt.%)	-	-	-	-	-	-	-	-	2.51
Ti	.74	.86	-	.72	1.20	1.03	1.70	-	.96
Mn	23.6	22.5	-	-	28.2	-	26.0	-	26.5
Fe	14.6	13.8	-	-	17.6	-	16.4	-	18.1
Al	-	-	-	-	-	-	-	-	.65
Co	.680	.430	.440	.640	.880	.870	1.05	.980	1.07
Ni	.860	.750	-	-	.570	-	.330	-	.390
Ca	11.1	9.76	-	-	2.89	-	2.90	-	2.40
Mg	-	-	-	-	-	-	-	-	.88
K	-	-	-	-	-	-	-	-	.43
P	4.16	3.40	-	-	.64	-	.40	-	.46
H_2O-	26.6	26.7	26.7	26.6	13.9	13.9	37.9	37.9	13.5
500°C	-	-	-	-	-	-	-	-	11.2
1000°C	-	-	-	-	-	-	-	-	7.9
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Young
Interval	-	-	-	-	-	-	-	-	-

Sequence#	090011	090011	090012	090012	090012	090013	090014	090015	090016
Latitude	20.133	20.133	20.133	20.133	20.133	20.222	20.222	20.218	20.218
Longitude	-170.681	-170.681	-170.681	-170.681	-170.681	-170.600	-170.600	-170.589	-170.589
Depth	1476	1476	1476	1476	1476	-	-	1480	1480
Lab#	CKB-125	CKB-126	CKB-127	CKB-128	CKB-129	CKB-130	CKB-131	CKB-132	CKB-133
Si(wt.%)	1.96	1.43	3.64	1.28	3.58	4.49	4.32	5.35	5.91
Ti	1.20	.64	.98	.75	1.24	1.16	1.24	1.15	.05
Mn	29.8	22.9	24.5	25.1	24.7	22.7	22.4	20.8	59.7
Fe	15.1	8.42	18.4	8.69	17.3	18.6	19.5	17.9	3.11
Al	.89	.37	.81	.46	1.28	1.29	1.25	1.43	-
Co	1.01	.370	1.05	.530	.940	.710	.700	.710	.002
Ni	.550	.740	.350	.710	.410	.420	.310	.310	-
Ca	2.53	11.3	2.31	10.0	2.28	2.32	2.26	2.54	-
Mg	.98	1.14	.92	1.13	.88	.84	.96	.72	-
K	.49	.44	.45	.50	.52	.48	.47	.52	.75
P	.36	3.70	.47	3.28	.38	.43	.40	.52	.04
H_2O-	12.3	9.8	13.5	11.2	12.4	14.0	12.8	12.2	15.5
500°C	10.6	9.6	6.0	5.8	10.4	6.4	6.2	9.5	7.3
1000°C	8.7	7.9	10.9	8.8	7.2	9.6	10.9	8.1	9.3
Sampled	Middle	Old	Young	Old	Middle	-	-	Bulk	Young
Interval	-	-	-	-	-	-	-	-	-

Sequence#	090016	090016	091002	091004	092001	092002	093002	093003	093004
Latitude	20.218	20.218	20.750	29.813	21.145	21.160	21.480	23.703	24.017
Longitude	-170.589	-170.589	173.667	179.043	163.397	163.147	159.248	159.547	159.450
Depth	1480	1480	3816	989	1777	1468	1602	2812	4079
Lab#	CKB-134	CKB-135	W-222592	W-222574	W-222594	W-222595	W-222598	W-222599	W-222600
Si(wt.%)	3.02	1.16	2.50	1.66	9.90	2.41	5.17	8.96	7.83
Ti	1.39	.68	.90	.86	1.02	.94	.86	1.03	.85
Mn	26.8	25.5	28.0	31.8	16.9	28.3	22.2	17.6	20.3
Fe	16.4	7.72	14.9	12.3	15.8	16.5	18.3	18.2	16.9
Al	1.50	.32	.40	.08	3.42	.13	.65	1.98	1.54
Co	.870	.670	.876	1.67	.685	1.04	.721	.444	.552
Ni	.520	.690	.631	.653	.232	.466	.298	.246	.270
Ca	2.47	10.2	2.99	2.50	2.90	2.65	2.31	2.18	2.03
Mg	1.08	1.15	1.28	1.33	1.14	1.22	.94	.98	1.00
K	.57	.50	.51	.48	.93	.46	.46	.58	.64
P	.40	3.31	.61	.45	.52	.52	.54	.45	.39
H_2O-	14.2	10.6	22.4	28.0	18.2	24.9	19.6	18.8	18.4
500°C	7.2	9.8	-	-	-	-	-	-	-
1000°C	11.5	7.5	-	-	-	-	-	-	-
Sampled	Middle	Old	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	0-5mm	0-7mm	0-4mm	0-9mm	0-12mm	0-10mm	0-6mm

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	093005	112001	115012	116003	116004	127013	127015	195002	195004	195006
Latitude	29.490	30.213	39.517	30.883	30.983	31.793	30.978	55.107	55.127	55.127
Longitude	153.348	-39.358	-65.350	-78.783	-78.217	174.325	175.878	-140.462	-140.423	-140.423
Depth	1991	-	3382	836	903	2130	1920	2200	1400	1400
Lab#	W-222601	CHAIN-115D-9	A-296D-3-2	A-266D40	A-266D41	L8-82-D3	L8-82-D4	S6-79-1-4	S6-79-2-33	S6-79-2-34B
Si(wt.%)	3.45	15.3	2.84	1.72	1.16	2.99	2.75	9.15	20.0	4.70
Ti	.80	.67	.50	.36	.39	1.00	.74	.61	1.26	.66
Mn	24.3	6.98	16.6	15.4	16.9	25.8	25.0	19.2	.10	23.1
Fe	17.4	16.2	25.7	14.5	14.1	15.4	17.3	17.7	8.94	18.8
Al	.23	4.36	1.57	1.70	1.25	1.01	.70	1.97	8.07	1.13
Co	.481	.079	.314	.318	.401	.867	.806	.311	-	.476
Ni	.405	.147	.058	.364	.332	.336	.299	.173	-	.207
Ca	2.37	.96	1.43	11.3	10.7	2.34	2.20	1.93	2.24	2.15
Mg	.99	1.38	.80	3.56	3.14	.96	.95	.97	1.91	.85
K	.46	1.27	.48	.40	.36	.62	.53	.60	1.39	.49
P	.47	.27	.42	.43	.40	.39	.49	.45	.52	.49
H_2O-	21.1	11.5	14.0	12.0	12.7	22.7	23.0	13.1	9.8	18.0
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	0-8mm	-	-	-	-	-	-	-	-	-

Sequence#	195008	195010	195011	195013	195015	196002	196004	196006	196008	196010
Latitude	55.127	55.127	53.543	53.543	53.543	54.662	54.662	54.662	54.662	54.662
Longitude	-140.423	-140.423	-144.373	-144.373	-144.373	-150.305	-150.305	-150.305	-150.305	-150.305
Depth	1400	1400	2100	2100	2100	1400	1400	1400	1400	1400
Lab#	S6-79-2-34C	S6-79-D2	S-79-4-4	S6-79-4-13	S6-79-4-15A	S6-79-9-1	S6-79-9-9A	S6-79-9-9B	S6-79-9-11A	S6-79-9-11B
Si(wt.%)	4.39	6.72	2.25	5.10	4.71	3.57	3.06	2.50	11.5	8.55
Ti	.63	.67	.82	.87	.76	.94	.95	1.06	1.47	.74
Mn	23.9	14.3	30.0	24.7	23.7	25.8	28.8	27.6	10.5	18.8
Fe	19.8	19.3	15.1	18.6	18.6	17.9	16.0	16.8	19.7	16.4
Al	.91	1.76	.67	1.09	.80	.94	.96	.77	4.15	2.31
Co	.548	.091	.585	.566	.651	.601	.537	.491	.355	.444
Ni	.137	.240	.237	.264	.213	.241	.195	.233	.011	.216
Ca	2.35	2.29	2.74	2.51	2.32	2.38	2.56	2.47	1.47	1.88
Mg	.92	.95	1.18	1.02	.95	.90	.96	.77	1.23	1.12
K	.44	.42	.42	.44	.53	.46	.54	.44	1.01	.85
P	.54	.32	.39	.47	.49	.44	.43	.42	.35	.41
H_2O-	19.7	12.5	19.7	20.5	20.2	16.8	18.0	18.5	12.7	12.1
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-

Sequence#	317010	317010	317010	317011	317014	353001	353002	380001	409001	409002
Latitude	-.388	-.388	-.388	-.399	-.399	-16.203	-16.548	-21.253	-31.833	-34.553
Longitude	-176.073	-176.073	-176.073	-176.116	-176.116	-176.257	-178.442	-80.925	-13.578	-15.147
Depth	2107	2107	2107	1551	1551	1352	1499	2300	2984	2924
Lab#	CKB-136	CKB-136	CKB-138	CKB-139	6DK-SEM-62	W-222559	W-222560	W-222712	AII-107-7-25	AII-107-7-18
Si(wt.%)	3.02	3.18	2.22	2.42	2.24	7.54	7.34	5.51	4.00	4.43
Ti	1.25	1.24	1.20	.81	.77	.80	.74	.78	.56	.69
Mn	24.0	24.0	26.5	26.8	28.4	14.0	13.2	11.8	14.7	11.9
Fe	16.6	16.5	15.5	14.7	14.9	23.4	24.5	20.2	21.5	19.3
Al	1.10	1.09	.78	.66	.28	2.96	2.87	1.69	1.42	1.52
Co	1.11	.957	1.14	.819	1.30	.283	.154	.348	.293	.333
Ni	.507	.507	.587	.775	.438	.142	.103	.108	.169	-
Ca	3.02	3.01	2.58	3.16	2.48	3.05	3.81	7.50	4.87	7.29
Mg	1.17	1.18	1.19	1.31	1.20	1.29	1.39	1.38	1.52	2.00
K	.53	.52	.49	.50	.60	.81	.52	.66	.41	.40
P	.53	.53	.37	.62	.40	.56	.54	.39	.47	.45
H_2O-	11.2	11.2	9.7	8.4	13.2	22.4	22.1	16.7	11.3	16.0
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Top	Young	Top	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	30mm	30mm	15mm	20mm	0-5mm	0-1mm	0-10mm	0-20mm	-	-

Table 2. Composition of ferromanganese crusts analyzed by USGS Woods Hole analytical laboratories (cont'd).

Sequence#	409004	409007	409008	511001	515001	515002	515003	515005	515006	515007
Latitude	-35.278	-36.558	-32.677	-56.170	-53.147	-53.238	-53.418	-53.428	-54.423	-54.442
Longitude	-15.735	-17.587	-14.018	41.800	9.192	9.193	9.198	9.152	1.570	1.622
Depth	3638	2683	2634	3709	2438	3670	4418	5349	3240	4818
Lab#	AII-107-7-17	AII-107-7-15	AII-107-7-23	AII-107-6-1	AII-107-6-66	AII-107-6-65	AII-107-6-61	AII-107-6-60	AII-107-6-40	AII-107-6-39
Si(wt.%)	3.83	5.72	4.08	16.7	8.30	7.36	7.12	13.7	13.6	13.8
Ti	.84	.61	.79	.59	1.75	1.73	1.53	1.06	1.00	.93
Mn	14.5	11.6	14.0	10.1	15.2	14.0	12.4	7.95	11.6	7.35
Fe	24.0	20.6	24.3	11.6	19.1	21.7	23.9	15.0	9.66	9.12
Al	1.40	1.98	1.99	3.44	2.18	2.03	2.12	3.00	2.59	1.94
Co	.415	.211	.364	.207	.277	.217	.289	.123	.107	.053
Ni	-	.004	.073	.316	.386	.229	-	.006	.483	.358
Ca	3.70	5.97	3.75	1.77	2.13	1.91	2.19	2.43	1.93	1.19
Mg	1.17	1.77	1.30	.95	.98	.91	.93	3.50	4.86	9.98
K	.40	.44	.40	1.00	.63	.55	.54	.49	.59	.45
P	.46	.44	.51	.17	.27	.31	.37	.16	.11	.09
H_2O-	18.0	14.6	17.5	8.1	17.0	16.9	16.9	10.7	6.8	5.0
500°C	-	-	-	-	-	-	-	-	-	-
1000°C	-	-	-	-	-	-	-	-	-	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories

Sequence#	017006	017007	017008	017009	017010	017011	017012	017013	017014	017015	017016	017019	017020
Latitude	8.414	8.414	8.414	8.398	8.398	8.389	8.353	8.353	8.308	8.308	8.308	8.194	8.194
Longitude	-164.289	-164.289	-164.289	-164.359	-164.359	-164.294	-164.317	-164.317	-164.346	-164.346	-164.346	-164.200	-164.200
Depth	1850	1850	1850	2400	2400	1600	1150	1150	1400	1400	1400	1600	1600
Lab#	7504	7505	7506	7507	7508	7509	7510	7511	7512	7513	7514	7515	7516
Ti(wt.%)	1.45	1.53	1.77	1.40	1.31	1.19	.93	1.16	1.07	.96	.91	1.00	1.19
Mn	30.8	27.4	27.9	26.2	28.9	26.3	38.8	30.3	34.8	30.1	34.2	30.5	29.0
Fe	18.4	18.6	19.4	18.2	18.7	15.7	9.97	14.8	15.0	14.9	13.8	15.1	16.8
Al	.56	.66	.78	1.00	.73	.84	.50	.30	.30	.28	.32	.38	.32
Co	1.14	.840	1.01	1.02	.960	1.37	3.02	1.41	1.41	1.07	1.97	1.47	.860
Ni	.600	.430	.420	.470	.480	.680	.980	.430	.790	.660	.780	.510	.520
Cu	.100	.100	.100	.090	.100	.090	.090	.050	.050	.040	.060	.060	.080
Ca	2.77	2.99	2.70	2.92	2.78	4.86	2.81	5.37	2.92	3.14	2.65	2.50	2.53
Mg	1.28	1.07	1.15	1.33	1.26	1.40	2.29	1.26	1.34	1.12	1.37	1.12	1.01
Na	-	-	-	-	-	-	-	1.61	-	-	-	-	1.61
P	.50	.63	.55	.75	.57	1.27	.49	.77	.49	.62	.36	.41	.43
Ba(ppm)	2400	2700	3200	2700	2300	1900	2100	4300	2400	2600	1900	2900	3300
Mo	700	800	700	700	800	600	900	1100	1100	1000	1000	1000	700
Pb	2600	1700	1600	1500	1500	2100	2500	2500	2600	1900	2200	2400	2300
Sr	2000	2000	1900	1700	1800	1800	1500	2200	2100	2100	1900	2000	2200
V	900	800	800	600	800	700	800	800	900	900	900	900	1000
Zn	1100	1500	1400	1300	1200	1200	1500	1000	1200	1000	900	800	1000
Sampled	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bottom	Top	Top	Bulk-minus
Interval	-	-	-	-	-	0-15mm	-	-	-	-	-	-	Top

Sequence#	017021	052019	052020	052021	052022	053017	053018	053019	053020	053021	053022	053023	053024
Latitude	8.186	19.481	19.236	19.408	19.408	19.335	19.369	19.369	19.511	19.511	19.511	19.511	19.511
Longitude	-164.202	-157.054	-157.172	-157.080	-157.080	-168.665	-168.695	-168.695	-168.835	-168.835	-168.835	-168.835	-168.835
Depth	1800	2750	3000	3050	3050	3791	2000	2000	1800	1800	1800	1800	1800
Lab#	7517	1502	1830	1833	1835	7486	7487	7488	7489	7490	7491	7492	7493
Ti(wt.%)	1.47	1.46	1.02	1.69	1.54	1.45	1.51	1.22	1.23	1.09	1.27	1.30	1.27
Mn	26.1	19.5	16.2	20.0	16.1	21.8	22.7	23.4	22.5	32.3	27.4	24.1	30.9
Fe	15.4	20.9	23.4	21.4	19.5	21.6	18.4	19.1	18.9	12.4	15.7	19.4	14.1
Al	.95	1.10	1.71	1.22	2.13	1.05	1.44	1.04	.97	.40	.80	1.05	.39
Co	1.39	.660	.080	.360	.520	.620	1.03	.850	.820	.830	.970	.940	.810
Ni	.560	.270	.240	.340	.190	.400	.440	.470	.420	.640	.580	.480	.500
Cu	.080	.050	.260	.140	.100	.120	.060	.080	.110	.250	.150	.110	.110
Ca	2.88	2.09	1.58	2.18	2.62	2.43	2.97	3.30	2.13	4.89	3.75	2.25	4.33
Mg	1.07	1.10	.97	1.12	1.24	1.08	1.49	1.10	1.02	1.14	1.12	1.08	1.09
Na	-	-	-	-	-	-	-	-	-	1.55	1.59	-	-
P	.46	.30	.30	.30	.50	.42	.59	.52	.55	1.55	.86	.43	.93
Ba(ppm)	1500	1700	3600	2800	1700	1800	1800	1800	2100	3800	2600	2200	3600
Mo	500	300	600	400	300	600	400	500	500	900	700	500	800
Pb	2200	1900	-	400	900	2500	2600	2500	2600	3000	2700	2800	2400
Sr	1600	1500	1500	1600	1300	1700	1700	1800	1800	2100	1900	1800	2100
V	700	600	1300	1100	500	800	800	800	800	1000	800	800	900
Zn	1000	300	500	400	300	800	900	900	1000	1200	900	1000	1100
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bottom	Bulk	Top	Bottom
Interval	-	7-11mm	70-80mm	25-35mm	10-20mm	-	-	-	-	-	-	-	-

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	053025	053026	053027	053028	053029	053030	053031	053032	053033	053034	088011	088012	088013
Latitude	19.511	19.695	19.553	19.553	19.515	19.515	19.515	19.515	19.515	19.515	25.946	25.944	25.951
Longitude	-168.835	-168.995	-168.832	-168.832	-168.855	-168.855	-168.855	-168.855	-168.855	-168.855	-159.903	-159.878	-159.914
Depth	1800	4500	2400	2400	1790	1790	1790	1790	1790	1790	3000	2600	3600
Lab#	7494	7495	7496	7497	7498	7499	7500	7501	7502	7503	1426	1495	1499
Ti(wt.%)	1.33	1.82	1.40	1.50	1.09	1.12	1.23	1.00	1.34	1.00	1.49	1.54	1.59
Mn	27.7	16.8	24.5	23.6	27.9	29.2	24.7	30.4	23.8	30.7	15.1	20.7	20.1
Fe	16.0	18.4	19.2	20.6	17.1	16.3	19.2	14.9	20.5	15.9	18.5	22.7	19.6
Al	.80	2.59	1.09	1.55	.78	.69	.93	.57	1.32	.44	2.73	.97	.96
Co	.880	.310	.820	.690	.730	.750	.750	.710	.870	.550	.280	.440	.720
Ni	.490	.420	.390	.420	.410	.440	.360	.480	.340	.430	.240	.310	.310
Cu	.100	.290	.130	.220	.140	.160	.130	.170	.110	.140	.120	.100	.050
Ca	2.85	1.70	2.34	2.35	4.72	5.65	2.54	5.62	2.54	5.46	2.10	2.21	2.06
Mg	1.09	1.31	1.11	1.14	1.07	1.06	1.08	1.08	1.07	1.06	1.11	1.15	1.06
Na	-	1.55	-	-	1.55	-	-	-	-	-	-	-	-
P	.52	.60	.59	.51	.79	1.19	.56	.84	.44	1.11	.30	.40	.30
Ba(ppm)	2800	2000	1700	1900	2600	3000	2000	3200	2000	3400	2100	2200	1800
Mo	700	300	400	400	700	700	500	800	500	800	100	400	400
Pb	2100	1600	2200	2100	2700	2800	2700	3200	2800	2700	1200	2300	1900
Sr	1800	1000	1800	1700	2100	2200	1900	2200	1700	2400	300	1800	1600
V	800	500	700	700	900	900	700	900	700	1000	300	700	600
Zn	1300	1100	1200	1100	1300	1500	1300	1600	1200	1200	-	400	400
Sampled	Bulk	Top	Bulk	Bulk	Bulk	Top	Top	Bottom	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	10-25mm	2-4mm	-

Sequence#	088014	088015	088016	088017	088018	089011	089013	089014	089015	089016	089017	089018	089019
Latitude	25.944	25.944	25.944	25.946	25.951	22.181	22.208	22.256	22.316	22.316	21.718	21.718	21.718
Longitude	-159.878	-159.878	-159.878	-159.903	-159.914	-166.810	-166.882	-166.854	-166.899	-166.899	-167.578	-167.578	-167.578
Depth	2600	2600	2600	3000	3600	3950	2402	1970	2350	2350	2400	2400	2400
Lab#	1800	1802	1812	1814	1817	7467	7468	7469	7470	7471	7472	7473	7474
Ti(wt.%)	1.22	1.28	1.20	1.40	1.31	1.42	1.92	1.75	1.52	1.63	1.88	1.65	1.44
Mn	24.1	24.5	16.8	23.4	17.9	20.7	20.4	22.5	23.7	24.4	25.1	22.7	21.5
Fe	21.5	19.5	21.9	19.9	20.3	21.8	20.8	21.5	21.6	21.6	19.0	22.3	22.4
Al	.85	.88	1.36	.85	1.40	1.89	2.45	1.79	1.77	.98	1.85	1.61	1.93
Co	.830	.910	.410	.960	.520	.480	.560	.700	.760	.740	.650	.600	.680
Ni	.310	.390	.170	.440	.220	.270	.430	.410	.460	.400	.500	.370	.330
Cu	.080	.110	.060	.100	.140	.180	.260	.130	.130	.110	.220	.120	.070
Ca	2.30	2.22	2.68	2.17	2.47	2.35	2.64	2.59	2.63	2.45	2.58	2.46	2.65
Mg	1.21	1.22	1.04	1.20	1.06	1.52	1.17	1.12	1.52	1.14	1.11	1.09	1.06
Na	-	-	-	-	-	-	-	-	-	1.56	-	-	-
P	.40	.40	.70	.40	.60	.76	.87	.70	.78	.58	.52	.56	.73
Ba(ppm)	1800	2200	1800	1800	1900	1900	2500	2400	2100	2200	3400	2400	1700
Mo	500	400	300	400	300	200	200	300	400	500	400	500	300
Pb	1900	1300	1500	1500	1200	2200	2400	2700	2800	2300	1700	2300	2300
Sr	1800	1700	1600	1600	1400	1500	1500	1700	1700	1800	1800	1700	1600
V	700	600	1600	600	600	600	700	800	700	700	700	700	800
Zn	400	300	400	400	300	900	1200	1000	1100	1000	1100	1200	1000
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bottom	Top	Top
Interval	4-6mm	6-8mm	5-8mm	7-10mm	7-25mm	-	-	<1mm	-	-	-	-	-

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	089020	089021	089022	089023	089025	089026	089027	089028	089029	089030	089031	089038	089039
Latitude	21.718	21.796	21.796	21.796	20.209	20.209	20.209	20.209	20.335	20.335	20.335	24.322	25.783
Longitude	-167.578	-167.624	-167.624	-167.624	-169.506	-169.506	-169.506	-169.506	-169.575	-169.575	-169.575	-168.083	-167.733
Depth	2400	2100	2100	2100	4500	4500	4500	4500	2400	2400	2400	1225	1600
Lab#	7475	7476	7477	7478	7479	7480	7481	7482	7483	7484	7485	1429	1460
Ti(wt.%)	1.79	2.14	2.00	1.25	2.53	2.10	1.75	2.63	1.50	1.54	1.99	1.62	.52
Mn	25.1	24.2	18.9	19.2	15.9	12.7	14.5	13.6	23.1	20.8	24.0	2.54	45.6
Fe	17.2	18.0	22.0	20.5	20.9	18.2	16.0	18.9	22.5	22.7	19.9	17.1	2.40
Al	3.28	.79	1.69	1.48	2.51	3.79	3.52	3.00	1.01	1.12	.80	5.26	1.33
Co	1.14	1.04	.450	.540	.330	.270	.330	.280	.650	.550	.930	.200	.070
Ni	.430	.350	.290	.280	.190	.190	.270	.200	.340	.340	.420	.180	.350
Cu	.080	.060	.110	.060	.140	.150	.160	.190	.080	.110	.111	.040	.100
Ca	2.82	2.25	2.37	2.10	2.02	1.97	1.93	1.76	2.17	2.08	2.47	4.92	1.07
Mg	1.16	1.12	1.00	1.03	1.09	1.39	1.55	1.11	1.07	1.02	1.07	2.63	2.38
Na	1.87	-	-	-	-	1.55	-	-	1.54	-	-	-	-
P	.65	.53	.53	.48	.45	.40	.40	.43	.49	.43	.39	.10	.30
Ba(ppm)	1700	2000	2500	1600	2200	1800	1800	1900	2000	2900	2500	600	14000
Mo	600	500	600	600	300	200	200	300	500	500	400	100	200
Pb	2100	2300	2100	2400	2000	2000	1800	1700	2300	2400	2200	500	-
Sr	1600	1600	1600	1500	1300	900	900	1000	1800	2000	1800	600	1400
V	600	600	600	600	600	500	500	400	900	800	700	500	400
Zn	1000	1200	900	700	800	700	800	700	800	800	900	-	1400
Sampled	Top	Bulk	Bulk	Top	Bulk	Top	Bottom	Bulk	Top	Bulk	Bulk	Bulk	Bulk
Interval	<1mm	-	-	-	-	-	-	-	-	-	-	-	75-85mm

Sequence#	089040	089041	089042	089043	089044	089045	089046	089047	089048	089049	089050	089051	089052
Latitude	25.929	23.672	25.685	25.135	25.276	25.728	25.260	25.783	25.454	25.489	25.783	25.783	24.322
Longitude	-167.755	-164.891	-160.180	-160.027	-162.068	-160.201	-162.046	-167.733	-168.683	-168.672	-167.733	-167.733	-168.083
Depth	2500	1650	3000	2800	3000	2600	2300	1600	1115	1200	1600	1600	1225
Lab#	1470	1419	1420	1421	1422	1423	1424	1459	1474	1475	1476	1478	1481
Ti(wt.%)	1.17	1.10	1.45	1.18	1.26	.89	1.13	.57	1.02	1.09	.53	.34	1.52
Mn	22.4	21.4	17.4	20.3	23.1	26.6	22.6	40.6	22.9	23.8	37.1	40.4	1.16
Fe	20.0	19.8	18.0	19.1	18.0	18.4	19.9	4.94	14.2	14.3	4.19	3.12	17.9
Al	.58	1.02	2.22	1.26	.96	.06	2.18	1.43	2.54	1.04	1.70	1.11	4.68
Co	.700	.630	.380	.580	.780	.850	.710	.150	1.11	1.43	.080	.070	.040
Ni	.360	.320	.310	.340	.420	.430	.380	.300	.350	.430	.330	.370	.090
Cu	.060	.080	.220	.060	.100	.040	.080	.140	.070	.040	.130	.100	.040
Ca	2.08	2.08	3.24	2.08	2.14	2.42	2.34	1.22	1.78	1.90	1.13	1.06	2.09
Mg	1.10	1.18	1.17	1.09	1.22	1.30	1.21	2.19	1.32	1.22	2.11	2.10	2.32
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.40	.40	.60	.30	.30	.50	.50	-	.30	.30	.20	.20	.30
Ba(ppm)	1700	1600	4200	1700	1800	1500	1800	14000	2200	1300	14000	15000	400
Mo	500	500	300	400	400	700	400	200	800	500	200	200	900
Pb	1200	1900	1300	1600	1700	2200	2100	2400	1100	1000	-	1100	1800
Sr	1700	1600	1600	1600	1600	1800	1600	1500	1300	1400	1400	1500	1500
V	600	600	600	600	600	900	700	400	600	600	300	400	600
Zn	100	-	-	-	-	-	-	1200	200	100	1000	800	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	10-15mm	4-6mm	2-3mm	15-18mm	5-8mm	-	5-7mm	75-85mm	8-10mm	2-22mm	75-85mm	75-85mm	0-1mm

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	089053	089054	089055	089056	089057	089058	089059	089060	089061	089062	089063	089064	089065
Latitude	25.489	25.489	25.454	24.322	23.988	25.489	25.489	25.135	23.915	25.929	25.926	25.926	25.783
Longitude	-168.672	-168.672	-168.683	-168.083	-164.485	-168.672	-168.672	-162.027	-164.408	-167.755	-167.710	-167.710	-167.733
Depth	1200	1200	1115	1225	2100	1200	1200	2800	800	2500	3250	3250	1600
Lab#	1483	1484	1485	1486	1425	1489	1490	1427	1428	1469	1471	1472	1473
Ti(wt.%)	1.00	1.32	.99	1.26	1.35	1.04	1.44	3.26	1.66	1.17	1.14	1.38	.98
Mn	22.0	3.53	23.2	19.7	18.9	22.9	16.0	4.42	19.6	21.6	13.0	3.53	19.9
Fe	18.2	10.5	17.5	19.3	16.9	17.8	17.8	18.0	19.5	19.5	15.5	4.06	16.9
Al	.94	4.14	1.32	1.50	2.18	1.61	3.08	3.30	1.90	.58	2.65	5.42	1.26
Co	1.04	.100	.900	.820	.390	.660	.620	.080	.500	.670	.300	.080	.730
Ni	.370	.190	.390	.310	.420	.460	.230	.150	.340	.360	.230	.120	.510
Cu	.060	.050	.070	.060	.160	.080	.060	.060	.100	.050	.150	.050	.080
Ca	1.96	15.9	2.10	2.35	2.14	2.04	1.85	1.41	2.24	2.04	3.13	4.65	1.91
Mg	1.22	1.20	1.10	1.36	1.19	1.44	1.80	2.39	1.17	1.18	2.14	4.01	1.28
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.50	5.30	.50	.40	.30	.50	.40	.70	.30	.30	.30	.80	.40
Ba(ppm)	1500	600	1600	1600	2600	1700	1000	600	2200	1700	1300	500	1500
Mo	600	100	600	400	300	500	400	100	300	600	300	50	500
Pb	3400	2000	3500	3700	1400	1400	1100	-	2000	1000	200	-	1100
Sr	1600	900	1600	1500	1300	1600	1200	300	1600	1700	1100	400	1300
V	600	300	700	600	500	700	600	200	500	700	600	300	700
Zn	200	-	200	200	-	300	200	-	-	200	200	-	400
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	3-18mm	1-2mm	10-15mm	1-10mm	10-15mm	15-20mm	1-5mm	2-6mm	3-12mm	10-25mm	4-8mm	3-5mm	1-9mm

Sequence#	089066	089067	089068	089069	089070	089071	089072	089073	089074	089075	089076	089077	089078
Latitude	25.783	24.322	24.322	25.489	25.489	25.685	23.961	23.956	25.260	25.094	25.094	25.260	25.260
Longitude	-167.733	-168.083	-168.083	-168.672	-168.672	-160.180	-164.276	-164.414	-162.046	-161.728	-161.728	-162.046	-162.046
Depth	1600	1225	1225	1200	1200	3000	2650	1300	2300	2800	2800	2300	2300
Lab#	1477	1479	1480	1482	1491	1494	1496	1497	1498	1500	1501	1801	1803
Ti(wt.%)	.45	1.50	1.59	1.02	1.15	.62	1.30	1.38	1.46	1.40	1.09	2.10	1.46
Mn	40.6	6.38	3.34	20.6	23.8	24.7	18.6	16.9	15.0	14.5	21.3	25.3	22.5
Fe	3.95	17.0	17.8	18.2	15.7	18.5	17.3	21.1	19.6	13.1	19.1	19.6	22.5
Al	1.30	4.20	5.11	1.21	1.32	.56	1.84	1.66	1.81	3.24	.69	.70	.74
Co	.090	.220	.110	.940	1.30	1.29	.550	.330	.500	.260	.600	1.02	.530
Ni	.320	.180	.250	.370	.400	.410	.320	.500	.250	.430	.300	.350	.290
Cu	.120	.040	.060	.060	.060	.050	.100	.090	.050	.220	.040	.080	.080
Ca	1.22	3.14	2.25	1.84	1.99	3.93	2.13	2.30	1.96	2.32	2.20	2.65	2.49
Mg	2.23	2.56	2.58	1.25	1.30	1.47	1.28	1.10	1.20	1.24	1.08	1.30	1.12
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.20	.30	.30	.50	.40	1.10	.40	.40	.50	.50	.30	.30	.40
Ba(ppm)	15000	800	600	1400	1300	1900	1600	2000	2000	2000	1500	2500	2400
Mo	200	200	100	500	600	800	400	300	400	300	400	400	600
Pb	900	1600	1100	3400	1500	2400	1800	1500	1600	1300	1800	1900	1400
Sr	1500	600	300	1500	1400	1800	1400	1600	1200	1000	1600	1800	2000
V	400	400	400	600	600	900	500	600	600	300	600	600	700
Zn	1000	-	-	100	200	400	400	500	400	900	200	400	400
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	75-85mm	1-3mm	3-4mm	15-29mm	4-20mm	1-2mm	12-14mm	5-9mm	20-25mm	4-8mm	10-15mm	38-45mm	50-60mm

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	089079	089080	089081	089082	089083	089084	089085	089086	089087	089088	089089	089090	089091
Latitude	25.276	25.980	25.980	25.980	25.980	25.980	25.276	23.672	23.672	25.260	25.135	25.276	23.672
Longitude	-162.068	-164.379	-164.379	-164.379	-164.379	-164.379	-162.068	-164.891	-164.891	-162.046	-162.027	-162.068	-164.891
Depth	3000	1800	1800	1800	1800	1800	3000	1650	1650	2300	2800	3000	1650
Lab#	1804	1805	1806	1807	1808	1809	1810	1811	1813	1815	1816	1818	1819
Ti(wt.%)	1.84	1.26	1.29	1.32	1.10	1.25	1.40	1.51	1.38	1.48	1.31	1.51	1.44
Mn	24.7	21.7	20.4	18.9	22.2	21.4	15.8	20.4	16.5	22.0	22.0	20.5	17.0
Fe	19.9	23.3	22.8	23.0	21.7	20.4	22.3	21.4	22.4	22.5	20.4	21.6	21.6
Al	.81	1.11	1.27	1.32	.79	1.27	2.09	1.30	1.83	.06	1.20	1.11	1.87
Co	.630	.660	.580	.540	.690	.600	.380	.480	.410	.580	.700	.500	.570
Ni	.410	.240	.220	.200	.310	.240	.120	.290	.180	.320	.320	.400	.350
Cu	.200	.050	.030	.060	.060	.080	.060	.120	.060	.090	.100	.160	.080
Ca	2.32	1.72	2.28	2.17	2.20	2.26	2.57	2.27	2.50	2.14	2.28	2.16	2.70
Mg	1.18	1.19	1.14	1.12	1.19	1.25	1.30	1.15	1.22	1.10	1.23	1.14	1.29
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.40	.40	.40	.40	.40	.40	.40	.40	.40	.50	.40	.50	.40
Ba(ppm)	3100	2100	2100	2000	2000	2000	2000	2200	2000	2200	1900	2200	1800
Mo	500	500	500	500	600	500	300	400	400	500	400	400	300
Pb	1600	1600	1800	1400	1900	1300	1300	2400	1300	1800	1300	1400	2700
Sr	1900	1900	1900	1900	1900	1800	1600	1700	1600	1800	1700	1800	1600
V	600	1100	1400	700	1400	700	600	600	700	700	700	600	600
Zn	500	500	400	400	300	400	400	400	400	500	300	400	300
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	25-60mm	35-40mm	30-35mm	30-35mm	35-40mm	14-18mm	3-6mm	6-8mm	7-10mm	25-30mm	2-3mm	7-13mm	6-10mm

Sequence#	089092	089093	089094	089095	089096	089097	089098	089099	089100	090018	090019	090020	090021
Latitude	25.276	25.260	25.303	25.276	25.303	23.979	23.979	25.135	25.094	28.895	28.895	29.106	29.167
Longitude	-162.068	-162.046	-162.094	-162.068	-162.094	-164.363	-164.363	-162.010	-161.728	-178.868	-178.868	-173.948	-174.067
Depth	3000	2300	3500	3000	3500	2200	2200	2175	2800	1280	1280	1850	1425
Lab#	1820	1821	1822	1823	1824	1832	1834	1836	1839	1445	1446	1448	1449
Ti(wt.%)	1.30	1.61	1.38	1.48	1.29	1.46	1.46	1.60	1.12	.84	.96	1.08	.90
Mn	21.5	19.4	17.7	19.5	18.6	16.0	16.9	16.2	29.6	25.0	18.5	24.9	27.0
Fe	24.0	20.9	22.2	23.3	23.1	16.9	19.2	16.3	12.2	5.88	6.57	18.0	15.9
Al	.82	1.66	1.77	1.42	1.50	2.94	2.54	3.40	1.36	3.74	4.59	.99	.55
Co	.490	.540	.330	.430	.520	.590	.330	.280	1.47	.540	.400	.680	.760
Ni	.370	.400	.380	.360	.310	.290	.280	.260	.600	.500	.260	.440	.450
Cu	.090	.120	.200	.130	.060	.060	.090	.150	.060	.060	.040	.080	.040
Ca	2.24	2.08	2.22	2.36	2.06	2.02	2.55	3.20	2.51	2.62	1.50	2.32	2.32
Mg	1.12	1.13	1.16	1.17	1.08	1.40	1.44	1.14	2.39	2.56	1.59	1.10	1.14
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.50	.50	.50	.60	.40	.20	.30	.50	.20	.30	.20	.50	.60
Ba(ppm)	2200	2700	3400	2300	1700	1400	1600	1800	1300	600	600	2000	1800
Mo	500	400	300	400	400	300	300	200	800	300	300	700	800
Pb	3000	3400	2300	3200	2600	800	500	-	1600	2500	200	2300	2100
Sr	1800	1800	1600	2000	1600	1000	1200	1200	1200	500	400	2000	1900
V	800	700	600	700	600	200	500	500	500	500	.400	800	800
Zn	400	300	400	300	200	300	400	200	400	2000	1400	1200	600
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Nodule	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	13-25mm	5-8mm	2-4mm	10-15mm	5-8mm	2-5mm	3-6mm	-	1-5mm	3-5mm	1-3mm	10-20mm	14-40mm

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	090022	090023	090024	090025	090027	090028	090029	090030	090031	090032	090033	090034	090035
Latitude	29.106	29.167	29.208	28.895	29.167	29.167	29.167	29.185	29.208	29.167	29.062	29.208	28.895
Longitude	-173.948	-174.067	-174.112	-178.868	-174.067	-174.067	-174.067	-174.010	-174.112	-174.067	-174.022	-174.112	-178.868
Depth	1850	1425	2200	1280	1425	1425	1425	985	2200	1425	1150	2200	1280
Lab#	1451	1452	1454	1434	1455	1457	1458	1462	1464	1465	1468	1467	1432
Ti(wt.%)	.91	1.35	1.22	.70	1.26	.82	.94	1.16	1.33	1.22	1.08	1.17	.67
Mn	25.5	25.0	21.0	26.5	19.6	26.8	26.4	27.2	23.3	28.2	28.8	20.3	31.4
Fe	16.4	16.0	15.3	12.9	19.2	14.9	16.7	16.0	17.1	17.7	15.8	15.7	13.0
Al	.54	.87	1.10	.93	1.12	.64	.58	1.39	1.34	1.30	.64	1.95	.50
Co	.860	.630	.690	.930	.720	.820	.930	1.10	.640	.770	.670	.440	1.54
Ni	.450	.450	.380	.550	.310	.530	.460	.440	.420	.480	.400	.390	.610
Cu	.060	.070	.120	.040	.080	.060	.040	.050	.120	.060	.040	.120	.050
Ca	2.21	2.64	2.08	2.50	1.99	2.24	2.24	2.76	2.22	2.89	2.46	2.30	2.30
Mg	1.14	1.25	1.08	1.72	1.11	1.21	1.21	1.33	1.20	1.29	1.30	1.21	1.44
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.50	.70	.60	.20	.70	.50	.50	.80	.50	.80	.40	.40	.30
Ba(ppm)	1600	2400	2800	1100	3500	1900	1600	2400	2700	1700	2400	3000	1400
Mo	700	700	500	800	400	800	800	800	400	800	700	400	800
Pb	2000	2300	1700	2100	2700	1900	2300	3100	1800	2900	1400	1200	2500
Sr	1700	1800	1500	1400	2000	1700	1700	1900	1600	1800	1900	1400	1600
V	600	700	600	700	600	800	700	800	600	800	800	500	800
Zn	600	800	600	-	600	600	200	400	700	600	400	400	-
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	25-33mm	15-20mm	15-20mm	1-2mm	10-25mm	25-35mm	15-20mm	-	15-25mm	4-12mm	90-110mm	20-25mm	10-12mm

Sequence#	090036	090026	090038	090039	090040	090041	090042	090043	090044	090045	090046	090047	090048
Latitude	28.881	28.895	28.895	28.739	29.106	29.106	29.167	29.167	29.106	29.106	29.106	29.106	28.881
Longitude	-179.745	-178.868	-178.868	-178.783	-173.948	-174.020	-174.067	-174.067	-173.948	-173.948	-173.948	-173.948	-179.745
Depth	2000	1280	1280	3000	1850	1475	1425	1425	1850	1850	1850	1850	2000
Lab#	1440	1441	1447	1450	1453	1461	1463	1466	1826	1827	1828	1829	1837
Ti(wt.%)	.68	.74	.88	.94	1.22	.88	1.05	1.05	1.08	1.16	.99	.93	1.29
Mn	26.9	26.9	30.5	19.7	14.1	28.5	25.9	23.5	24.4	25.6	27.2	29.1	26.0
Fe	13.1	13.9	11.9	19.6	20.6	12.5	16.6	15.0	17.3	17.9	17.6	12.7	17.6
Al	1.17	.74	.92	.73	1.62	1.24	1.55	2.23	1.11	.72	.61	1.52	1.02
Co	.620	1.32	1.75	.470	.790	1.42	.680	.500	.700	.840	.870	.580	.760
Ni	.940	.510	.740	.280	.210	.620	.460	.460	.480	.510	.400	1.150	.420
Cu	.200	.070	.060	.040	.060	.050	.060	.080	.080	.070	.060	.130	.060
Ca	1.98	2.94	2.16	1.98	1.40	2.32	2.20	2.34	2.76	2.36	2.76	2.60	2.50
Mg	1.60	1.42	1.68	1.02	1.17	1.35	1.28	1.23	1.27	1.30	1.27	1.81	1.26
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.30	.30	.40	.50	.60	.60	.60	.60	.70	.50	.50	.40	.30
Ba(ppm)	1400	1600	1400	1400	2000	1400	2200	3800	3000	2000	2600	3000	1500
Mo	600	800	800	400	200	700	600	600	600	600	800	600	500
Pb	1500	2100	2700	1400	2500	3100	2400	2300	2700	3000	3600	2000	600
Sr	1500	1800	1300	1600	1700	1400	1700	1600	1700	1800	1900	1300	1600
V	600	800	700	600	500	700	800	600	600	700	800	600	600
Zn	1000	600	1300	600	500	3800	600	700	300	200	200	800	300
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	1-3mm	-	1-9mm	8-10mm	4-10mm	-	20-25mm	15-30mm	13-25mm	13-20mm	3-5mm	4-8mm	6-8mm

Table 3. Chemical composition of ferromanganese crusts analyzed by BOM Avondale analytical laboratories (cont'd).

Sequence#	090049	091005	091006	091007	091008	091009	091010	091011	091012	091013	091014	091015	091016
Latitude	28.895	29.857	29.643	29.857	29.839	29.839	29.634	29.641	29.869	29.820	29.641	29.634	29.839
Longitude	-178.869	179.083	179.282	179.083	179.065	179.065	179.288	179.282	179.098	179.103	179.282	179.288	179.065
Depth	1280	2250	1300	2250	2100	2100	1865	1300	2900	1700	1300	1865	2100
Lab#	1838	1435	1442	1487	1430	1431	1433	1456	1492	1438	1436	1437	1439
Ti(wt.%)	1.06	1.23	.69	1.12	1.24	.98	.82	1.02	1.56	1.28	.84	.72	.99
Mn	27.9	23.0	29.0	20.1	14.4	23.8	25.7	21.9	22.7	21.4	27.3	23.7	14.2
Fe	16.5	16.6	14.8	20.1	16.5	16.0	18.6	19.6	18.2	17.2	17.6	18.0	22.6
Al	.88	1.00	.51	1.25	2.78	1.20	.54	.62	1.04	1.56	.69	.54	1.90
Co	.740	.570	1.28	.500	.460	.800	.640	1.23	.730	.620	.840	.600	.520
Ni	.510	.400	.510	.380	.360	.380	.380	.320	.380	.460	.400	.390	.320
Cu	.070	.090	.070	.080	.120	.050	.080	.040	.080	.060	.040	.060	.060
Ca	2.39	2.26	2.24	1.93	2.84	2.06	2.52	2.04	2.30	2.69	2.46	2.09	1.72
Mg	2.02	1.17	1.30	1.24	1.98	1.22	1.22	1.22	1.16	1.48	1.27	1.07	1.24
Na	-	-	-	-	-	-	-	-	-	-	-	-	-
P	.40	.30	.30	.40	.30	.40	.40	.60	.40	.30	.30	.30	.40
Ba(ppm)	2000	3000	1400	2000	2700	1300	1400	2400	2400	1300	1500	1400	3200
Mo	700	600	900	500	200	600	700	600	400	600	800	700	200
Pb	1600	2000	2100	3300	2100	2000	2400	2500	1600	1900	2500	2500	3100
Sr	1600	1600	1800	1600	1200	2300	1800	2000	1500	1600	1700	1800	1600
V	700	700	700	600	500	700	800	600	500	700	800	800	700
Zn	500	600	500	400	-	-	-	400	300	500	400	500	700
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	3-5mm	-	2-12mm	1-6mm	2-6mm	5-15mm	7-8mm	-	-	5-6mm	-	8-12mm	1-3mm

Sequence#	091017	091018	091019	091020	091021
Latitude	29.634	29.634	29.866	29.869	29.820
Longitude	179.288	179.288	179.083	179.098	179.104
Depth	1865	1865	2250	2900	1700
Lab#	1443	1444	1488	1493	1825
Ti(wt.%)	.81	.70	1.01	1.04	2.37
Mn	24.6	20.8	22.0	18.5	9.04
Fe	18.1	17.3	18.2	17.3	14.7
Al	.78	1.19	.88	1.60	3.89
Co	.640	.480	.580	.390	.250
Ni	.400	.400	.340	.400	.130
Cu	.050	.060	.060	.120	.040
Ca	2.14	1.84	2.18	2.00	3.82
Mg	1.01	1.18	1.12	1.30	2.50
Na	-	-	-	-	-
P	.30	.30	.40	.40	.40
Ba(ppm)	1700	1400	1600	2000	700
Mo	700	600	500	400	300
Pb	2400	1500	1500	700	1300
Sr	1900	1700	1700	1300	700
V	800	800	600	500	400
Zn	500	600	300	300	200
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	8-15mm	7-10mm	1-3mm	8-10mm	-

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.)

Sequence#	017006	017007	017008	017009	017010	017011	017012	017013	017014	017015	017015
Latitude	8.414	8.414	8.414	8.398	8.398	8.389	8.353	8.353	8.308	8.308	8.308
Longitude	-164.289	-164.289	-164.289	-164.359	-164.359	-164.294	-164.317	-164.317	-164.346	-164.346	-164.346
Depth	1850	1850	1850	2400	2400	1600	1150	1150	1400	1400	1400
Lab#	38	39	40	41	42	43	44	45	46	47	47
Si(wt.%)	2.08	2.78	2.66	3.49	4.32	2.36	1.17	1.33	.72	.67	1.30
Ti	1.14	1.12	1.46	1.00	1.13	1.05	.71	.93	.92	.90	.88
Mn	27.3	24.9	23.9	25.8	23.0	23.7	33.9	27.6	31.8	32.4	29.1
Fe	16.0	18.1	18.8	16.9	18.4	15.3	8.47	13.4	13.8	14.1	13.8
Al	.51	.63	.68	.66	.94	.92	.51	.27	.37	.34	.31
Co	1.01	.808	.871	.894	.903	1.20	2.56	1.24	1.14	1.06	1.08
Ni	.566	.511	.446	.536	.478	.633	.948	.410	.676	.643	.654
Ca	.053	.068	.085	.091	.085	.076	.073	.040	.035	.041	.040
Ca	2.65	3.21	2.60	2.63	2.85	5.08	2.49	5.38	2.87	3.44	6.15
Mg	1.13	1.08	1.07	1.11	1.17	1.39	1.77	1.17	1.21	1.20	1.18
P	.36	.57	.39	.45	.54	1.45	.40	1.51	.37	.57	.60
H_2O-	17.0	15.8	10.4	4.9	5.9	6.8	4.0	4.9	9.7	9.8	9.8
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Cr	81	53	61	49	58	85	43	37	37	43	41
Pb	1400	1600	1600	1400	1200	1700	1800	1200	1100	1500	1500
Sr	1300	2200	2100	1900	1800	1800	1500	2200	2100	2000	2200
Zn	1000	1000	950	810	800	900	1100	700	870	950	1000
Sampled	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bottom	Bottom
Interval	-	-	-	-	-	0-15mm	-	-	-	-	-

Sequence#	017016	017016	017019	017020	017021	017030	017035	017036	017037	017038	017041
Latitude	8.308	8.308	8.194	8.194	8.186	9.081	9.148	9.148	9.148	9.148	9.142
Longitude	-164.346	-164.346	-164.200	-164.200	-164.202	-164.727	-164.808	-164.808	-164.808	-164.808	-164.784
Depth	1400	1400	1600	1600	1800	4301	2600	2600	2600	2600	2465
Lab#	48	48	50	51	52	MP1-CKB11	MP1-CKB18	MP1-CKB19	MP1-CKB20	MP1-CKB21	MP1-CKB24
Si(wt.%)	.98	1.08	1.66	1.26	3.60	4.93	2.56	1.59	1.01	3.58	-
Ti	.79	.76	.88	1.02	1.27	.98	.77	.65	.56	1.07	-
Mn	32.8	31.4	30.6	29.7	24.5	23.5	25.8	28.1	20.1	23.7	33.2
Fe	12.4	12.1	14.7	16.5	15.0	15.0	14.3	13.2	9.60	14.5	10.7
Al	.36	.23	.42	.33	1.22	1.21	.32	.25	.12	.66	-
Co	1.87	1.82	1.45	.872	1.26	.380	.920	1.13	.530	.780	1.62
Ni	.750	.728	.498	.495	.535	.500	.460	.560	.360	.380	.770
Ca	.021	.022	.047	.063	.038	.390	.050	.060	.070	.050	.040
Ca	2.83	2.68	2.81	2.81	2.99	2.90	3.40	2.62	9.50	3.46	-
Mg	1.36	1.35	1.23	1.11	1.25	.90	.90	.76	.68	.86	-
P	.41	.37	.44	.42	.52	.14	.03	.14	2.05	.31	-
H_2O-	9.3	9.3	9.7	7.1	10.3	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Cr	31	58	37	45	79	29	40	18	20	48	-
Pb	1400	1800	1200	1100	1500	740	900	1000	1100	1300	-
Sr	1800	1800	2200	2300	1700	-	-	-	-	-	-
Zn	820	760	740	1000	760	700	-	700	800	-	-
Sampled	Top	Top	Top	Bulk-minus	Bulk	Bulk	Bulk	Bulk	Old	Young	Bulk
Interval	-	-	-	Top	-	-	-	-	-	-	-

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	017042	017043	017105	017106	017107	017108	017109	017110	017111	017112	017113	017114
Latitude	9.142	9.142	9.081	9.081	9.081	9.081	9.081	9.081	9.081	9.148	9.148	9.148
Longitude	-164.784	-164.784	-164.727	-164.727	-164.727	-164.727	-164.727	-164.727	-164.727	-164.808	-164.808	-164.808
Depth	2465	2465	4301	4301	4301	4301	4301	4301	4301	2600	2600	2600
Lab#	MP1-CKB25	MP1-CKB26	30-B	30-H	30-I	30-K	30-L	30-M	30-N	31-E1	31-E2	31-F
Si(wt.%)	.71	.23	2.48	2.69	15.4	2.59	3.02	2.31	2.76	1.24	2.13	1.54
Ti	.43	.12	-	-	-	-	-	-	-	-	-	-
Mn	29.9	24.2	21.2	22.8	8.63	20.5	20.6	22.3	22.3	25.7	25.0	25.1
Fe	11.5	7.00	16.1	15.8	7.91	16.2	16.2	15.6	16.7	11.3	11.9	12.6
Al	.18	.11	.48	.62	5.29	.52	.64	.51	.57	.22	.45	.27
Co	1.18	.790	.540	.580	.120	.550	.580	.610	.610	1.25	1.12	1.26
Ni	.710	.780	.380	.410	.370	.390	.380	.410	.380	.750	.670	.650
Cu	.050	.040	.091	.110	.360	.094	.087	.089	.086	.044	.056	.072
Ca	3.89	9.40	1.64	2.59	2.94	1.91	1.85	2.59	2.84	1.76	3.67	2.03
Mg	.92	1.06	.87	.99	1.63	.89	.93	1.00	1.02	1.04	1.04	1.06
P	.39	1.88	.35	.00	.52	.31	.31	.00	.00	.40	.58	.30
H_2O-	-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	124	-
Cr	23	20	-	-	-	-	-	-	-	-	-	-
Pb	1500	1700	960	1100	360	960	980	1100	1100	1300	860	1200
Sr	-	-	1500	1400	260	1400	1400	1400	1400	980	1500	1500
Zn	700	1200	520	740	610	560	540	610	640	910	1700	810
Sampled	Young	Old	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	13.0	13.0	-	15.0	12.0	12.0	17.0	25.0	25.0	60.0

Sequence#	017115	017116	017117	017118	017119	017120	017121	017122	017123	017124	053018	053018
Latitude	9.148	9.148	9.148	9.148	9.148	9.148	9.148	9.148	9.142	9.142	19.369	19.369
Longitude	-164.808	-164.808	-164.808	-164.808	-164.808	-164.808	-164.808	-164.808	-164.784	-164.784	-168.695	-168.695
Depth	2600	2600	2600	2600	2600	2600	2600	2600	2465	2465	2000	2000
Lab#	31-G	31-H	31-I	31-K	31-L	31-M	31-N	31-O	32-B	32-D	21	21
Si(wt.%)	3.67	5.84	5.54	2.64	7.62	9.02	2.88	3.53	1.05	.56	4.20	5.23
Ti	-	-	-	-	-	-	-	-	-	-	1.30	1.28
Mn	19.4	16.9	16.2	23.8	13.5	12.7	21.5	19.8	26.9	17.9	24.3	22.6
Fe	16.5	11.3	13.1	13.8	10.0	13.3	15.1	16.7	10.3	5.11	17.5	16.7
Al	.62	1.81	1.67	.53	2.52	3.08	.53	.67	.28	.82	1.45	1.35
Co	.620	.750	.600	1.11	.590	.660	.700	.510	1.60	.660	1.01	.998
Ni	.380	.530	.420	.550	.550	.390	.490	.410	.730	1.240	.461	.395
Cu	.078	.064	.066	.050	.120	.065	.058	.110	.054	.120	.035	.037
Ca	1.60	4.27	4.08	2.79	7.08	2.18	1.73	1.60	1.81	11.0	3.13	3.00
Mg	.88	1.00	.98	1.03	1.10	1.11	.90	.85	1.16	1.66	1.44	1.22
P	.00	1.31	.00	.00	1.97	.73	.00	.00	.35	.00	.40	.38
H_2O-	-	-	-	-	-	-	-	-	-	-	8.8	8.8
As(ppm)	-	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	49	61
Pb	950	780	1100	1400	690	910	1100	830	1300	610	2100	2100
Sr	1500	1100	1300	1400	720	870	1500	1000	1300	1600	1800	1800
Zn	670	800	610	760	880	760	700	680	820	1400	650	700
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	30.0	3.0	10.0	-	-	3.0	30.0	20.0	10.0	10.0	-	-

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	053019	053020	053021	053023	053024	053026	053027	053027	053028	053029	053030
Latitude	19.369	19.511	19.511	19.511	19.511	19.695	19.553	19.553	19.553	19.515	19.515
Longitude	-168.695	-168.835	-168.835	-168.835	-168.835	-168.995	-168.832	-168.832	-168.832	-168.855	-168.855
Depth	2000	1800	1800	1800	1800	4500	2400	2400	2400	1790	1790
Lab#	22	23	24	26	27	29	30	30	31	32	33
Si(wt.%)	4.32	4.70	1.36	4.66	1.46	8.61	3.99	4.52	5.10	2.26	2.71
Ti	1.05	1.11	1.01	1.16	1.09	1.63	1.15	1.15	1.23	.92	1.00
Mn	21.2	23.1	32.3	22.5	29.5	15.8	24.2	22.8	22.3	25.7	25.2
Fe	17.4	18.6	11.1	17.6	12.7	19.2	18.1	19.0	18.5	15.3	14.8
Al	1.09	1.12	.27	.11	.27	2.70	.87	1.17	1.34	.57	.53
Co	.744	.849	.798	.847	.762	.331	.820	.798	.703	.690	.657
Ni	.383	.407	.641	.423	.549	.437	.472	.416	.434	.437	.449
Cu	.050	.061	.150	.044	.068	.230	.094	.090	.130	.094	.110
Ca	3.60	2.34	5.07	2.34	4.62	1.81	2.38	2.69	2.44	5.15	5.51
Mg	1.08	1.00	1.14	1.07	1.06	1.31	1.12	1.15	1.16	1.03	1.03
P	.44	.41	1.03	.34	.86	.26	.40	.41	.40	1.23	1.33
H_2O-	11.3	16.4	17.3	19.7	19.9	15.3	11.0	11.0	14.7	13.0	8.7
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Cr	53	50	24	56	25	122	47	47	52	43	43
Pb	2000	1800	1700	2000	2000	1700	2100	1500	1700	1700	1700
Sr	1700	1900	2200	1800	2200	1200	1900	1800	1800	2100	2000
Zn	590	710	960	670	860	860	750	740	820	840	920
Sampled	Bulk	Top	Bottom	Top	Bottom	Top	Bulk	Bulk	Bulk	Bulk	Top
Interval	-	-	-	-	-	-	-	-	-	-	-

Sequence#	053031	053032	053033	053033	053034	053034	053037	053043	053044	053046	053047
Latitude	19.515	19.515	19.515	19.515	19.515	19.515	13.115	13.001	12.987	13.151	13.200
Longitude	-168.855	-168.855	-168.855	-168.855	-168.855	-168.855	-165.552	-164.968	-164.958	-165.485	-165.462
Depth	1790	1790	1790	1790	1790	1790	4774	3040	2055	4150	1508
Lab#	34	35	36	36	37	37	MP1-CKB28	MP1-CKB34	MP1-CKB35	MP1-CKB37	MP1-CKB38
Si(wt.%)	4.07	1.51	4.03	4.20	1.20	1.47	11.1	3.67	2.89	2.80	1.58
Ti	1.04	.89	1.03	1.15	.87	.86	1.38	.98	.35	.31	.99
Mn	22.9	27.5	22.0	21.1	28.3	28.5	13.0	24.1	27.4	18.9	30.7
Fe	18.1	13.5	17.5	18.3	14.1	13.7	12.3	14.8	14.6	14.3	12.2
Al	.85	.39	.86	1.12	.43	.43	2.98	.76	.56	.38	.28
Co	.717	.669	.836	.836	.547	.547	.310	.630	.840	.620	1.21
Ni	.435	.491	.424	.412	.419	.488	.200	.480	.530	.270	.620
Cu	.064	.130	.047	.047	.070	.068	.110	.150	.060	.100	.050
Ca	2.44	5.98	2.27	2.31	5.64	5.72	2.22	3.65	3.25	2.84	3.86
Mg	1.07	1.06	1.02	1.05	.99	.99	.91	.91	.91	.71	1.00
P	.48	1.45	.40	.38	1.31	1.35	.19	.23	.25	.22	.27
H_2O-	14.9	10.3	19.9	19.9	14.0	14.0	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Cr	44	31	59	56	43	52	129	29	22	26	22
Pb	1800	1300	1900	1900	1500	1900	760	710	510	1000	1600
Sr	1900	2100	1800	1600	2300	2400	-	-	-	-	-
Zn	790	890	660	670	830	830	500	800	700	-	700
Sampled	Top	Bottom	Bulk	Bulk	Bulk	Bulk	Bulk	Young	Young	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	053048	053049	053141	053142	053143	053144	053145	053146	053147	053148	053149	053150
Latitude	13.200	13.200	13.001	13.001	13.001	13.001	13.001	13.001	13.001	12.987	12.987	12.987
Longitude	-165.462	-165.462	-164.968	-164.968	-164.968	-164.968	-164.968	-164.968	-164.968	-164.958	-164.958	-164.958
Depth	1508	1508	3040	3040	3040	3040	3040	3040	3040	2055	2055	2055
Lab#	MP1-CKB39	MP1-CKB40	43-A	43-B1	43-B2	43-C	43-D	43-E	43-F	44-A	44-B	44-E
Si(wt.%)	.99	2.10	3.72	3.67	1.17	4.84	8.09	4.16	3.23	7.92	6.22	5.19
Ti	.58	.74	-	-	-	-	-	-	-	-	-	-
Mn	30.0	22.1	18.4	19.1	20.8	18.3	12.6	17.4	20.3	3.56	17.6	3.19
Fe	11.5	8.00	15.6	15.4	15.1	13.4	14.9	15.4	15.3	5.50	12.0	33.7
Al	.15	.44	.72	.85	.69	1.39	2.56	1.03	.49	.72	2.06	.62
Co	1.14	.710	.600	.590	.740	.620	.480	.620	.780	.070	.560	.110
Ni	.570	.560	.350	.460	.510	.570	.250	.350	.410	.160	.630	.090
Cu	.050	.050	.056	.097	.105	.190	.046	.060	.063	.030	.130	.056
Cu	4.19	10.00	2.40	1.64	1.62	2.62	2.98	2.60	1.64	23.3	4.73	7.46
Mg	.82	.88	.86	.86	.90	.91	.96	.64	.88	.64	1.18	.64
P	.38	2.64	.40	.00	.28	.43	.89	.00	.33	7.02	1.44	.00
H_2O-	-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	83	74	-	-	137	-	40	-	159
Cr	15	55	-	-	-	-	-	-	-	-	-	-
Pb	1200	1000	1100	700	910	430	780	920	980	570	850	280
Sr	-	-	1500	950	1400	920	730	1400	1500	1300	920	550
Zn	600	800	760	640	620	820	510	660	630	390	1100	810
Sampled	Young	Old	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	20.0	50.0	50.0	-	5.0	20.0	-	-	30.0	-

Sequence#	053151	053152	053153	053154	053155	053156	053157	053158	053159	053160	053161	053162
Latitude	12.987	13.151	13.151	13.151	13.200	13.200	13.200	13.200	13.200	13.200	13.200	13.200
Longitude	-164.958	-165.485	-165.485	-165.485	-165.462	-165.462	-165.462	-165.462	-165.462	-165.462	-165.462	-165.462
Depth	2055	4150	4150	4150	1508	1508	1508	1508	1508	1508	1508	1508
Lab#	44-I	57-A	57-C	57-D	58-A1	58-A2	58-B	58-C	58-D	58-E1	58-F	58-G
Si(wt.%)	6.73	3.55	9.68	8.02	1.57	1.82	1.80	3.34	1.31	4.96	1.87	3.23
Ti	-	-	-	-	-	-	-	-	-	-	-	-
Mn	14.6	19.6	10.4	14.4	24.3	23.9	27.6	22.5	24.6	16.9	25.3	22.4
Fe	15.2	17.6	14.1	15.7	12.6	12.9	13.3	10.7	12.3	11.1	12.8	12.4
Al	1.99	.55	3.77	2.71	.26	.31	.33	.10	.27	1.50	.55	.87
Co	.750	.580	.340	.400	1.34	1.40	1.42	1.30	1.44	.970	1.30	1.26
Ni	.310	.300	.200	.250	.530	.530	.590	.530	.540	.400	.500	.550
Cu	.032	.210	.054	.170	.027	.026	.036	.040	.038	.049	.036	.037
Ca	2.00	2.65	2.26	1.93	1.73	1.85	3.04	3.78	1.94	6.06	2.43	1.93
Mg	.97	.93	.85	.84	.97	.98	1.15	1.12	1.02	.99	1.03	1.09
P	.68	.43	.50	.48	.42	.00	.46	.00	.44	.00	.51	.54
H_2O-	-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	135	80	97	-	-	-	-	179	-	102	118
Cr	-	-	-	-	-	-	-	-	-	-	-	-
Pb	400	1200	870	810	1300	660	1400	1300	1500	1300	1300	1300
Sr	930	1400	990	1100	1600	1400	1600	1300	1000	850	1600	1300
Zn	610	650	610	700	560	620	700	950	630	540	610	630
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	1.0	2.0	3.0	5.0	30.0	30.0	50.0	3.0	8.0	2.0	7.0	5.0

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	053163	054003	054005	054006	054007	054008	054012	054013	054014	054050	054051
Latitude	13.200	19.402	19.361	19.373	19.373	19.373	19.408	19.408	19.408	19.402	19.402
Longitude	-165.462	-171.173	-171.064	-170.991	-170.991	-170.991	-171.391	-171.391	-171.391	-171.173	-171.173
Depth	1508	2856	2010	1190	1190	1190	1925	1925	1925	2856	2856
Lab#	58-X	MP1-CKB42	MP1-CKB45	MP1-CKB46	MP1-CKB47	MP1-CKB48	MP1-CKB52	MP1-CKB53	MP1-CKB54	73-A	73-B
Si(wt.%)	1.45	6.40	3.72	2.19	1.55	1.64	1.13	-	-	11.1	9.58
Ti	-	1.16	1.06	.89	1.02	.71	.47	-	-	-	-
Mn	26.0	19.0	23.4	27.0	21.6	29.0	24.2	21.8	18.4	11.7	12.8
Fe	11.1	16.6	14.6	15.5	7.90	15.6	11.1	13.7	10.9	13.2	14.9
Al	.27	1.10	.66	.33	.31	.25	.22	-	-	2.95	2.35
Co	1.33	.560	.830	1.02	.500	1.38	.450	.550	.550	.380	.400
Ni	.700	.130	.380	.440	.620	.510	.390	.510	.380	.250	.250
Cu	.048	.120	.090	.040	.110	.030	.060	.150	.110	.090	.130
Ca	1.79	3.26	3.65	3.77	9.51	4.39	9.20	-	-	1.19	1.22
Mg	1.09	.92	.96	.97	1.02	1.07	.76	-	-	1.45	1.37
P	.32	.31	.26	.34	2.08	.35	1.29	-	-	.36	.40
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Cr	-	41	38	22	25	27	16	-	-	-	-
Pb	1300	1500	1600	1900	1800	2000	2300	-	-	1200	1000
Sr	1500	-	-	-	-	-	-	-	-	600	680
Zn	720	-	-	500	900	500	700	-	-	550	580
Sampled	Bulk	Bulk	Young	Bulk	Old	Young	Old	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	3.0	3.0

Sequence#	054052	054053	054054	054055	054056	054057	054058	054059	054060	054061	054062
Latitude	19.402	19.402	19.402	19.402	19.402	19.361	19.361	19.361	19.361	19.361	19.361
Longitude	-171.173	-171.173	-171.173	-171.173	-171.173	-171.064	-171.064	-171.064	-171.064	-171.064	-171.064
Depth	2856	2856	2856	2856	2856	2010	2010	2010	2010	2010	2010
Lab#	73-C	73-E	73-F	73-G	73-H	75-A	75-B	75-C	75-D	75-E	75-G
Si(wt.%)	5.03	7.88	9.72	7.62	8.46	3.58	4.75	4.58	3.97	3.41	5.12
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	19.6	12.7	12.0	15.6	14.2	21.1	16.7	18.1	18.9	21.4	18.1
Fe	16.7	15.8	15.6	16.1	15.6	16.3	16.0	17.5	16.4	16.1	17.1
Al	.10	2.45	2.40	.20	2.37	.64	1.03	.48	.69	.59	1.27
Co	.700	.490	.380	.480	.490	.850	.580	.690	.710	.840	.540
Ni	.350	.300	.260	.430	.280	.400	.300	.350	.350	.400	.330
Cu	.083	.140	.094	.104	.120	.054	.047	.057	.059	.048	.093
Ca	2.62	1.98	1.04	2.20	1.81	2.69	2.40	1.57	1.83	2.66	2.56
Mg	1.17	1.21	1.46	1.10	1.37	1.02	.85	.90	.89	1.00	.91
P	.00	.47	.39	.50	.40	.49	.00	.52	.47	.38	.46
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	103	-	-	-	-	-	-	-	-	-	73
Cr	-	-	-	-	-	-	-	-	-	-	-
Pb	1500	1300	1300	1300	1200	3400	1400	1500	1400	1300	1500
Sr	1300	1200	650	1100	1200	1500	1500	1400	1500	1500	1500
Zn	650	650	630	860	660	710	570	700	590	650	720
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	5.0	5.0	2.0	5.0	2.0	20.0	1.0	30.0	2.0	2.0	5.0

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	054063	054064	054065	054066	054067	054068	054069	054070	054071	054072	054073	054074	054075
Latitude	19.373	19.373	19.373	19.373	19.373	19.373	19.373	19.408	19.408	19.408	19.408	19.408	19.408
Longitude	-170.991	-170.991	-170.991	-170.991	-170.991	-170.991	-170.991	-171.391	-171.391	-171.391	-171.391	-171.391	-171.391
Depth	1190	1190	1190	1190	1190	1190	1190	1925	1925	1925	1925	1925	1925
Lab#	76-A	76-B	76-D	76-E	76-F	76-G	76-H	78-A	78-B	78-C	78-D	78-E	78-F
Si(wt.%)	2.08	1.68	2.15	2.50	2.48	1.96	2.22	2.55	3.06	2.52	3.83	5.14	5.26
Ti	-	-	-	-	-	-	-	-	-	-	-	-	-
Mn	24.3	23.6	22.5	21.3	21.3	22.3	21.9	22.1	20.9	30.3	2.05	17.3	15.9
Fe	15.6	12.6	15.6	14.9	15.1	14.6	15.6	12.6	13.7	8.75	1.83	16.8	14.7
Al	.04	.35	.37	.45	.43	.31	.38	.72	.86	.70	1.51	1.45	1.31
Co	1.10	1.33	1.02	.970	.820	.950	.930	.680	.740	.460	.040	.590	.620
Ni	.440	.540	.400	.380	.390	.410	.410	.520	.500	.340	.080	.360	.370
Cu	.031	.039	.031	.036	.040	.037	.036	.180	.094	.150	.040	.075	.074
Ca	2.89	1.68	1.86	1.66	1.71	1.75	1.75	2.60	2.50	1.86	32.0	4.37	4.01
Mg	1.08	1.03	.97	.91	.91	.95	.96	.93	.97	1.08	.63	.94	1.05
P	.44	.51	.00	.00	.57	.00	.00	.30	.00	.00	.00	.72	1.37
H_2O-	-	-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-	81	-
Cr	-	-	-	-	-	-	-	-	-	-	-	-	-
Pb	3800	1600	1600	1500	1500	1500	1400	1300	1400	310	208	1200	1500
Sr	1600	1500	1600	1600	1600	1700	1600	1600	1500	2300	1800	1500	840
Zn	570	590	690	490	530	520	520	770	690	800	300	730	620
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	30.0	40.0	20.0	20.0	25.0	15.0	5.0	40.0	-	4.0	3.0	4.0	3.0

Sequence#	054076	054077	054078	054079	054080	054081	089011	089013	089017	089018	089019	089020	089021
Latitude	19.408	19.408	19.408	19.408	19.408	19.408	22.181	22.208	21.718	21.718	21.718	21.718	21.796
Longitude	-171.391	-171.391	-171.391	-171.391	-171.391	-171.391	-166.810	-166.882	-167.578	-167.578	-167.578	-167.578	-167.624
Depth	1925	1925	1925	1925	1925	1925	3950	2402	2400	2400	2400	2400	2100
Lab#	78-G	78-H	78-I	78-L	78-M	78-N	1	2	6	7	8	9	10
Si(wt.%)	2.78	6.19	4.56	2.88	3.06	12.8	6.88	6.87	5.50	5.38	7.10	3.91	3.74
Ti	-	-	-	-	-	-	1.20	1.49	1.42	1.27	1.16	1.64	1.87
Mn	22.8	12.4	18.6	21.9	20.3	2.40	19.3	17.1	22.0	20.5	18.3	25.0	23.1
Fe	14.7	11.7	15.4	14.2	15.6	4.56	21.4	18.7	16.5	20.7	19.7	18.1	18.7
Al	.59	1.61	.12	.58	.50	6.00	1.88	2.36	1.53	1.41	1.69	.97	.85
Co	.710	.420	.630	.830	.650	.060	.458	.465	.570	.587	.559	1.21	.768
Ni	.420	.340	.350	.470	.340	.200	.256	.465	.461	.329	.263	.487	.374
Cu	.059	.085	.063	.070	.042	.065	.160	.220	.160	.077	.042	.072	.052
Ca	2.74	6.94	2.45	1.97	1.85	17.7	2.45	2.49	2.53	2.45	2.45	3.02	2.49
Mg	.97	.83	1.00	.99	1.02	.76	1.23	1.16	1.01	1.04	.98	1.22	1.18
P	.00	3.03	.00	.00	.00	5.49	.34	.34	.28	.39	.49	.37	.31
H_2O-	-	-	-	-	-	-	6.2	7.5	17.6	14.8	12.4	5.6	6.3
As(ppm)	-	50	-	-	133	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	65	79	53	53	78	57	67
Pb	1400	830	1800	1300	1300	300	1700	1800	1300	1200	1800	2300	2100
Sr	1400	900	1300	1600	1600	1000	1600	1600	1800	1800	1600	1800	1800
Zn	740	590	700	660	580	540	750	940	840	800	960	780	690
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bottom	Top	Top	Top	Bulk
Interval	-	3.0	3.0	3.0	30.0	-	-	-	-	-	-	<1mm	-

Table 4. Composition of ferromanganese crusts analyzed by TUCLZ (Halbach et al.) and German Geological Survey (Marchig et al.) (cont'd).

Sequence#	089022	089023	089025	089026	089027	089030	089031	090006	090007	090008	090009	090070
Latitude	21.796	21.796	20.209	20.209	20.209	20.335	20.335	20.078	20.078	20.078	20.220	20.078
Longitude	-167.624	-167.624	-169.506	-169.506	-169.506	-169.575	-169.575	-170.642	-170.642	-170.642	-170.568	-170.642
Depth	2100	2100	4500	4500	4500	2400	2400	1332	1332	1332	2573	1332
Lab#	11	12	13	14	15	18	19	MP1-CKB57	MP1-CKB58	MP1-CKB59	MP1-CKB60	111-B
Si(wt.%)	6.40	6.36	7.68	10.9	9.30	5.42	3.62	1.77	.75	2.50	-	3.06
Ti	1.67	1.08	2.19	1.78	1.53	1.40	1.71	.81	.80	.64	-	-
Mn	19.1	17.9	15.0	11.7	14.7	21.8	22.6	26.8	24.6	27.0	24.0	20.3
Fe	21.6	20.3	22.8	18.9	19.3	21.6	17.6	15.7	7.30	13.8	14.6	12.8
Al	1.58	1.52	2.56	3.93	3.81	1.05	.91	.25	.25	.18	-	.92
Co	.506	.563	.330	.252	.358	.552	.926	1.10	.750	.840	1.10	1.02
Ni	.334	.258	.192	.168	.246	.293	.293	.440	.820	.460	.350	.560
Cu	.087	.045	.120	.150	.160	.073	.079	.020	.180	.040	.070	.057
Ca	2.53	2.20	2.11	2.11	2.16	2.07	2.70	3.10	9.80	4.30	-	4.20
Mg	1.00	.98	1.15	1.37	1.41	1.00	1.11	.76	.96	1.02	-	1.21
P	.48	.42	.31	.26	.26	.37	.38	.31	1.98	.42	-	1.44
H_2O-	7.2	14.7	6.2	4.9	10.5	11.2	14.7	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-	-
Cr	56	65	90	112	151	53	52	15	17	27	-	-
Pb	1500	1700	1900	1400	1300	2000	1700	1700	1400	2000	-	1600
Sr	1800	1700	1500	1100	1100	1900	1800	-	-	-	-	1500
Zn	820	690	710	570	700	790	750	700	1400	-	-	700
Sampled	Bulk	Top	Bulk	Top	Bottom	Bulk	Bulk	Bulk	Old	Young	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	5.0

Sequence#	090071	090072	090073	090074	090075	090076	090077	090078	090079	090080	090081
Latitude	20.078	20.078	20.078	20.078	20.078	20.220	20.220	20.220	20.220	20.220	20.220
Longitude	-170.642	-170.642	-170.642	-170.642	-170.642	-170.568	-170.568	-170.568	-170.568	-170.568	-170.568
Depth	1332	1332	1332	1332	1332	2573	2573	2573	2573	2573	2573
Lab#	111-F	111-G	111-H1	111-H2	111-I	113-A	113-B	113-C	113-D	113-E	113-F
Si(wt.%)	2.99	2.24	2.45	.96	2.17	2.20	7.69	4.49	5.40	5.49	17.1
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	20.4	22.3	21.7	23.6	17.1	20.6	13.3	16.5	15.5	17.4	3.27
Fe	13.7	14.4	14.0	5.69	14.5	13.6	17.5	16.2	18.8	15.4	11.8
Al	.68	.42	.48	.13	.66	.47	1.81	1.12	1.08	.15	5.60
Co	1.000	1.19	1.16	.480	1.02	1.09	.390	.520	.420	.580	.100
Ni	.430	.420	.440	.940	.480	.410	.230	.310	.230	.330	.180
Cu	.041	.025	.038	.074	.074	.039	.088	.077	.074	.210	.096
Ca	3.13	1.76	2.89	6.94	1.85	2.78	1.75	2.31	1.51	2.84	1.46
Mg	1.14	.97	1.02	1.01	1.02	.90	1.08	.92	.85	1.02	1.62
P	1.34	.00	.00	.00	.00	.36	.63	.00	.41	.00	.45
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	121	-	-	185	-	-	-	66	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Pb	1600	1700	1600	1100	1500	1500	1200	1500	1400	1200	320
Sr	1600	1600	1500	1600	1100	1500	760	1500	880	1200	310
Zn	530	700	550	1100	630	600	580	600	600	740	430
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	20.0	5.0	2.0	2.0	-	7.0	5.0	.5	10.0	5.0	.2

Table 5. Composition of ferromanganese crusts analyzed onboard SP Lee L5-83HW and L5-84CP by Portaspec XRF

Sequence#	017006	017007	017008	017009	017010	017011	017012	017013	017014	017015	017016	017017	017019
Latitude	8.414	8.414	8.414	8.398	8.398	8.389	8.353	8.353	8.308	8.308	8.308	8.297	8.194
Longitude	-164.289	-164.289	-164.289	-164.359	-164.359	-164.294	-164.317	-164.317	-164.346	-164.346	-164.346	-164.369	-164.200
Depth	1850	1850	1850	2400	2400	1600	1150	1150	1400	1400	1400	1700	1600
Lab#	38	39	40	41	42	43	44	45	46	-	48	49	50
Mn(wt.%)	25.0	22.2	23.4	24.6	22.1	22.8	33.6	25.2	28.9	28.4	30.8	20.3	28.0
Fe	15.8	17.5	18.8	17.4	20.0	14.6	8.30	11.7	12.6	13.7	12.0	10.4	14.1
Co	1.12	.800	.980	.930	1.01	1.37	2.48	1.26	1.10	1.10	1.000	1.24	1.49
Ni	.430	.290	.290	.370	.310	.470	.810	.210	.480	.460	.590	.390	.330
Cu	.020	.040	.050	.040	.040	-	.030	<.030	<.030	<.030	<.030	.390	<.030
Pb(ppm)	1000	1000	1100	940	960	1000	850	1100	1000	970	1000	1000	1100
Zn	710	750	750	600	610	750	670	410	570	650	-	-	400
Sampled	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bottom	Top	Bulk	Top
Interval	-	-	-	-	-	0-15mm	-	-	-	-	-	-	-

Sequence#	017020	017021	019003	020001	020002	053017	053018	053019	053020	053021	053022	053023	053024
Latitude	8.194	8.186	7.250	8.747	8.755	19.335	19.369	19.369	19.511	19.511	19.511	19.511	19.511
Longitude	-164.200	-164.202	171.008	169.738	169.792	-168.665	-168.695	-168.695	-168.835	-168.835	-168.835	-168.835	-168.835
Depth	1600	1800	2250	3550	2900	3791	2000	2000	1800	1800	1800	1800	1800
Lab#	51	52	D-1	D-4-2	D-6-1	20	21	22	23	24	25	26	27
Mn(wt.%)	27.0	24.0	24.4	21.6	26.5	20.2	20.5	20.6	21.2	28.7	23.0	21.5	26.0
Fe	16.2	14.4	14.5	17.0	12.7	20.3	17.0	18.3	17.4	9.60	13.6	16.2	10.3
Co	.890	1.45	1.22	.810	1.25	.064	1.18	.900	.910	.770	.970	1.01	.880
Ni	.340	.410	.490	.490	.630	.070	.170	.180	.200	.420	.310	.250	.280
Cu	<.030	<.030	.090	.080	.110	-	.010	.030	.040	.140	.180	.030	.040
Pb(ppm)	1000	970	-	-	-	1200	1000	1100	1100	1000	1100	1200	1100
Zn	630	350	-	-	-	800	800	800	450	600	560	460	560
Sampled	Bulk-minus	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bottom	Bulk	Top	Bottom
Interval	Top	-	0-10mm	0-3mm	0-20mm	-	-	-	-	-	-	-	-

Sequence#	053025	053026	053027	053028	053029	053030	053031	053032	053033	053034	053035	055005	055006
Latitude	19.511	19.695	19.553	19.553	19.515	19.515	19.515	19.515	19.515	19.515	16.678	11.020	11.008
Longitude	-168.835	-168.995	-168.832	-168.832	-168.855	-168.855	-168.855	-168.855	-168.855	-168.855	-169.359	170.177	170.203
Depth	1800	4500	2400	2400	1790	1790	1790	1790	1790	1790	1400	1575	2000
Lab#	28	29	30	31	32	33	34	35	36	37	53	D-12-1	D-13-4
Mn(wt.%)	23.5	12.0	20.7	18.0	24.0	24.0	22.2	25.5	20.1	26.3	<.50	22.5	23.5
Fe	12.9	18.7	17.8	18.6	14.4	13.8	18.4	12.3	18.8	13.0	10.3	15.8	15.5
Co	.870	.320	.920	.690	.680	.710	.800	.064	.930	.490	<.100	.660	1.07
Ni	.270	.200	.180	.200	.270	.290	.240	.320	.210	.280	<.100	.470	.480
Cu	.040	.230	.060	.200	.090	.100	.060	.120	.050	.070	-	.100	.090
Pb(ppm)	1200	960	1100	1100	1400	1200	1400	1100	1200	1500	590	-	-
Zn	580	680	450	620	580	590	570	550	540	560	370	-	-
Sampled	Bulk	Top	Bulk	Bulk	Bulk	Top	Top	Bottom	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	25mm	30mm

Table 5. Composition of ferromanganese crusts analyzed onboard SP Lee L5-83HW and L5-84CP by Portaspec XRF(cont'd).

Sequence#	055007	056006	056008	056009	089011	089013	089014	089015	089016	089017	089018	089019	089020
Latitude	11.005	12.183	13.905	13.900	22.181	22.208	22.256	22.316	22.316	21.718	21.718	21.718	21.718
Longitude	170.230	168.995	167.627	167.653	-166.810	-166.882	-166.854	-166.899	-166.899	-167.578	-167.578	-167.578	-167.578
Depth	1800	1300	1600	1600	3950	2402	1970	2350	2350	2400	2400	2400	2400
Lab#	D-14-3	D-15	D-17	D-18	1	2	3	4	5	6	7	8	9
Mn(wt.%)	25.5	24.0	22.0	21.2	17.3	15.6	17.0	18.2	20.0	20.0	19.5	17.0	23.0
Fe	12.5	13.5	15.5	17.0	20.0	18.0	18.5	19.7	20.0	15.2	20.3	19.4	15.8
Co	.990	.800	.740	.680	.440	.530	.670	.740	.680	.520	.550	.600	1.000
Ni	.590	.590	.440	.390	.150	.250	.230	.265	.210	.270	.180	.150	.260
Cu	.120	.180	.110	.110	.140	.200	.070	.072	.050	.170	.070	.040	.050
Pb(ppm)	-	-	-	-	-	1000	1200	1200	1200	1000	1000	1200	1200
Zn	-	-	-	-	-	-	-	-	-	680	500	440	440
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bottom	Top	Top	Top
Interval	10mm	30mm	20mm	30mm	-	-	<1mm	-	-	-	-	-	<1mm

Sequence#	089021	089022	089023	089024	089025	089026	089027	089028	089029	089030	089031
Latitude	21.796	21.796	21.796	21.841	20.209	20.209	20.209	20.209	20.335	20.335	20.335
Longitude	-167.624	-167.624	-167.624	-167.666	-169.506	-169.506	-169.506	-169.506	-169.575	-169.575	-169.575
Depth	2100	2100	2100	4123	4500	4500	4500	4500	2400	2400	2400
Lab#	10	11	12	PC4	13	14	15	16	17	18	19
Mn(wt.%)	23.5	16.5	16.8	10.3	14.0	11.0	13.8	12.3	18.5	18.0	20.5
Fe	16.0	23.1	19.2	24.0	20.4	18.6	16.1	19.2	20.7	19.7	16.8
Co	1.10	.540	.064	.470	.380	.340	.420	.360	.710	.630	1.02
Ni	.210	.160	.140	.370	.100	.100	.160	.120	.070	.060	.160
Cu	.050	.060	.040	.340	.100	.130	.160	.160	.020	.050	.070
Pb(ppm)	1200	1200	1200	-	900	800	800	900	1100	1100	1000
Zn	450	610	480	870	550	500	550	650	400	450	800
Sampled	Bulk	Bulk	Top	Bulk	Bulk	Top	Bottom	Bulk	Top	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF

Sequence#	017047	017048	017049	017050	017051	017051	017052	017052	017053	017053	017059	017059
Latitude	9.694	9.694	9.694	9.694	9.696	9.696	9.696	9.696	9.696	9.696	9.716	9.716
Longitude	-162.178	-162.178	-162.178	-162.178	-162.181	-162.181	-162.181	-162.181	-162.181	-162.181	-162.167	-162.167
Depth	1993	1993	1993	1993	1927	1927	1927	1927	1927	1927	1602	1602
Lab#	CKB-30	CKB-31	CKB-32	CKB-33	CKB-34	CKB-35	CKB-36	CKB-37	CKB-38	CKB-39	CKB-40	CKB-41
Si(wt.%)	2.00	2.00	4.10	3.00	1.50	1.70	2.20	2.00	2.40	2.10	1.20	1.10
Ti	1.09	1.33	1.43	1.70	.81	.95	1.38	1.05	1.32	1.08	.93	.84
Mn	27.7	30.9	28.4	30.1	21.7	31.0	30.9	17.3	28.8	30.5	32.9	22.9
Fe	16.8	14.2	17.6	17.6	12.3	14.5	15.5	12.0	16.1	13.2	13.4	11.3
Al	.40	.36	.81	.53	.26	.27	.38	.54	.51	.70	.33	.30
Co	.870	1.41	1.02	1.40	.380	1.23	1.17	.330	.980	1.19	1.45	.470
Ni	.440	.660	.470	.590	.290	.660	.650	.460	.590	.860	.720	.480
Cu	.048	.058	.039	.048	.048	.039	.048	.058	.058	.077	.048	.048
Ca	3.64	3.34	3.93	5.62	19.4	3.39	4.22	25.0	4.10	4.40	4.10	20.1
P	.45	.27	.42	-	3.36	.45	.50	5.38	.63	.71	.53	3.70
Pb(ppm)	1600	1700	1700	1800	2000	2100	2000	1700	2100	2000	2300	2000
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	700	960	770	970	800	920	980	970	1000	1200	910	850
Sampled	Bulk	Bulk	Bulk	Porous	Old	Young	Young	Old	Bulk	Top	Young	Old
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	017059	017059	017060	017062	017063	017064	017064	017070	017071	017077	017078	017079
Latitude	9.716	9.716	9.716	9.682	9.705	9.705	9.705	6.516	6.503	6.271	6.274	6.281
Longitude	-162.167	-162.167	-162.167	-162.184	-162.184	-162.184	-162.184	-162.408	-162.370	-162.876	-162.886	-162.878
Depth	1602	1602	1602	2706	1940	1940	1940	2349	2572	2957	2217	1376
Lab#	CKB-42	CKB-43	CKB-44	CKB-45	CKB-46	CKB-47	CKB-48	CKB-50AM	CKB-51	CKB-52AM	CKB-53AM	CKB-54AM
Si(wt.%)	1.40	.90	1.20	7.30	1.80	1.50	1.70	2.50	4.10	6.20	4.40	5.70
Ti	.93	.65	.89	1.04	.97	.57	.81	.96	1.04	.94	.99	1.14
Mn	25.7	27.8	31.2	17.8	22.9	12.7	28.1	25.3	23.7	19.0	20.1	26.2
Fe	11.7	7.60	11.6	12.1	12.5	7.50	10.9	14.3	15.7	13.7	12.6	9.80
Al	.39	.66	.34	2.47	.44	.78	.47	.37	.83	1.39	1.26	2.09
Co	.850	1.05	1.52	.990	.430	.480	1.44	.930	.730	.570	1.08	1.93
Ni	.560	1.350	.780	.380	.400	.640	.670	.620	.470	.400	.450	.600
Cu	.048	.116	.048	.029	.087	.068	.048	.058	.077	.048	.019	.019
Ca	13.2	11.2	3.50	13.7	13.3	27.7	4.10	2.60	3.50	6.10	5.00	4.30
P	2.47	2.36	.51	2.66	2.56	7.24	.74	.45	.68	1.36	.45	.50
Pb(ppm)	2100	1800	2300	1500	2200	1600	2200	1500	1500	1200	1400	1700
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	900	1600	1000	650	950	1000	810	800	780	760	710	870
Sampled	Bulk	Bulk	Top	Top	Bulk	Old	Young	-	-	Bulk	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	017080	017082	017082	017083	017084	017085	017085	017085	017085	017085	017086	017087
Latitude	6.281	6.263	6.263	6.263	6.263	6.290	6.290	6.290	6.290	6.290	9.164	9.172
Longitude	-162.878	-162.963	-162.963	-162.963	-162.963	-162.970	-162.970	-162.970	-162.970	-162.970	-164.842	-164.826
Depth	1376	2887	2887	2887	2887	2486	2486	2486	2486	2486	2291	1853
Lab#	CKB-55AM	CKB-57AM	CKB-58AM	CKB-59	CKB-60	CKB-61	CKB-61AM	CKB-62	CKB-63	CKB-64	CKB-65	CKB-66
Si(wt.%)	3.70	5.40	4.10	4.90	5.80	2.70	2.40	3.40	3.20	3.10	3.90	2.40
Ti	1.06	.98	1.02	1.25	1.33	1.48	1.14	1.37	1.50	1.46	1.03	1.32
Mn	25.7	23.9	23.2	25.6	23.6	28.8	25.2	29.6	27.0	27.4	24.3	28.0
Fe	9.60	18.9	16.0	18.4	18.8	21.1	17.4	20.3	21.3	21.8	18.2	13.4
Al	1.16	.89	.81	.88	1.20	.51	.44	.55	.70	.55	.61	.75
Co	1.97	.540	.870	.800	.720	.710	.620	.640	.560	.610	.720	1.41
Ni	.590	.370	.450	.480	.440	.490	.430	.540	.440	.440	.420	.610
Cu	.019	.058	.039	.058	.077	.068	.048	.048	.106	.087	.048	.068
Ca	4.70	4.10	2.90	4.30	5.60	6.00	3.60	5.90	5.60	5.70	3.80	5.00
P	.46	.72	.45	.59	.87	.64	.51	.78	.76	.79	.56	.61
Pb(ppm)	1700	1300	1200	1500	1500	1600	1600	1800	1500	1600	1500	1900
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	870	770	730	850	830	1100	870	1000	1200	1300	770	890
Sampled	Bulk	-	-	Bulk	Bulk	Bulk	Bulk	Top	Bottom	Middle	Bulk	Bulk
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	017087	017088	017088	017088	017088	017088	017088	017089	017090	017093	017093	017093
Latitude	9.172	9.179	9.179	9.179	9.179	9.179	9.179	9.166	9.140	9.225	9.225	9.225
Longitude	-164.826	-164.830	-164.830	-164.830	-164.830	-164.830	-164.830	-164.798	-164.789	-164.780	-164.780	-164.780
Depth	1853	1263	1263	1263	1263	1263	1263	1427	2638	1456	1456	1456
Lab#	CKB-67	CKB-68	CKB-69	CKB-70AM	CKB-71	CKB-72	CKB-72AM	CKB-73	CKB-74	CKB-75	CKB-76	CKB-76AM
Si(wt.%)	16.7	1.17	2.14	.91	1.44	1.13	1.23	1.45	.82	2.15	1.71	.85
Ti	1.13	1.06	1.33	1.04	1.25	.94	.86	1.00	.86	1.28	1.16	.87
Mn	-	30.3	32.6	32.5	33.3	29.4	28.5	29.5	33.6	30.8	27.1	26.0
Fe	6.70	11.9	15.3	9.50	13.9	11.5	11.1	11.1	11.3	14.4	12.7	11.3
Al	7.78	.31	.41	.32	.36	.32	.37	.49	.26	.45	.41	.28
Co	.020	1.26	1.38	1.76	1.34	.930	.920	1.30	1.71	1.35	.950	.960
Ni	.030	.720	.610	.840	.740	.700	.710	.650	.800	.650	.580	.610
Cu	.002	.039	.039	.058	.039	.039	.039	.058	.058	.039	.058	.039
Ca	12.2	5.30	5.00	2.90	5.60	11.3	12.7	12.3	3.80	4.90	9.50	10.3
P	2.49	.68	.68	.34	.60	1.78	1.89	1.87	.40	.71	1.65	1.30
Pb(ppm)	290	2100	2200	2300	2300	2200	2300	2100	2200	2200	1900	1700
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	227	980	870	1000	970	1000	1000	900	920	900	930	910
Sampled	Bulk	Young	Old	Young	Bulk	Young	Young	-	-	Young	Old	Old
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	017093	017095	017095	017096	017096	017097	017098	017098	017099	017099	017099	017099
Latitude	9.225	9.247	9.247	9.247	9.247	9.247	9.247	9.247	9.200	9.200	9.200	9.200
Longitude	-164.780	-164.846	-164.846	-164.846	-164.846	-164.846	-164.846	-164.846	-164.929	-164.929	-164.929	-164.929
Depth	1456	-	-	-	-	-	-	-	-	-	-	-
Lab#	CKB-77AM	CKB-79	CKB-80	CKB-81	CKB-82	CKB-83	CKB-84	CKB-85	CKB-86AM	CKB-87	CKB-88	CKB-89AM
Si(wt.%)	1.18	1.50	1.70	1.50	1.20	2.60	2.00	1.20	3.00	1.20	.90	1.20
Ti	1.08	1.24	1.23	1.25	1.04	1.11	1.55	.93	.47	1.14	.73	.89
Mn	29.8	31.8	27.0	32.1	26.4	33.1	32.9	26.3	11.7	34.1	27.6	27.9
Fe	11.3	14.3	13.1	14.8	11.7	13.1	15.6	11.9	5.40	11.7	9.90	12.9
Al	.30	.40	.45	.33	.28	.81	.44	.35	1.28	.28	.26	.29
Co	1.75	1.38	.870	1.40	.820	1.80	1.32	.670	.460	1.71	.700	1.43
Ni	.620	.720	.600	.660	.570	.770	.680	.630	.630	.780	.770	.550
Cu	.029	.043	.048	.039	.039	.048	.048	.048	.097	.048	.039	.019
Ca	.80	6.20	19.0	6.50	20.9	6.40	6.50	20.1	29.0	4.20	13.4	2.80
P	.49	.71	3.60	.64	3.92	.59	.70	3.77	7.44	.47	2.61	.50
Pb(ppm)	2100	2200	1900	2200	1800	2200	2300	1700	1000	2200	2000	2200
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	800	940	1000	880	950	910	1000	1000	920	940	1100	700
Sampled	Top	Young	Old	Young	Old	Top	Young	Old	-	Young	Old	Top
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	017101	017102	052002	052003	052004	052005	052005	052005	052005	052006	052006	052006
Latitude	9.716	9.223	18.699	18.699	18.699	18.643	18.643	18.643	18.643	18.643	18.643	18.643
Longitude	-162.167	-164.858	-158.380	-158.380	-158.380	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295	-158.295
Depth	1602	1420	3261	3261	3261	1924	1924	1924	1924	1924	1924	1924
Lab#	CKB-49	CKB-78	CKB-1	CKB-2	CKB-3	CKB-4AM	CKB-4G	CKB-5	CKB-6	CKB-7	CKB-8	CKB-8AM
Si(wt.%)	1.90	.90	6.90	6.70	10.6	6.90	7.50	5.30	6.00	5.80	6.60	6.60
Ti	1.06	1.04	1.67	1.86	2.51	1.57	1.52	1.36	1.12	1.07	1.44	.14
Mn	26.3	31.4	15.7	15.9	4.60	19.2	19.7	17.5	19.7	19.4	20.9	19.6
Fe	12.3	9.80	20.1	20.8	20.5	17.3	20.2	20.1	16.5	16.2	19.7	20.0
Al	.57	.28	1.63	1.60	2.38	1.88	1.86	.89	1.41	1.52	1.53	1.48
Co	1.24	1.46	.380	.360	.110	.660	.540	.470	.490	.480	.560	.550
Ni	.630	.810	.180	.160	.050	.350	.290	.180	.290	.290	.300	.270
Cu	.058	.048	.087	.087	.058	.107	.116	.048	.145	.136	.126	.107
Ca	11.9	3.70	1.45	1.90	.40	2.70	3.30	1.70	2.00	2.10	3.00	2.70
P	2.08	.36	.34	.39	.28	.48	.54	.44	.33	.38	.53	.54
Pb(ppm)	2100	2100	1600	1500	1100	1400	1500	1800	1200	1100	1400	1500
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	960	990	790	770	780	710	770	730	660	670	750	730
Sampled	Bulk	-	Bulk	Bulk	Bulk	Bulk	Bulk	Top	Bottom	Bulk	Top	Top
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	052006	052007	052007	052007	052008	052009	052010	052010	052011	052012	052015	052015
Latitude	18.643	18.643	18.643	18.643	18.643	18.637	18.637	18.637	18.637	18.637	18.683	18.683
Longitude	-158.295	-158.295	-158.295	-158.295	-158.295	-158.313	-158.313	-158.313	-158.313	-158.313	-158.314	-158.314
Depth	1924	1924	1924	1924	1924	2002	2002	2002	2002	2002	1047	1047
Lab#	CKB-9	CKB-10	CKB-10con	CKB-11	CKB-12	CKB-13	CKB-17	CKB-18	CKB-19	CKB-20	CKB-21	CKB-22
Si(wt.%)	5.70	10.6	10.6	4.90	6.20	4.70	4.60	4.70	5.40	4.30	2.70	4.00
Ti	.78	.90	.79	1.36	1.26	1.28	1.33	1.35	1.42	1.26	1.04	1.49
Mn	19.3	13.0	10.1	21.1	21.4	21.1	21.6	21.6	19.2	21.8	22.8	26.9
Fe	16.3	13.8	12.0	20.8	16.6	21.4	20.1	20.1	20.6	19.5	14.4	16.6
Al	1.73	3.54	3.51	.85	1.61	.85	.90	1.01	1.03	.80	.69	.96
Co	.360	.300	.230	.560	.520	.470	.530	.660	.500	.540	.530	.790
Ni	.400	.260	.200	.270	.350	.260	.270	.360	.240	.280	.440	.480
Cu	.252	.155	.136	.058	.165	.078	.097	.087	.058	.106	.116	.107
Ca	2.20	1.00	4.30	2.20	2.60	2.00	2.20	2.50	1.90	2.00	8.00	3.90
P	.40	.36	1.05	.45	.33	.41	.37	.53	.42	.37	1.39	.71
Pb(ppm)	850	1100	750	1600	1100	1500	1500	1800	1500	1400	1500	1700
Sr	-	-	-	-	-	-	-	-	-	-	-	-
Zn	750	670	610	800	780	850	780	790	810	750	810	870
Sampled	Bottom	Bulk	Bulk	Bulk	Top	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Young
Interval	-	-	-	-	-	-	-	-	-	-	-	-

Sequence#	052015	052016	052016	052016	052017	052017	052017	052023	053103	053103	053104	053104
Latitude	18.683	18.683	18.683	18.683	18.683	18.683	18.683	18.637	14.462	14.462	14.456	14.456
Longitude	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.314	-158.313	-169.017	-169.017	-169.003	-169.003
Depth	1047	1047	1047	1047	1047	1047	1047	2002	2110	2110	1770	1770
Lab#	CKB-23	CKB-24	CKB-25	CKB-26	CKB-27	CKB-28	CKB-29	CKB-16	CKB-141	CKB-142	CKB-149	CKB-150
Si(wt.%)	2.30	3.70	3.60	3.60	2.80	3.00	1.50	9.20	1.94	1.53	3.31	2.42
Ti	.89	1.30	1.20	.67	.98	1.11	.62	2.07	1.14	1.05	.88	1.12
Mn	21.5	24.7	25.4	16.9	22.4	24.9	19.4	25.9	26.8	23.7	22.2	23.8
Fe	12.0	15.2	19.2	10.7	13.9	15.0	10.8	24.1	14.1	11.1	14.0	12.5
Al	.65	.98	.82	1.12	.73	.74	.32	2.06	.70	.50	.90	.80
Co	.450	.720	.730	.320	.500	.620	.340	.580	1.09	.840	1.09	1.05
Ni	.470	.540	.490	.440	.410	.470	.270	.340	.570	.600	.460	.550
Cu	.184	.116	.116	.184	.126	.126	.107	.155	.057	.098	.026	.050
Ca	11.6	3.12	2.89	11.6	9.82	4.79	14.3	5.30	2.57	-	2.25	2.61
P	2.27	.54	.50	2.38	1.76	.84	2.66	.54	.37	.87	.30	.30
Pb(ppm)	1200	1600	1700	1300	1600	1500	1700	1700	1700	1300	1700	1600
Sr	-	-	-	-	-	-	-	-	1300	1400	1200	1200
Zn	870	920	830	810	750	790	650	920	710	820	620	720
Sampled	Old	Bulk	Young	Old	Bulk	Young	Old	Bulk	Young-Top	Old-Bottom	Young	Middle
Interval	-	-	-	-	-	-	-	-	0-20mm	0-20mm	0-10mm	0-10mm

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	053104	053109	053109	053109	053110	053110	053113	053116	053116	053116	053117	053117
Latitude	14.456	15.597	15.597	15.597	15.563	15.563	15.675	15.544	15.544	15.544	15.615	15.615
Longitude	-169.003	-169.232	-169.232	-169.232	-169.224	-169.224	-169.124	-169.238	-169.238	-169.238	-169.227	-169.227
Depth	1770	1630	1630	1630	1651	1651	3443	1769	1769	1769	1498	1498
Lab#	CKB-151	CKB-206	CKB-207	CKB-208	CKB-211	CKB-212	CKB-213	CKB-214	CKB-214	CKB-215	CKB-224	CKB-225
Si(wt.%)	1.88	1.95	.30	.74	2.09	2.65	4.12	3.30	3.44	3.24	3.17	.96
Ti	1.16	1.01	.42	.74	.87	.64	1.44	1.25	1.17	1.18	1.03	.94
Mn	25.3	27.4	20.1	24.6	28.3	15.1	21.1	29.9	29.9	23.2	38.3	32.6
Fe	11.3	15.1	5.56	8.75	12.4	9.96	18.9	17.4	17.5	14.4	21.0	13.2
Al	.80	.60	.30	.10	.73	.35	.99	.90	.97	.65	1.17	.35
Co	.940	1.28	.480	.890	1.25	.360	1.10	1.22	1.22	.770	1.49	.980
Ni	.670	.530	.820	.960	.680	.410	.380	.570	.600	.740	.840	.990
Cu	.082	.024	.045	.119	.162	.145	.058	.056	.056	.126	.090	.138
Ca	2.77	2.82	12.8	7.48	3.20	10.4	2.47	3.75	3.44	5.97	3.18	8.62
P	.30	.40	3.93	1.74	.41	2.82	.35	.50	.57	1.60	.42	2.13
Pb(ppm)	1400	1900	1300	1500	1800	1400	1500	1700	1700	1300	1900	1400
Sr	1300	1300	1400	1200	1200	1500	1200	1200	1200	1300	1300	1400
Zn	820	640	1000	990	800	800	660	670	640	790	810	1000
Sampled	Old	Young-Top	Old-Top	Bottom	Young	Old	Bulk	Top	Top	Bottom	Young	Old
Interval	0-10mm	0-20mm	20-30mm	5mm	0-5mm	5-15mm	0-15mm	15mm	15mm	15mm	10mm	20mm

Sequence#	053118	053118	053119	053119	053128	053128	053128	053128	053128	053128	053129	053129
Latitude	15.584	15.584	15.628	15.628	14.462	14.462	14.462	14.462	14.462	14.462	14.456	14.456
Longitude	-169.205	-169.205	-169.239	-169.239	-169.017	-169.017	-169.017	-169.017	-169.017	-169.017	-169.003	-169.003
Depth	1605	1605	1552	1552	2110	2110	2110	2110	2110	2110	1770	1770
Lab#	CKB-228	CKB-229	CKB-230	CKB-231	CKB-143	CKB-144	CKB-145	CKB-146	CKB-147	CKB-148	CKB-152	CKB-153
Si(wt.%)	3.01	1.34	2.15	.28	3.30	3.35	2.77	2.00	1.74	.98	2.42	2.15
Ti	1.01	.65	.97	.63	.93	1.05	1.14	1.02	1.10	.54	.94	.67
Mn	36.0	21.8	37.0	30.5	23.8	23.4	23.4	24.3	25.0	11.0	25.1	19.3
Fe	20.5	13.7	19.8	10.5	15.1	14.5	13.7	12.1	11.6	6.76	11.4	7.81
Al	1.03	.30	.97	.30	.90	1.10	1.00	.80	.80	.50	1.10	.70
Co	1.47	.450	1.56	.810	1.03	.890	.700	1.04	.880	.320	1.03	.510
Ni	.690	.530	.740	1.040	.480	.560	.560	.560	.630	.380	.750	1.060
Cu	.042	.099	.042	.110	.046	.078	.133	.055	.089	.100	.110	.248
Ca	3.25	14.3	3.29	11.4	2.32	2.57	2.84	2.74	2.75	11.3	2.67	5.79
P	.47	4.74	.46	3.72	.36	.12	.13	.31	.34	4.00	.40	1.73
Pb(ppm)	2000	1600	1900	1300	1600	1500	-	1600	1500	1200	1700	1400
Sr	1300	1700	1300	1400	1200	1300	1400	1200	1300	1600	1200	1100
Zn	670	810	700	980	670	740	800	700	790	680	850	1800
Sampled	Young	Old	Young-Top	Old-Bottom	Top	Young-Top	Young-Bottom	Old	Young	Old	Old	Bottom
Interval	25mm	20mm	20mm	30mm	10mm	15mm	15mm	20mm	10mm	10mm	10mm	10mm

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	053130	053130	053131	053131	053131	053131	053131	053132	053132	053132	053133	053133
Latitude	15.597	15.597	15.544	15.544	15.544	15.544	15.544	15.544	15.544	15.544	15.615	15.615
Longitude	-169.232	-169.232	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.238	-169.227	-169.227
Depth	1630	1630	1769	1769	1769	1769	1769	1769	1769	1769	1498	1498
Lab#	CKB-209	CKB-210	CKB-216	CKB-217	CKB-218	CKB-219	CKB-220	CKB-221	CKB-222	CKB-223	CKB-226	CKB-227
Si(wt.%)	2.50	.58	3.03	3.30	.98	1.25	3.06	3.82	2.79	1.13	2.36	.30
Ti	1.17	.56	1.04	1.21	.76	.46	.99	1.03	1.20	.65	1.18	.46
Mn	28.2	17.4	30.6	34.5	31.7	21.1	33.7	36.3	38.2	29.8	37.4	26.1
Fe	13.6	6.61	18.4	20.7	13.9	12.9	17.0	22.3	20.9	14.1	17.0	8.77
Al	.75	.30	.85	1.08	.30	.20	1.23	1.09	1.09	.30	1.12	.20
Co	1.28	.490	1.29	1.36	.790	.330	1.07	1.64	1.41	.720	1.59	.700
Ni	.640	.740	.590	.770	1.020	.600	1.350	.600	.800	.910	.910	1.140
Cu	.055	.103	.042	.097	.136	.100	.313	.031	.069	.107	.076	.120
Ca	2.91	12.5	3.32	3.84	10.7	16.3	6.03	3.63	3.57	11.9	3.29	14.6
P	.36	3.84	.58	.41	3.28	6.05	1.66	.51	.48	3.95	.34	5.16
Pb(ppm)	1800	1200	1800	1700	1300	1300	1500	2000	1900	1400	1900	1100
Sr	1300	1500	1200	1300	1400	1600	1100	1300	1300	1500	1200	1400
Zn	750	870	610	810	1000	880	1300	690	810	940	880	1100
Sampled	Young	Old	Young-Top	Top-Middle	Old-Top	Old-Bottom	Young-Bottom	Young	Middle	Old	Young-Top	Old-Top
Interval	15mm	15mm	-	-	10mm	10mm	10mm	15mm	15mm	40mm	20mm	30mm

Sequence#	053135	053135	053135	053135	053136	053136	053136	053137	053137	054019	054021	054021
Latitude	15.628	15.628	15.628	15.628	15.628	15.628	15.628	15.628	15.628	15.696	15.683	15.683
Longitude	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-169.239	-170.344	-170.359	-170.359
Depth	1552	1552	1552	1552	1552	1552	1552	1552	1552	2260	1628	1628
Lab#	CKB-232	CKB-233	CKB-234	CKB-235	CKB-236	CKB-236	CKB-237	CKB-239	CKB-240	CKB-154	CKB-157	CKB-158
Si(wt.%)	2.88	.21	1.99	.45	2.31	2.33	.43	2.67	1.71	4.39	2.33	2.14
Ti	1.13	.48	1.16	.44	1.01	1.03	.67	1.05	.98	1.11	.97	1.10
Mn	37.2	24.0	37.4	22.1	36.2	36.7	29.2	36.7	32.9	21.8	25.5	27.6
Fe	19.4	10.1	17.2	10.3	19.6	19.2	10.9	19.6	15.4	14.7	12.2	14.7
Al	1.10	.35	1.19	.30	1.20	1.09	.35	1.00	.15	1.02	.56	.96
Co	1.35	.460	1.31	.420	1.53	1.53	.760	1.44	.840	.870	.800	1.07
Ni	.830	.800	.930	.760	.800	.800	1.000	.700	.900	.500	.690	.590
Cu	.078	.087	.144	.107	.064	.065	.115	.045	.117	.067	.088	.051
Ca	3.51	15.4	3.42	15.0	3.43	3.31	12.5	3.28	7.64	2.43	4.93	2.72
P	.47	5.05	.38	5.53	.48	.43	3.70	.42	2.10	.35	1.17	.37
Pb(ppm)	1900	1400	1800	1200	1900	1900	1200	1900	1300	1600	1600	1700
Sr	1300	1500	1300	1500	1300	1300	1400	1300	1400	1200	1300	1300
Zn	820	940	920	930	750	750	1000	710	900	680	820	730
Sampled	Young-Top	Old-Top	Young-Bottom	Old-Bottom	Young-Top	Young-Top	Old-Bottom	Young	Old	Bulk	Top	Middle
Interval	10mm	10mm	7mm	7mm	15mm	15mm	25mm	15mm	15mm	10mm	10mm	10mm

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	054021	054022	054022	054022	054023	054023	054023	054024	054024	054025	054025	054025
Latitude	15.683	15.649	15.649	15.649	15.671	15.671	15.671	15.664	15.664	15.673	15.673	15.673
Longitude	-170.359	-170.413	-170.413	-170.413	-170.413	-170.413	-170.413	-170.397	-170.397	-170.381	-170.381	-170.381
Depth	1628	2180	2180	2180	1815	1815	1815	1433	1433	1117	1117	1117
Lab#	CKB-159	CKB-163	CKB-164	CKB-165	CKB-171	CKB-171	CKB-172	CKB-180	CKB-181	CKB-184	CKB-185	CKB-185
Si(wt.%)	.50	4.60	5.72	1.36	3.49	3.50	3.28	2.20	<.50	1.15	.50	.60
Ti	.47	1.09	1.22	.67	.95	.98	1.24	.87	.33	.78	.43	.41
Mn	16.3	23.8	23.0	19.7	26.5	27.3	27.0	28.8	15.5	29.9	16.8	17.5
Fe	7.52	17.4	16.9	10.2	15.7	16.1	14.2	14.0	5.67	10.3	6.51	6.50
Al	<.50	1.07	1.60	.50	1.03	1.02	1.12	.66	<.30	.70	<.30	<.30
Co	.330	1.07	.970	.600	1.07	1.12	.810	1.22	.440	1.15	.360	.370
Ni	.560	.420	.530	.650	.540	.560	.680	.650	.600	.760	.540	.550
Cu	.040	.047	.098	.137	.034	.034	.104	.040	.050	.066	.022	.023
Ca	12.7	2.88	2.46	9.28	2.60	2.71	3.62	4.23	16.0	4.10	13.9	14.2
P	4.28	.38	.32	2.97	.37	.40	.63	.92	6.01	.61	5.13	4.84
Pb(ppm)	1300	1600	1500	1000	1700	1800	1500	1800	1300	1700	1700	1700
Sr	1500	1300	1200	1400	1300	1300	1300	1300	1700	1200	1500	1600
Zn	830	650	760	780	660	680	860	700	810	770	690	720
Sampled	Bottom	Top	Middle	Bottom	Top	Top	Bottom	Top	Bottom	Young-Top	Old-Top	Old-Top
Interval	10mm	10mm	10mm	10mm	20mm	20mm	20mm	25mm	25mm	15mm	15mm	15mm

Sequence#	054025	054031	054032	054032	054032	054033	054033	054034	054034	054034	054036	054036
Latitude	15.673	15.631	15.637	15.637	15.637	15.658	15.658	15.665	15.665	15.665	15.696	15.696
Longitude	-170.381	-170.402	-170.406	-170.406	-170.406	-170.385	-170.385	-170.386	-170.386	-170.386	-170.344	-170.344
Depth	1117	2200	1770	1770	1770	1186	1186	1520	1520	1520	2260	2260
Lab#	CKB-186	CKB-187	CKB-188	CKB-189	CKB-190	CKB-194	CKB-195	CKB-198	CKB-199	CKB-200	CKB-155	CKB-156
Si(wt.%)	1.04	3.19	4.77	4.00	2.22	.78	.30	.95	.31	.20	3.23	3.89
Ti	.78	1.24	1.02	1.24	1.25	.89	.49	.79	.67	.11	1.11	1.16
Mn	30.9	28.3	26.1	28.4	30.0	32.9	23.4	33.3	25.9	4.64	24.7	24.9
Fe	13.4	16.3	18.0	17.5	14.3	12.9	7.73	16.2	10.7	.55	15.6	15.4
Al	1.06	.95	1.06	1.03	.91	.85	.30	.68	.30	<.30	.83	1.12
Co	1.44	1.000	1.14	.970	.910	1.45	.520	1.66	.880	.060	1.14	1.03
Ni	.700	.580	.450	.620	.720	.760	.770	.620	.710	.410	.480	.580
Cu	.039	.078	.028	.091	.158	.034	.029	.022	.052	.045	.042	.087
Ca	3.18	3.13	2.79	2.80	3.83	2.89	10.7	3.09	8.98	20.6	2.99	2.66
P	.56	.34	.40	.39	.63	.36	3.50	.47	2.71	8.54	.40	.34
Pb(ppm)	1900	1500	1700	1500	1300	1900	1900	1900	1700	5100	1600	1500
Sr	1300	1300	1300	1300	1400	1200	1400	1300	1300	2100	1300	1200
Zn	680	750	610	690	830	680	840	570	740	790	650	720
Sampled	Young-Bottom	Bulk	Top	Middle	Bottom	Top	Bottom	Young	Old	Old	Young-Top	Bottom
Interval	8mm	25mm	10mm	10mm	-	20mm	20mm	-	-	-	10mm	10mm

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	054037	054037	054037	054038	054038	054038	054038	054038	054039	054039	054040	054040
Latitude	15.683	15.683	15.683	15.649	15.649	15.649	15.649	15.649	15.671	15.671	15.671	15.671
Longitude	-170.359	-170.359	-170.359	-170.413	-170.413	-170.413	-170.413	-170.413	-170.413	-170.413	-170.413	-170.413
Depth	1628	1628	1628	2180	2180	2180	2180	2180	1815	1815	1815	1815
Lab#	CKB-160	CKB-161	CKB-162	CKB-166	CKB-167	CKB-168	CKB-169	CKB-170	CKB-173	CKB-174	CKB-175	CKB-176
Si(wt.%)	3.62	2.36	1.65	3.68	3.36	2.13	1.72	.60	2.89	2.84	3.54	3.03
Ti	1.03	.92	.43	1.08	1.25	1.09	.59	.50	1.07	.95	.94	1.13
Mn	26.0	27.5	13.2	24.6	25.2	25.3	14.4	16.3	27.0	22.3	27.6	27.7
Fe	14.7	16.0	7.77	16.9	15.7	12.5	10.7	8.19	14.7	11.4	16.0	14.7
Al	1.15	.96	.50	.97	.99	.48	<.50	<.30	1.09	.34	.82	.95
Co	1.15	1.29	.500	1.11	.970	.710	.330	.430	.990	.670	1.10	.830
Ni	.640	.540	.670	.420	.520	.640	.380	.340	.650	.700	.570	.740
Cu	.075	.028	.117	.031	.067	.114	.099	.142	.080	.170	.041	.109
Ca	2.54	2.88	11.4	2.46	2.82	6.06	11.8	13.0	2.75	6.71	2.60	3.13
P	.37	.54	4.33	.41	.30	1.33	4.23	4.40	.37	1.62	.31	.47
Pb(ppm)	1800	1900	1200	1800	1500	1200	1100	1500	1600	1300	1700	1400
Sr	1200	1300	1500	1400	1300	1400	1600	1600	1200	1300	1200	1200
Zn	760	650	860	640	720	840	700	690	760	930	700	850
Sampled	Young-Top	Old-Top	Bottom	-	-	-	-	-	Top	Bottom	Top	Bottom
Interval	20mm	20mm	10mm	-	-	-	-	-	20mm	20mm	20mm	10mm

Sequence#	054041	054041	054041	054042	054042	054043	054043	054043	054044	054044	054045	054045
Latitude	15.671	15.671	15.671	15.664	15.664	15.637	15.637	15.637	15.658	15.658	15.665	15.665
Longitude	-170.413	-170.413	-170.413	-170.397	-170.397	-170.406	-170.406	-170.406	-170.385	-170.385	-170.386	-170.386
Depth	1815	1815	1815	1433	1433	1770	1770	1770	1186	1186	1520	1520
Lab#	CKB-177	CKB-178	CKB-179	CKB-182	CKB-183	CKB-191	CKB-192	CKB-193	CKB-196	CKB-197	CKB-201	CKB-202
Si(wt.%)	3.49	3.24	1.25	.20	.50	3.68	.77	1.15	1.97	3.12	.74	.20
Ti	1.00	1.06	.79	.35	.44	1.14	.65	.51	.94	1.19	.95	.65
Mn	27.5	27.7	23.4	9.76	19.2	28.7	21.8	15.8	30.9	29.6	29.0	25.5
Fe	16.4	16.1	11.5	5.08	7.61	16.2	9.03	9.16	15.0	15.0	12.0	6.16
Al	1.13	.87	.30	<.30	<.30	1.04	.30	.30	.75	.89	.58	.35
Co	1.15	.940	.550	.220	.410	1.10	.540	.290	1.29	1.09	1.31	.880
Ni	.550	.600	.640	.440	.600	.640	.810	.450	.620	.630	.640	.970
Cu	.034	.065	.101	.050	.034	.060	.103	.073	.086	.078	.043	.066
Ca	2.93	2.87	8.58	17.2	13.1	2.75	10.1	12.6	3.27	3.24	3.38	8.64
P	.49	.38	2.25	5.57	4.55	.32	3.02	3.42	.30	.36	.33	2.27
Pb(ppm)	1800	1600	1300	1200	1500	1700	1100	1100	1800	1800	1800	1400
Sr	1300	1300	1500	1800	1500	1200	1400	1600	1300	1300	1300	1300
Zn	700	730	830	790	850	740	920	700	7000	7000	700	1000
Sampled	Top	Middle	Bottom	-	Old	Top	Middle	Bottom	Top	Bottom	Top	Bottom
Interval	10mm	10mm	30mm	-	-	15mm	10mm	20mm	15mm	15mm	20mm	-

Table 5a. Composition of ferromanganese crusts analyzed onboard R/V Sonne Midpac2a and Midpac2b by XRF(cont'd).

Sequence#	054046	054046	054046	090011	090011	090011	090012	090012	090012	090013	090014	090015
Latitude	15.665	15.665	15.665	20.133	20.133	20.133	20.133	20.133	20.133	20.222	20.222	20.218
Longitude	-170.386	-170.386	-170.386	-170.681	-170.681	-170.681	-170.681	-170.681	-170.681	-170.600	-170.600	-170.589
Depth	1520	1520	1520	1476	1476	1476	1476	1476	1476	-	-	1480
Lab#	CKB-203	CKB-204	CKB-205	CKB-124	CKB-125	CKB-126	CKB-127	CKB-128	CKB-129	CKB-130	CKB-131	CKB-132
Si(wt.%)	1.50	.30	1.57	3.10	2.20	1.40	4.20	1.50	5.10	5.90	5.60	8.10
Ti	.84	.49	.80	1.08	1.31	.71	1.14	.94	1.62	1.46	1.58	.99
Mn	29.8	21.5	28.4	26.7	28.9	22.8	24.8	26.6	27.0	24.3	24.4	23.1
Fe	10.2	5.59	11.3	18.3	14.8	8.00	18.4	9.30	18.8	19.5	20.7	19.5
Al	.83	.30	.76	.51	.42	.39	.76	.42	1.86	1.28	1.05	1.86
Co	1.10	.590	1.22	1.07	.980	.410	1.01	.580	.970	.750	.760	.760
Ni	1.010	.880	.850	.440	.640	.790	.390	.740	.470	.470	.370	.360
Cu	.124	.062	.102	.029	.058	.087	.029	.136	.058	.194	.058	.048
Ca	3.39	11.1	2.77	3.40	3.40	20.3	3.20	21.4	3.90	4.00	3.60	4.40
P	.58	3.23	.38	.68	.49	4.58	.64	4.47	.63	.35	.60	.81
Pb(ppm)	1600	1500	1600	2500	2200	1500	2400	1800	2100	2100	2100	2100
Sr	1100	1400	1100	-	-	-	-	-	-	-	-	-
Zn	1000	990	780	670	880	1000	620	1200	760	910	780	680
Sampled	Young-Top	Old-Top	Old-Bottom	Young	Middle	Old	Young	Old	Middle	-	-	Bulk
Interval	10mm	20mm	10mm	-	-	-	-	-	-	-	-	-

Sequence#	090016	317010	317010	317010	317011	317011
Latitude	20.218	-.388	-.388	-.388	-.399	-.399
Longitude	-170.589	-176.073	-176.073	-176.073	-176.116	-176.116
Depth	1480	2107	2107	2107	1551	1551
Lab#	CKB-133	CKB-136	CKB-137	CKB-138	CKB-139	CKB-140
Si(wt.%)	5.10	3.51	4.10	2.73	2.93	.69
Ti	1.62	1.43	1.67	1.32	.89	.65
Mn	26.6	28.2	26.0	31.7	32.1	24.7
Fe	19.7	20.0	19.7	19.8	19.4	10.2
Al	.89	1.00	1.30	.80	1.00	-
Co	1.06	1.06	1.000	1.28	.780	.730
Ni	.410	.540	.470	.650	.880	.700
Cu	.038	.088	.111	.078	.074	.062
Ca	4.00	3.32	4.32	3.22	3.87	11.7
P	.76	.58	.63	.41	.83	4.03
Pb(ppm)	2400	1500	1300	1600	1500	1300
Sr	-	1400	1400	1300	1400	1600
Zn	640	830	900	840	870	930
Sampled	Young	Bulk	Bottom	Top	Young	Old
Interval	-	30mm	10mm	15mm	20mm	20mm

Table 6. Composition of ferromanganese crusts analyzed by Japanese - (unpublished data).

Sequence#	094007	094008	094008	094009	094009	094009	094010	094011	094012	094013	094013	094013
Latitude	26.430	25.987	25.987	26.166	26.166	26.166	26.164	26.081	25.934	25.314	25.314	25.314
Longitude	144.280	143.499	143.499	144.252	144.252	144.252	144.182	144.352	144.275	143.913	143.913	143.913
Depth	2780	2390	2390	905	905	905	790	955	1870	1515	1515	1515
Lab#	D845-6	D849-10C	D849-10N	D851-14	D851-15	D851-18	D853-12	D854-14	D856-4	D858-1A	D858-1B	D858-1C
Si(wt.%)	5.03	5.72	2.57	1.21	.61	2.46	1.71	3.99	8.17	2.80	2.72	.95
Mn	18.1	17.4	21.4	11.5	32.1	24.7	12.9	23.0	14.4	21.7	24.9	24.2
Fe	18.6	17.3	11.4	7.42	7.30	16.4	5.48	10.2	19.4	18.9	14.5	7.88
Al	1.27	1.50	1.05	.65	.36	.75	1.44	1.90	1.86	.98	.85	.35
Co	.530	.570	.560	.740	.850	1.11	.300	.600	.340	.810	.580	.460
Ni	.260	.310	.570	.270	1.050	.370	.480	.600	.170	.310	.480	.800
Cu	.065	.041	.100	.097	.264	.060	.059	.081	.038	.041	.057	.097
H2O+	8.7	8.8	8.1	5.2	9.1	10.5	6.1	9.3	8.8	10.5	9.9	7.6
Pb(ppm)	1500	1600	2800	2200	3000	2600	200	1700	1800	2600	2200	1500
Zn	610	520	870	580	1200	490	1300	840	520	560	600	780
Sampled	Bulk	Bulk	Nodule	Young-Nodule	Young-Nodule	Bulk	Bulk	Bulk	Bulk	Top	Middle	Bottom
Interval	8.0	6.0	6.0	35.0	17.0	10.0	20.0	20.0	6.0	15.0	30.0	30.0

Sequence#	094014	094014	094015	094016	094016	094017	094017	094018	094019	094020	094021	094022
Latitude	25.223	25.223	25.272	26.172	26.172	26.250	26.250	26.902	25.846	25.751	25.797	25.793
Longitude	143.928	143.928	144.082	145.168	145.168	145.154	145.154	145.507	147.798	147.992	146.747	146.783
Depth	1560	1560	2500	1250	1250	1100	1100	1250	1410	1375	1470	1395
Lab#	D859-11A	D859-11B	D862-1	D866-1A	D866-1B	D867-1	D867-3	D869-2	D879-9	D881-1	D883-1	D884-1
Si(wt.%)	2.54	4.32	5.66	11.4	5.82	4.16	.70	4.29	7.55	4.09	1.29	5.13
Mn	20.6	22.9	15.9	12.4	19.1	21.4	27.6	23.3	15.1	22.5	24.8	21.5
Fe	10.9	13.8	19.5	15.9	16.4	18.2	5.98	14.0	17.6	17.1	4.77	15.2
Al	.67	1.52	1.53	4.79	2.16	1.05	.31	1.45	2.38	.85	.68	1.75
Co	.380	.720	.330	.210	.400	.560	.630	.530	.730	.760	.500	.670
Ni	.500	.550	.260	.370	.390	.280	.840	.770	.280	.370	1.060	.330
Cu	.130	.081	.073	.092	.074	.046	.082	.070	.086	.048	.151	.078
H2O+	7.5	9.8	10.1	6.7	11.1	11.9	9.2	11.3	9.4	11.6	9.0	11.1
Pb(ppm)	1400	1800	1500	300	1800	2200	1700	1600	2000	2300	1600	1800
Zn	630	630	620	700	600	480	780	810	560	470	1300	600
Sampled	Bulk	Bulk	Bulk	Top	Bottom	Bulk	Bulk	Nodule	Bulk	Bulk	Bulk	Bulk
Interval	50.0	20.0	20.0	20.0	30.0	20.0	40.0	15.0	30.0	20.0	12.0	8.0

Table 7. Composition of ferromanganese crusts analyzed by Analytical Services Company

Sequence#	052019	052020	052021	052022	088011	088012	088013	088014	088015	088016	088017	088018
Latitude	19.481	19.236	19.408	19.408	25.946	25.944	25.951	25.944	25.944	25.944	25.946	25.951
Longitude	-157.054	-157.172	-157.080	-157.080	-159.903	-159.878	-159.914	-159.878	-159.878	-159.878	-159.903	-159.914
Depth	2750	3000	3050	3050	3000	2600	3600	2600	2600	2600	3000	3600
Lab#	109	306	309	311	8	102	106	201	203	213	215	218
Mn(wt.%)	19.6	16.0	19.6	15.1	15.1	20.0	16.7	22.2	22.9	15.9	23.3	18.1
Fe	20.2	22.6	20.0	15.2	18.0	21.4	20.5	18.4	17.4	20.0	18.0	19.5
Al	1.20	2.01	1.34	3.60	3.10	1.06	1.91	.87	.97	1.50	1.00	1.62
Co	.797	.123	.439	.338	.327	.536	.451	.819	.913	.443	.881	.667
Ni	.255	.309	.336	.284	.247	.292	.195	.369	.403	.192	.400	.247
Cu	.056	.245	.131	.158	.148	.093	.092	.058	.093	.064	.081	.129
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	7-11mm	70-80mm	25-35mm	10-20mm	10-25mm	2-4mm	-	4-6mm	6-8mm	5-8mm	7-10mm	7-25mm

Sequence#	089038	089039	089040	089041	089042	089043	089044	089045	089046	089047	089048	089049
Latitude	24.322	25.783	25.929	23.672	25.685	25.135	25.276	25.728	25.260	25.783	25.454	25.489
Longitude	-168.083	-167.733	-167.755	-164.891	-160.180	-160.027	-162.068	-160.201	-162.046	-167.733	-168.683	-168.672
Depth	1225	1600	2500	1650	3000	2800	3000	2600	2300	1600	1115	1200
Lab#	11	42	52	1	2	3	4	5	6	41	56	57
Mn(wt.%)	2.57	42.2	22.2	20.8	15.6	20.1	22.8	25.6	22.6	38.3	23.7	25.7
Fe	17.2	1.82	19.3	19.6	17.6	19.7	17.9	17.2	18.5	4.48	14.5	15.0
Al	6.24	1.44	.62	1.07	2.58	1.16	.99	.56	1.00	1.70	3.10	1.27
Co	.136	.072	.824	.686	.400	.679	.893	.926	.762	.153	1.23	1.68
Ni	.133	.367	.311	.314	.295	.292	.417	.425	.381	.342	.344	.426
Cu	.026	.114	.046	.069	.214	.054	.096	.021	.080	.144	.061	.036
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	-	75-85mm	10-15mm	4-6mm	2-3mm	15-18mm	5-8mm	-	5-7mm	75-85mm	8-10mm	2-22mm

Sequence#	089050	089051	089052	089053	089054	089055	089056	089057	089058	089059	089060	089061
Latitude	25.783	25.783	24.322	25.489	25.489	25.454	24.322	23.988	25.489	25.489	25.135	23.915
Longitude	-167.733	-167.733	-168.083	-168.672	-168.672	-168.683	-168.083	-164.485	-168.672	-168.672	-162.027	-164.408
Depth	1600	1600	1225	1200	1200	1115	1225	2100	1200	1200	2800	800
Lab#	58	60	63	65	66	67	68	7	71	72	9	10
Mn(wt.%)	37.6	43.0	2.65	23.1	3.53	23.6	19.4	18.8	22.2	15.3	4.50	19.0
Fe	3.37	2.44	20.0	17.7	9.76	17.1	18.2	16.5	16.9	17.4	16.9	18.8
Al	1.96	1.36	5.64	.98	4.41	1.59	1.75	2.46	1.92	3.45	3.95	1.96
Co	.109	.096	.079	1.18	.139	1.19	1.04	.460	.774	.740	.113	.595
Ni	.286	.327	.081	.314	.153	.346	.263	.431	.517	.244	.140	.307
Cu	.142	.099	.008	.032	.033	.046	.040	.155	.062	.037	.043	.106
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	75-85mm	75-85mm	0-1mm	3-18mm	1-2mm	10-15mm	1-10mm	10-15mm	15-20mm	1-5mm	2-6mm	3-12mm

Sequence#	089062	089063	089064	089065	089066	089067	089068	089069	089070	089071	089072	089073
Latitude	25.929	25.926	25.926	25.783	25.783	24.322	24.322	25.489	25.489	25.685	23.961	23.956
Longitude	-167.755	-167.710	-167.710	-167.733	-167.733	-168.083	-168.083	-168.672	-168.672	-160.180	-164.276	-164.414
Depth	2500	3250	3250	1600	1600	1225	1225	1200	1200	3000	2650	1300
Lab#	51	53	54	55	59	61	62	64	73	101	103	104
Mn(wt.%)	22.0	13.4	3.29	21.0	40.3	6.46	3.34	22.1	23.5	25.2	14.7	20.6
Fe	19.3	15.9	10.7	17.5	2.15	15.8	17.5	17.5	15.8	18.1	13.4	19.9
Al	.69	3.18	6.55	1.38	1.50	4.72	6.69	1.56	1.59	.55	3.87	1.03
Co	.803	.361	.085	.088	.111	.253	.178	1.22	1.39	1.30	.332	.841
Ni	.326	.208	.078	.475	.296	.145	.305	.330	.395	.434	.486	.334
Cu	.043	.154	.052	.074	.121	.025	.034	.048	.032	.049	.260	.052
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	10-25mm	4-8mm	3-5mm	1-9mm	75-85mm	1-3mm	3-4mm	15-29mm	4-20mm	1-2mm	12-14mm	5-9mm

Table 7. Composition of ferromanganese crusts analyzed by Analytical Services Company (cont'd).

Sequence#	089074	089075	089076	089077	089078	089079	089080	089081	089082	089083	089084	089085
Latitude	25.260	25.094	25.094	25.260	25.260	25.276	25.980	25.980	25.980	25.980	25.980	25.276
Longitude	-162.046	-161.728	-161.728	-162.046	-162.046	-162.068	-164.379	-164.379	-164.379	-164.379	-164.379	-162.068
Depth	2300	2800	2800	2300	2300	3000	1800	1800	1800	1800	1800	3000
Lab#	105	107	108	202	204	205	206	207	208	209	210	211
Mn(wt.%)	14.6	18.5	22.4	23.8	20.5	22.2	19.6	19.5	18.0	22.0	20.9	19.4
Fe	19.5	17.1	19.8	17.7	20.6	18.1	20.5	21.3	20.9	20.0	19.4	19.9
Al	3.32	2.32	.72	.71	.83	.88	1.25	1.43	1.55	.84	1.41	1.48
Co	.599	.738	.732	1.03	.540	.726	.717	.594	.575	.723	.651	.564
Ni	.248	.310	.329	.403	.290	.442	.278	.237	.223	.312	.434	.308
Cu	.043	.087	.041	.061	.072	.176	.029	.040	.037	.320	.054	.103
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	20-25mm	4-8mm	10-15mm	38-45mm	50-60mm	25-60mm	35-40mm	30-35mm	30-35mm	35-40mm	14-18mm	3-6mm

Sequence#	089086	089087	089088	089089	089090	089091	089092	089093	089094	089095	089096	089097
Latitude	23.672	23.672	25.260	25.135	25.276	23.672	25.276	25.260	25.303	25.276	25.303	23.979
Longitude	-164.891	-164.891	-162.046	-162.027	-162.068	-164.891	-162.068	-162.046	-162.094	-162.068	-162.094	-164.363
Depth	1650	1650	2300	2800	3000	1650	3000	2300	3500	3000	3500	2200
Lab#	212	214	216	217	219	220	221	222	223	224	225	308
Mn(wt.%)	14.9	15.8	21.9	21.6	20.7	17.2	21.4	19.9	17.8	17.4	17.6	15.0
Fe	20.1	21.0	21.3	19.1	20.4	20.1	21.6	18.9	19.4	18.5	18.5	15.7
Al	1.95	2.19	.69	1.31	1.20	2.30	.93	1.89	1.77	1.40	1.92	2.69
Co	.448	.424	.647	.827	.554	.593	.514	.621	.302	.452	.563	.667
Ni	.191	.238	.304	.328	.333	.246	.277	.344	.311	.254	.225	.327
Cu	.038	.044	.058	.079	.124	.043	.058	.094	.139	.089	.053	.065
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	6-8mm	7-10mm	25-30mm	2-3mm	7-13mm	6-10mm	13-25mm	5-8mm	2-4mm	10-15mm	5-8mm	2-5mm

Sequence#	089098	089099	089100	090018	090019	090020	090021	090022	090023	090024	090025	090027
Latitude	23.979	25.135	25.094	28.895	28.895	29.106	29.167	29.106	29.167	29.208	28.895	29.167
Longitude	-164.363	-162.010	-161.728	-178.868	-178.868	-173.948	-174.067	-173.948	-174.067	-174.112	-178.868	-174.067
Depth	2200	2175	2800	1280	1280	1850	1425	1850	1425	2200	1280	1425
Lab#	310	312	315	27	28	30	31	33	34	36	16	37
Mn(wt.%)	15.7	24.5	16.8	23.8	17.5	23.0	27.8	24.5	24.2	21.5	27.1	19.0
Fe	19.1	16.4	18.0	5.36	6.08	15.4	16.0	15.9	14.4	15.9	12.8	18.9
Al	2.34	1.06	2.00	3.84	4.45	.61	.52	.54	.80	1.24	.99	1.11
Co	.389	.838	.538	.598	.436	.711	.889	.925	.677	.851	1.16	.787
Ni	.324	.470	.245	.420	.225	.398	.451	.417	.558	.419	.540	.296
Cu	.090	.060	.098	.043	.027	.058	.038	.044	.064	.127	.035	.070
Sampled	Bulk	Nodule	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	3-6mm	-	1-5mm	3-5mm	1-3mm	10-20mm	14-40mm	25-33mm	15-20mm	15-20mm	1-2mm	10-25mm

Sequence#	090028	090029	090030	090031	090032	090033	090034	090035	090036	090026	090038	090039
Latitude	29.167	29.167	29.185	29.208	29.167	29.062	29.208	28.895	28.881	28.895	28.895	28.739
Longitude	-174.067	-174.067	-174.010	-174.112	-174.067	-174.022	-174.112	-178.868	-179.745	-178.868	-178.868	-178.783
Depth	1425	1425	985	2200	1425	1150	2200	1280	2000	1280	1280	3000
Lab#	39	40	44	46	47	50	49	14	22	23	29	32
Mn(wt.%)	27.5	25.9	29.8	22.3	25.8	27.2	18.8	31.1	27.5	28.4	29.0	19.0
Fe	14.9	15.3	13.4	17.3	16.0	15.6	15.7	12.6	12.6	16.0	10.5	19.1
Al	.63	.48	.63	1.18	.55	.64	2.14	.26	1.33	.73	.57	.70
Co	.902	.986	1.66	.756	.904	.779	.563	1.43	.778	1.32	1.61	.576
Ni	.556	.493	.685	.379	.424	.379	.381	.642	.959	.546	.690	.271
Cu	.053	.035	.052	.121	.037	.043	.134	.037	.197	.047	.041	.042
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	25-35mm	15-20mm	-	15-25mm	4-12mm	90-110mm	20-25mm	10-12mm	1-3mm	-	1-9mm	8-10mm

Table 7. Composition of ferromanganese crusts analyzed by Analytical Services Company (cont'd).

Sequence#	090040	090041	090042	090043	090044	090045	090046	090047	090048	090049	091005	091006
Latitude	29.106	29.106	29.167	29.167	29.106	29.106	29.106	29.106	28.881	28.895	29.857	29.641
Longitude	-173.948	-174.020	-174.067	-174.067	-173.948	-173.948	-173.948	-173.948	-179.745	-178.869	179.083	179.282
Depth	1850	1475	1425	1425	1850	1850	1850	1850	2000	1280	2250	1300
Lab#	35	43	45	48	302	303	304	305	313	314	17	24
Mn(wt.%)	14.2	29.3	24.3	23.4	23.6	25.1	26.4	28.0	26.4	27.3	22.2	30.4
Fe	20.5	12.7	16.0	15.6	16.0	15.2	15.8	10.8	15.2	11.2	16.1	13.8
Al	1.89	.35	1.00	1.34	1.22	.81	.60	1.78	.91	1.88	.98	.26
Co	.866	1.63	.752	.665	.746	.918	1.01	.681	.814	1.61	.720	1.26
Ni	.179	.648	.470	.463	.443	.489	.445	1.160	.553	.640	.403	.603
Cu	.028	.036	.047	.070	.059	.054	.040	.131	.067	.046	.105	.043
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	4-10mm	-	20-25mm	15-30mm	13-25mm	13-20mm	3-5mm	4-8mm	6-8mm	3-5mm	-	2-12mm

Sequence#	091007	091008	091009	091010	091011	091012	091013	091014	091015	091016	091017	091018
Latitude	29.857	29.839	29.839	29.634	29.641	29.869	29.820	29.641	29.634	29.839	29.634	29.634
Longitude	179.083	179.065	179.065	179.288	179.282	179.098	179.103	179.282	179.288	179.065	179.288	179.288
Depth	2250	2100	2100	1865	1300	2900	1700	1300	1865	2100	1865	1865
Lab#	69	12	13	15	38	74	20	18	19	21	25	26
Mn(wt.%)	19.0	13.6	23.8	24.7	21.7	21.8	21.4	26.6	25.7	15.3	25.1	19.9
Fe	18.7	16.8	16.2	17.6	18.5	17.4	16.4	16.7	17.9	22.7	17.6	16.1
Al	1.46	2.70	1.22	.42	.59	1.12	1.70	.44	.48	1.64	.57	1.15
Co	.615	.578	.963	.766	1.24	.848	.755	1.08	.792	.683	.788	.559
Ni	.249	.389	.397	.348	.293	.394	.396	.410	.388	.307	.365	.367
Cu	.056	.070	.044	.027	.028	.067	.030	.028	.024	.057	.026	.033
Sampled	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk	Bulk
Interval	1-6mm	2-6mm	5-15mm	7-8mm	-	-	5-6mm	-	8-12mm	1-3mm	8-15mm	7-10mm

Sequence#	091019	091020	091021
Latitude	29.857	29.869	29.820
Longitude	179.083	179.098	179.104
Depth	2250	2900	1700
Lab#	70	75	301
Mn(wt.%)	21.9	17.7	8.39
Fe	17.7	16.4	12.7
Al	.94	1.77	4.67
Co	.722	.447	.296
Ni	.376	.439	.186
Cu	.049	.114	.012
Sampled	Bulk	Bulk	Bulk
Interval	1-3mm	8-10mm	-

Table 8. Composition of crusts analyzed by Aplin (PhD. thesis)

Sequence#	016008	016009	016010	053051	053052	053053	053054	053055	053056	053057	053058	053059
Latitude	-2.083	3.633	4.367	10.817	10.817	10.817	12.517	13.467	13.467	13.467	13.467	14.983
Longitude	-157.350	-159.517	-159.083	-165.550	-165.550	-165.550	-167.050	-165.417	-165.417	-165.417	-165.417	-166.100
Depth	1350	2800	2150	1150	1150	1150	3000	3850	3850	3850	3850	2800
Lab#	041-1/1	054-1/1	055-3/3	058-1/2	058-2/2A	058-2/2B	059-7/7	060-2/4A	060-2/4B	060-3/4	060-4/4	061-2/5A
Ti(wt.%)	1.06	.97	.51	.39	1.01	.77	1.48	1.38	1.26	1.32	1.34	1.20
Mn	29.3	23.7	15.4	21.6	29.2	27.9	20.3	19.7	20.3	19.2	23.1	21.9
Fe	14.4	15.3	16.1	21.0	13.0	12.3	19.5	18.2	18.2	18.6	20.7	19.0
Al	.52	.70	.87	.62	.38	.52	.87	1.41	.88	.95	.74	1.13
Co	1.16	.800	.232	.660	1.57	1.12	.547	.483	.496	.520	.560	.540
Ni	.570	.530	.370	.310	.690	.700	.280	.260	.298	.260	.330	.370
Cu	.031	.047	.059	.080	.059	.061	.121	.095	.099	.096	.136	.201
Ca	2.64	2.65	4.53	2.29	2.56	5.10	2.15	2.30	2.15	2.02	2.43	2.49
Mg	1.18	1.20	1.32	.96	1.26	1.22	.99	1.08	1.02	1.03	.99	.98
Na	1.69	2.29	3.72	1.46	1.60	1.44	1.54	1.53	1.65	1.72	1.55	1.62
K	.33	.34	.39	.38	.40	.40	.35	.45	.34	.36	.36	.43
P	.35	.31	1.18	.32	.33	1.10	.31	.32	.32	.33	.30	.30
Ba(ppm)	1100	960	1800	1400	840	620	1300	1200	1400	1400	1400	1600
Cd	6.3	5.5	3.1	4.3	8.1	7.0	3.9	3.3	4.2	4.0	4.0	3.6
Cr	52	49	29	30	32	36	28	22	31	33	32	33
Mo	660	450	280	480	780	740	340	370	450	370	500	450
Pb	1600	770	310	1400	1700	1600	1200	1100	1100	1200	1100	930
Sr	1300	1200	1500	1300	1300	1400	1200	1100	1300	1200	1300	1200
V	630	550	450	590	620	580	580	530	580	550	600	540
Zn	680	590	510	590	700	720	540	520	550	540	570	560
Thickness(mm)	5.0	6.0	2.0	10.0	30.0	30.0	5.0	20.0	10.0	8.0	13.0	20.0

Sequence#	053060	053061	053062	053063	053064	053065	053066	053067	053068	053069	053070	053071
Latitude	14.983	14.983	14.983	14.983	14.983	15.150	15.150	15.150	15.150	15.150	15.150	15.150
Longitude	-166.100	-166.100	-166.100	-166.100	-166.100	-168.100	-168.100	-168.100	-168.100	-168.100	-168.100	-168.100
Depth	2800	2800	2800	2800	0	2700	2700	2700	2700	2700	2700	2700
Lab#	061-2/5B	061-4/5A	061-4/5B1	061-4/5B2	061-4/5B3	062-1/3A	062-1/3B	062-1/3C	062-1/3D	062-1/3E	062-1/3F	062-3/3A
Ti(wt.%)	1.37	1.40	1.23	1.42	1.12	1.38	.97	1.20	1.43	1.10	1.74	1.10
Mn	21.8	23.1	26.3	21.0	24.2	20.8	19.9	20.9	18.5	19.3	18.0	17.7
Fe	19.3	19.9	18.3	14.3	18.0	18.5	16.9	19.5	20.6	17.8	19.6	16.0
Al	1.20	.96	.36	.19	.80	.94	1.95	1.00	1.24	1.27	1.43	2.97
Co	.354	.590	.940	.495	.513	.464	.354	.291	.238	.235	.244	.431
Ni	.358	.370	.440	.490	.380	.330	.358	.325	.335	.348	.237	.360
Cu	.273	.137	.094	.169	.175	.177	.273	.325	.347	.316	.255	.365
Ca	2.54	2.41	2.46	3.29	.29	2.16	2.10	2.13	1.88	1.97	2.08	2.86
Mg	.98	.97	1.01	1.15	1.01	.95	.92	.95	.97	.91	.87	.94
Na	1.56	1.52	1.44	1.54	1.35	1.38	1.37	1.20	1.10	1.18	1.11	1.75
K	.45	.41	.34	.78	.43	.40	.67	.48	.54	.73	.71	1.01
P	.30	.33	.59	.39	.27	.23	.24	.22	.20	.30	.35	.33
Ba(ppm)	2400	1500	1400	1500	1900	1700	2400	3000	1200	1600	1900	2000
Cd	3.7	4.0	5.2	4.8	3.7	3.5	2.5	2.0	2.9	2.6	3.1	3.1
Cr	34	29	29	49	43	30	37	58	33	30	34	33
Mo	400	310	600	400	470	440	400	710	620	650	490	250
Pb	580	1000	1300	710	680	1000	580	1000	1400	1800	2400	710
Sr	1300	1300	1300	1100	1400	1400	1300	1500	1400	1400	1600	1100
V	560	580	610	490	620	570	560	840	840	750	750	390
Zn	640	570	570	550	620	590	640	780	900	770	830	550
Thickness(mm)	15.0	25.0	35.0	35.0	35.0	70.0	70.0	70.0	70.0	70.0	70.0	62.0

Table 8. Composition of crusts analyzed by Aplin (PhD. thesis) cont'd.

Sequence#	053072	053073	053074	053075	053076	053077	053078	053079	053080	053081	053082	053083
Latitude	15.150	15.150	16.433	16.433	16.433	16.433	16.433	16.433	16.433	16.433	16.433	16.433
Longitude	-168.100	-168.100	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150
Depth	2700	2700	2325	2325	2325	2325	2325	2325	2325	2325	2325	2400
Lab#	062-3/3E	062-3/3F	063-1/9	063-2/9A	063-2/9B	063-2/9C	063-5/9A	063-5/9B	063-6/9A	063-6/9B	063-8/9	064-2/7
Ti(wt.%)	1.27	1.32	1.39	1.37	1.40	1.53	1.52	1.33	1.46	1.31	1.33	1.53
Mn	19.6	19.5	21.3	24.7	22.0	23.2	21.0	15.6	22.8	13.2	20.4	21.8
Fe	21.6	15.8	17.4	16.3	15.5	16.1	21.9	17.6	18.5	16.0	18.5	20.8
Al	.93	2.74	1.00	.62	1.21	.94	.86	1.51	.57	2.31	.82	1.05
Co	.494	.530	.770	.710	.570	.750	.600	.444	.840	.329	.630	.540
Ni	.250	.420	.410	.410	.430	.440	.290	.290	.330	.300	.267	.350
Cu	.113	.247	.115	.112	.160	.134	.075	.075	.055	.124	.058	.128
Ca	2.13	2.40	2.23	2.26	2.85	2.36	2.25	2.16	2.20	5.03	2.14	2.45
Mg	.98	.97	1.12	.99	1.00	1.03	.99	1.43	1.02	1.02	1.03	.99
Na	1.35	1.83	1.54	1.44	1.53	1.59	1.83	3.96	1.50	1.67	1.67	1.39
K	.35	1.03	.44	.37	.56	.45	.39	.73	.38	.59	.39	.39
P	.32	.33	.30	.46	.29	.35	.33	.35	1.12	.39	.34	.75
Ba(ppm)	1400	1700	1400	1300	1400	1500	1300	320	1300	1600	1300	1500
Cd	3.2	3.6	4.3	38.0	4.3	4.6	3.6	3.3	3.7	3.5	3.4	3.5
Cr	29	35	41	28	40	35	37	38	29	42	12	35
Mo	410	310	460	510	420	470	440	231	480	155	440	450
Pb	1300	730	1300	1500	1100	1400	1400	1200	1500	850	1400	1300
Sr	1300	1100	1300	1300	1300	1300	1300	1000	1400	990	1300	1300
V	580	400	560	580	530	540	560	420	580	360	580	560
Zn	560	550	580	570	630	590	540	570	530	560	540	560
Thickness(mm)	62.0	62.0	10.0	25.0	25.0	25.0	2.0	1.0	20.0	5.0	20.0	30.0

Sequence#	053084	053085	053086	053087	053088	053089	315003	315004	315005	350007	350008	350009
Latitude	16.433	16.433	16.433	16.433	16.433	16.433	-7.583	-9.067	-9.067	-15.017	-13.033	-13.033
Longitude	-168.150	-168.150	-168.150	-168.150	-168.150	-168.150	-151.550	-150.700	-150.700	-149.033	-147.933	-147.933
Depth	2400	2400	2400	2400	2400	2400	1880	1300	1300	3400	4700	4700
Lab#	064-4/7A	064-4/7B	064-5/7A	064-5/7B	064-7/7A	064-7/7B	044-2/2	045-6/13A	045-6/13B	052-4/7	053-1/1A	053-1/1B
Ti(wt.%)	1.55	1.66	1.42	1.37	1.42	1.49	1.18	1.38	1.35	1.06	.87	.51
Mn	16.4	20.3	20.4	20.6	22.2	23.1	26.1	27.6	28.5	17.2	11.7	5.32
Fe	15.8	18.0	22.7	20.8	18.3	20.0	18.3	13.7	12.3	17.0	11.5	7.65
Al	2.98	1.98	.87	.94	1.37	1.19	.33	.46	.32	1.19	5.02	5.02
Co	.270	.456	.700	.770	.540	.483	.930	1.05	1.15	.485	.252	.089
Ni	.390	.400	.290	.300	.420	.390	.540	.690	.760	.256	.440	.200
Cu	.250	.186	.067	.078	.187	.190	.043	.069	.063	.058	.225	.107
Ca	3.50	2.70	2.26	2.20	2.32	2.39	2.64	2.44	2.66	2.18	2.04	2.44
Mg	1.21	1.13	.98	.99	1.05	1.09	1.05	1.12	1.17	1.42	1.26	1.02
Na	1.65	1.74	1.43	1.42	1.69	1.61	1.60	1.55	1.59	1.88	2.43	2.83
K	.71	.52	.38	.38	.54	.45	.31	.40	.40	.32	2.10	2.91
P	.45	.33	.33	.25	.26	.36	.34	.29	.28	.34	.48	.70
Ba(ppm)	2800	1600	1400	1400	1600	1600	1100	860	890	520	960	690
Cd	3.8	3.4	3.5	3.8	3.9	3.8	5.4	6.9	7.4	3.2	3.6	1.4
Cr	50	42	32	36	47	32	28	31	31	35	45	49
Mo	193	330	410	390	470	470	560	550	600	270	170	70
Pb	780	970	1400	1400	940	880	1400	1300	1600	760	390	160
Sr	1000	1100	1300	1200	1300	1400	1400	1300	1300	1100	500	330
V	340	500	570	540	550	560	610	570	560	500	320	170
Zn	570	950	570	570	630	600	620	760	790	500	500	260
Thickness(mm)	15.0	15.0	12.0	15.0	15.0	3.0	5.0	22.0	22.0	1.0	6.0	6.0

Table 8. Composition of crusts analyzed by Aplin (PhD. thesis) cont'd.

Sequence#	350010	350011	351007	351008	351009	351010	351011	351012	351013	351014	351015
Latitude	-13.033	-13.033	-11.050	-11.050	-12.883	-12.883	-12.883	-12.883	-12.883	-12.883	-12.883
Longitude	-147.933	-147.933	-150.100	-150.100	-150.767	-150.767	-150.767	-150.767	-150.767	-150.767	-150.767
Depth	4700	4700	4250	4250	3000	3000	3000	3000	3000	3000	3000
Lab#	053-1/1C	053-1/1D	050-4/6A	050-4/6B	051-2/7	051-3/7A	051-2/7B	051-5/7A	051-5/7B	051-5/7C	051-6/7A
Ti(wt.%)	.45	.46	1.28	.91	.93	.78	.87	.91	.94	.98	.80
Mn	5.75	8.39	25.0	20.6	19.9	17.4	18.0	20.5	20.2	20.5	17.6
Fe	5.68	6.24	19.8	18.5	17.9	16.1	17.1	21.0	22.0	22.3	15.8
Al	6.12	6.70	.76	1.92	.78	2.88	2.62	1.81	1.40	1.43	3.00
Co	.091	.107	.600	.460	.380	.316	.316	.377	.406	.384	.309
Ni	.250	.450	.370	.390	.320	.400	.430	.410	.380	.370	.420
Cu	.129	.246	.101	.124	.124	.309	.224	.191	.194	.196	.331
Ca	1.96	2.00	2.62	2.64	2.27	2.04	2.19	2.97	2.56	2.62	2.03
Mg	.92	1.11	1.03	1.01	1.24	.99	1.09	1.04	1.03	1.00	1.08
Na	3.01	2.77	1.59	1.58	2.41	2.05	1.83	1.49	1.41	1.41	1.97
K	3.42	2.96	.32	.48	.33	1.00	.76	.45	.39	.40	.96
P	.55	.20	.29	.42	.35	.30	.32	.42	.43	.38	.28
Ba(ppm)	610	630	1300	1300	1000	1200	1300	1300	1300	1300	1300
Cd	1.7	3.7	4.0	3.0	3.5	3.0	3.7	3.3	5.1	3.1	3.4
Cr	41	55	30	33	32	48	48	49	66	47	41
Mo	100	150	600	440	410	320	300	410	450	420	300
Pb	130	160	860	700	690	460	520	480	540	560	460
Sr	270	310	1300	1100	1200	970	1000	1200	1200	1200	950
V	160	200	610	510	590	470	480	520	560	550	440
Zn	250	380	460	480	540	570	650	520	580	570	610
Thickness(mm)	6.0	6.0	30.0	30.0	2.0	12.0	12.0	30.0	30.0	30.0	15.0

Table 8a. Rare earth elements of crusts analyzed by Aplin (PhD. thesis) cont'd.

Sequence#	016008	016010	053051	053053	053054	053056	053059	053065	053068	053070	053075
Latitude	2.083	4.367	10.817	10.817	12.517	13.467	14.983	15.150	15.150	15.150	16.433
Longitude	-157.350	-159.083	-165.550	-165.550	-167.050	-165.417	-166.100	-168.100	-168.100	-168.100	-168.150
Depth(m)	1350	2150	1150	1150	3000	3850	2800	2700	2700	2700	2325
Lab#	041-1/1	055-3/3	058-1/2	058-2/2B	059-7/7	060-2/4B	061-2/5	062-1/3A	062-1/3D	062-1/3F	063-2/9A
La(ppm)	175	172	330	223	340	330	310	300	320	460	310
Ce	610	300	940	1100	1300	1000	1000	700	1500	2900	890
Pr	26	28	64	30	78	70	59	58	57	58	54
Hd	131	139	300	158	360	330	280	270	260	280	260
Sm	26	27	63	30	76	68	57	54	47	56	50
Eu	7	7	16	8	19	17	14	13	11	14	12
Gd	31	31	66	36	73	68	59	54	42	60	54
Dy	34	32	60	40	68	66	56	52	38	48	55
Er	26	21	33	31	36	37	32	31	21	30	34
Yb	24	19	29	27	30	31	29	27	18	27	30
La	4	3	4	4	4	5	4	4	3	4	4
Thickness(mm)	5.0	2.0	10.0	30.0	5.0	10.0	20.0	70.0	70.0	70.0	25.0

Sequence#	053078	053087	315003	315005	350011	351007	351008	351015
Latitude	16.433	16.433	-7.583	-9.067	-13.033	-11.050	-11.050	-12.883
Longitude	-168.150	-168.150	-151.550	-150.700	-147.933	-150.100	-150.100	-150.767
Depth(m)	2325	2400	1880	1300	4700	4250	4250	3000
Lab#	063-5/9A	064-5/7B	044-2/2	045-6/13B	053-1/1D	050-4/6A	050-4/6B	051-6/7A
La(ppm)	350	350	218	165	228	390	280	139
Ce	990	1100	500	710	219	1400	900	320
Pr	65	70	32	22	43	65	55	24
Hd	310	330	160	109	201	290	260	113
Sm	63	77	30	19	48	67	53	21
Eu	16	17	8	5	12	17	13	5
Gd	67	68	35	24	56	70	53	23
Dy	63	66	40	28	50	60	52	24
Er	36	38	28	22	31	35	32	16
Yb	31	32	26	21	29	34	28	14
La	5	5	4	3	5	6	4	2
Thickness(mm)	2.0	15.0	5.0	22.0	6.0	30.0	30.0	15.0

Table 9. Composition of crusts from the Scripps Nodule Databank

Sequence#	0800024-01	0870004-00	0890009-00	0910002-00	0910005-01	0910005-02	1120022-00	1130048-00	1130061-00	1130062-01	1130063-01
Latitude	-62.850	-64.517	-64.183	-63.067	-63.100	-63.100	-56.617	-55.933	-53.042	-59.142	-53.058
Longitude	-74.758	-145.967	-165.933	178.483	177.617	177.617	-34.800	-45.202	-48.883	-48.883	-48.950
Depth	4005	3775	2932	3583	3383	3383	3696	3740	3118	3850	3255
Si(wt.%)	-	-	11.3	15.5	-	-	-	-	-	-	-
Ti	-	.91	.63	.46	.78	1.16	-	-	.53	-	-
Mn	10.3	18.1	14.8	8.80	13.5	12.1	22.0	26.6	7.40	12.3	27.7
Fe	25.7	17.3	11.0	12.4	22.4	23.0	19.2	13.0	19.9	23.6	14.5
Al	-	-	2.40	3.90	-	-	-	-	-	-	-
Co	.140	.570	.170	.140	.330	.350	.480	.120	.340	.150	.210
Ni	.100	.290	.700	.270	.200	.130	.260	.990	.060	.220	.770
Cu	.100	.090	.290	.130	.080	.080	.050	.410	.090	.100	.160
Ca	2.28	-	1.52	1.79	-	-	2.24	2.00	-	2.14	1.65
Mg	2.99	-	-	-	-	-	.96	1.90	-	1.82	1.63
Na	2.16	-	-	-	-	-	1.57	3.57	-	2.97	2.78
K	.98	-	-	-	-	-	.34	1.07	-	.99	1.07
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	17.1	17.4	12.2	19.1	20.4	-	-	15.0	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	1200	3900	2500	1700	2800	-	-	1100	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	1300	110	50	1100	620	-	-	510	-	-
Pb	2000	-	1500	1400	-	-	3100	900	-	2600	800
Sr	-	1300	1000	1100	1300	1300	-	-	860	-	-
V	-	560	-	-	1200	920	-	-	490	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	640	400	1000	580	600	500	1800	2700	300	870	1600
Sample type	Mn-coated rock	Nodule -	Crust -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Several crusts	Crust -	Crust -
Portion sampled	unknown -	without nucleus	cross section	cross section	outer crust	outer crust	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	Clay	-	-	-	-	-	-	-	-	-
Reference	A368	A227	A197	A197	A227	A227	A368	A368	A227	A368	A368

Sequence#	1130065-00	1140011-01	1140029-01	1140040-05	1140051-00	1140081-01	1140081-02	1140088-01	1140119-00	1140127-00	1140127-01
Latitude	-59.033	-53.000	-57.538	-55.100	-55.733	-56.267	-56.267	-56.233	-55.642	-52.833	-52.833
Longitude	-48.978	-52.900	-55.138	-55.833	-56.050	-58.275	-58.275	-58.700	-55.912	-50.500	-50.500
Depth	3862	3101	4075	2871	3914	4087	4087	4133	4085	2842	2842
Si(wt.%)	-	13.8	-	-	-	-	-	-	-	-	-
Ti	-	.25	-	-	.37	.40	.47	-	-	-	-
Mn	18.4	10.8	11.3	14.0	3.90	1.00	1.00	1.56	6.20	9.50	9.20
Fe	21.1	15.8	17.9	28.2	19.2	14.5	16.8	40.3	20.8	14.7	18.9
Al	-	2.70	-	-	-	-	-	-	-	3.57	3.00
Co	.160	.150	.160	.280	.120	.130	.150	.020	.100	.100	.140
Ni	.500	.390	.240	.230	.120	.290	.130	.030	.110	.240	.070
Cu	.250	.080	.080	.070	.090	.160	.160	.060	.040	.100	.090
Ca	1.65	1.19	1.66	1.35	-	-	-	1.51	-	-	-
Mg	1.70	-	2.52	1.54	-	-	-	1.75	-	-	-
Na	3.08	-	4.07	2.09	-	-	-	2.19	-	-	-
K	.96	-	2.59	.77	-	-	-	.91	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	13.0	-	-	7.8	10.1	7.7	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	3000	-	-	580	400	510	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	52	14
Mo	-	140	-	-	510	260	290	-	-	160	230
Pb	2100	1200	1100	3200	-	-	-	2400	-	600	1100
Sr	-	800	-	-	760	480	520	-	-	-	-
V	-	-	-	-	710	230	660	-	-	350	570
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1100	670	520	900	300	460	450	660	-	720	1700
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Crust -	Crust -	Crust -
Portion sampled	unknown -	cross section	unknown -	unknown -	outer crust	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A197	A368	A368	A227	A227	A227	A368	A333	A333	A333

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	1140128-00	1150001-00	1150191-00	1160020-02	1160025-02	1180019-00	1230002-00	1230002-01	1230006-00	1230007-00	1230011-00
Latitude	-51.517	-57.050	-58.467	-57.983	-57.083	-52.017	-52.167	-52.167	-59.850	-58.083	-59.133
Longitude	-52.433	-60.017	-60.625	-70.883	-70.983	-99.950	-142.133	-142.133	-144.867	-144.950	-145.133
Depth	2052	3438	3039	4007	3767	4418	2295	2295	3219	3025	3155
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	.60	-	-	-	.67	1.08	1.43	1.14	1.03	.71
Mn	.20	7.60	11.7	10.4	14.7	21.2	21.2	20.5	10.6	11.7	12.5
Fe	15.3	23.3	26.8	15.9	25.5	14.6	20.7	17.1	22.4	21.3	18.4
Al	2.60	-	-	-	-	-	-	-	-	-	-
Co	.010	.220	.210	.570	.160	.180	.740	1.39	.440	.420	.350
Ni	.040	.130	.080	.210	.310	.840	.400	.390	.170	.180	.520
Cu	.010	.130	.070	.070	.140	.320	.110	.060	.110	.080	.280
Ca	-	-	2.41	-	2.11	-	-	-	-	-	-
Mg	-	-	1.52	-	2.09	-	-	-	-	-	-
Na	-	-	2.49	-	2.71	-	-	-	-	-	-
K	-	-	.58	-	1.12	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	13.1	-	17.0	-	19.5	10.1	8.1	15.7	19.2	15.9
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	2600	-	-	-	900	1000	1000	650	830	2300
Cd	-	-	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	128	-	-	-	-	-	-	-	-	-	-
Mo	50	820	-	-	-	550	630	640	1100	410	350
Pb	-	-	3300	-	2100	-	-	-	-	-	-
Sr	-	910	-	-	-	1000	1400	1200	910	1100	810
V	200	890	-	-	-	540	1000	800	850	760	540
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	330	500	720	-	740	700	550	410	600	500	700
Sample type	Crust -	Crust -	Mn-coated rock	Nodule -	Crust -	Crust -	Unknown -	Nodule -	Crust -	Crust -	Crust -
Portion sampled	fragments -	outer crust	unknown -	whole -	unknown -	outer crust	unknown -	whole -	outer crust	whole -	outer crust
Nucleus	-	Clay	-	-	-	Sediment	-	-	Undetermined	non-apparent	Palagonite
Reference	A333	A227	A368	A227	A368	A227	A227	A227	A227	A227	A227

Sequence#	1250012-00	1270003-00	1280029-00	1290010-00	1290032-00	1290032-01	1290032-02	1290032-03	1290062-00	1300013-00	1300013-01
Latitude	-54.500	-50.317	-50.783	-56.367	-55.158	-55.158	-55.158	-55.158	-56.683	-56.417	-56.417
Longitude	-163.317	176.383	169.958	158.467	150.050	150.050	150.050	150.050	158.767	140.017	140.017
Depth	4650	2377	896	1595	3866	3866	3866	3866	1280	3750	3750
Si(wt.%)	9.80	1.50	1.50	-	-	-	-	-	4.60	31.3	11.2
Ti	.61	1.00	1.00	1.15	-	-	-	-	-	.55	1.01
Mn	14.4	11.1	5.10	21.5	12.4	10.9	13.5	11.5	15.2	.20	12.4
Fe	14.9	12.2	24.4	20.4	16.2	18.0	15.4	14.5	20.8	5.25	12.9
Al	2.00	2.00	2.00	-	-	-	-	-	-	7.30	1.90
Co	.300	.300	.200	.730	.450	.290	.320	.130	.300	.010	.100
Ni	.370	.150	.200	.380	.260	.190	.840	.360	.250	-	-
Cu	.150	-	-	.040	.060	.040	.040	.060	.110	.010	.220
Ca	1.32	2.00	2.00	-	-	-	-	-	1.83	.41	2.14
Mg	-	1.00	1.50	-	-	-	-	-	-	1.50	1.29
Na	-	-	-	-	-	-	-	-	-	1.28	1.59
K	-	-	-	-	-	-	-	-	-	2.77	.70
P	-	1.00	3.00	-	-	-	-	-	.27	.03	.15
H_2O-	16.5	-	-	27.0	-	-	-	-	-	1.0	18.2
As(ppm)	-	-	-	-	-	-	-	-	270	-	-
Ba	4200	-	-	1500	-	-	-	-	-	100	800
Cd	-	-	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	-	40	100	-	-	-	-	-	-	70	70
Mo	170	100	100	720	-	-	-	-	440	-	-
Pb	1700	1500	1500	-	-	-	-	-	1600	300	1100
Sr	1000	-	-	1600	-	-	-	-	1400	200	900
V	-	500	800	1100	-	-	-	-	-	200	300
Y	-	-	-	-	-	-	-	-	175	-	-
Zn	570	-	-	620	190	160	190	160	910	200	600
Sample type	Crust -	Crust -	Mn-coated rock	Nodule -	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock
Portion sampled	cross section	unknown -	unknown -	whole -	outer crust	outer crust	outer crust	outer crust	outer crust	nucleus -	outer crust
Nucleus	-	-	-	-	-	-	-	-	volcanic	Rock	Rock
Reference	A197	A260	A260	A227	A250	A250	A250	A250	A388	A247	A247

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	1300013-02	1300013-03	1300013-04	1300013-05	1300013-06	1300013-07	1300013-08	1300013-09	1300013-10	1300013-11	1300013-13
Latitude	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417
Longitude	140.017	140.017	140.017	140.017	140.017	140.017	140.017	140.017	140.017	140.017	140.017
Depth	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750	3750
Si(wt.%)	29.0	20.0	23.0	15.0	19.6	31.0	20.1	16.0	10.7	30.0	6.00
Ti	.35	.54	.47	.51	1.00	.29	.58	.67	.62	.24	.22
Mn	3.70	2.40	.49	11.0	8.80	2.38	4.94	7.01	18.5	.20	28.9
Fe	4.13	17.1	6.01	8.18	9.93	3.45	14.3	12.8	13.4	2.70	6.01
Al	6.30	2.20	8.60	4.40	4.30	6.67	2.90	2.80	1.40	8.10	1.10
Co	.020	.020	.010	.060	.030	.010	.020	.040	.230	.010	.120
Ni	.020	.060	.020	.510	.280	.010	.170	.200	.610	.010	1.130
Cu	.020	.050	.020	.220	.130	.010	.090	.150	.260	.010	.410
Ca	2.93	1.04	3.34	2.48	2.17	1.09	.94	1.37	1.77	1.52	1.98
Mg	1.35	1.72	3.11	2.27	1.46	.74	1.19	1.39	1.25	.46	1.69
Na	-	1.66	2.14	2.05	-	-	1.94	1.95	1.90	3.15	2.15
K	-	1.24	1.24	.86	-	-	1.74	1.01	.71	2.18	.78
P	.05	.06	.05	.07	.36	-	-	.10	.14	.03	.11
H_2O-	2.9	11.1	6.4	10.6	6.4	2.6	9.2	15.2	10.9	4.1	13.9
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	400	200	200	500	400	500	400	500	900	400	1300
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	70	140	70	70	70	70	70	70	70	70	70
Mo	200	500	100	400	500	200	100	200	300	100	600
Pb	-	1200	200	600	-	-	900	900	900	900	700
Sr	-	300	300	600	-	-	500	700	800	200	800
V	100	200	300	400	500	200	200	300	300	100	500
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	300	300	1000	-	-	600	600	1000	80	3400
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock
Portion sampled	whole -	whole -	nucleus -	outer crust	whole -	whole -	whole -	whole -	whole -	whole -	whole -
Nucleus	Rock	Clay	Rock	Rock	Rock	Rock	Rock	Clay	Rock	Rock	-
Reference	A247	A247	A247	A247	A247	A247	A247	A247	A247	A247	A247

Sequence#	1300013-14	1300013-15	1300013-16	1340035-00	1350032-00	1360009-00	1360023-01	1430013-00	1440015-00	1490051-00	1490055-00
Latitude	-56.417	-56.417	-56.417	-56.555	-54.833	-52.083	-55.880	-52.167	-50.367	-49.633	-49.650
Longitude	140.017	140.017	140.017	100.068	90.140	84.547	81.118	10.483	8.750	-42.467	-44.117
Depth	3750	3750	3750	3409	4662	4232	4086	2561	4686	2202	2952
Si(wt.%)	20.0	33.6	24.3	-	-	-	-	-	-	-	-
Ti	.36	.48	.60	-	-	-	-	-	-	-	-
Mn	3.40	.20	.19	11.0	1.00	16.3	8.90	24.0	21.0	14.8	15.2
Fe	6.40	3.87	11.2	14.1	15.2	16.6	10.6	19.5	9.80	14.8	17.7
Al	7.80	4.80	3.20	-	-	-	-	-	-	1.88	1.40
Co	.010	.010	.010	.050	-	.110	-	.600	.080	.240	.170
Ni	.170	.010	.050	.180	.310	.410	.270	.380	.600	.450	.270
Cu	.080	.010	.100	.470	.370	.260	.210	.040	.290	.200	.120
Ca	1.43	1.32	.71	1.30	1.00	1.50	1.50	-	-	-	-
Mg	2.23	1.51	1.71	-	-	-	-	-	-	-	-
Na	.09	.58	2.33	-	-	-	-	-	-	-	-
K	3.75	1.91	1.57	-	-	-	-	-	-	-	-
P	.07	.03	.05	-	-	-	-	-	-	-	-
H_2O-	10.7	2.7	10.6	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	800	400	300	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	70	70	70	-	-	-	-	-	-	-	-
Mo	300	100	100	-	-	-	-	-	-	180	260
Pb	500	300	900	1300	1100	1400	1300	-	-	800	1300
Sr	400	80	200	-	-	-	-	-	-	-	-
V	200	100	200	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	200	200	300	900	700	700	700	-	-	960	820
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Crust -	Mn-encrusted sediment	Mn-coated rock	Mn-coated rock	Crust -	Crust -
Portion sampled	whole -	whole -	whole -	without nucleus	fragments -	fragments -	half -	unknown -	unknown -	unknown -	unknown -
Nucleus	Chert	Rock	Rock	Rock	-	-	-	-	-	-	-
Reference	A247	A247	A247	A422	A422	A422	A422	A333	A333	A333	A333

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	1490056-00	1500059-00	1500059-01	1500129-00	1530001-00	1530003-00	1550005-07	1580001-01	1590005-02	1630063-00	1630064-00
Latitude	-49.617	-47.933	-47.933	-47.762	-42.067	-42.083	-41.983	-42.017	-45.100	-49.667	-49.400
Longitude	-44.100	-57.100	-57.100	-57.642	-81.983	-86.050	-102.017	-130.033	-145.183	179.883	177.983
Depth	2932	2585	2585	3652	3200	3012	4200	4839	4954	2286	978
Si(wt.%)	-	-	-	-	-	-	-	-	-	1.50	1.50
Ti	-	-	-	-	.53	1.15	-	1.15	-	1.50	1.00
Mn	5.80	23.0	18.6	.09	12.3	10.7	24.5	10.7	18.7	14.7	18.8
Fe	11.0	18.0	22.2	4.50	27.6	28.2	8.20	28.2	9.80	17.1	7.07
Al	3.68	-	-	-	-	-	-	-	-	2.00	.60
Co	.080	1.20	.320	-	.260	.240	.100	.240	.190	.600	.600
Ni	.080	1.100	.210	.010	.130	.130	.920	.130	.770	.300	1.000
Cu	.070	.080	.060	.010	.080	.090	.480	.090	.460	-	-
Ca	-	-	1.84	-	-	-	-	-	1.60	2.00	1.00
Mg	-	-	.93	-	-	-	-	-	-	1.00	.70
Na	-	-	1.43	-	-	-	-	-	-	-	1.00
K	-	-	.31	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	1.50	-
H_2O-	-	-	-	-	21.9	25.2	-	25.2	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	1200	1100	1600	1100	-	-	1000
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	40	20
Mo	100	-	-	-	510	620	-	620	-	200	150
Pb	600	-	2600	-	-	-	-	-	900	2000	1000
Sr	-	-	-	-	1300	1000	-	1000	-	-	1000
V	-	-	-	-	1300	810	-	810	-	500	700
Y	-	-	-	-	-	-	-	-	-	-	100
Zn	370	-	700	-	500	500	1800	500	800	-	-
Sample type	Crust -	Crust -	Crust -	Mn-coated rock	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Nodule -	Nodule -
Portion sampled	unknown -	unknown -	unknown -	unknown -	outer crust	outer crust	unknown -	outer crust	half -	unknown -	unknown -
Nucleus	-	-	-	-	Basalt	-	-	Palagonite	Pumice	Undetermined	-
Reference	A333	A179	A368	A419	A227	A227	A323	A227	A459	A260	A260

Sequence#	1630064-01	1630065-01	1630066-00	1630066-01	1810024-00	1810025-00	1840038-00	1840039-00	1890007-00	1890007-01	1890013-00
Latitude	-49.400	-49.983	-49.367	-49.367	-33.800	-33.800	-30.033	-30.500	-33.050	-33.050	-33.042
Longitude	177.983	177.533	176.267	176.267	-1.233	-1.233	-38.950	-35.933	-82.050	-82.050	-83.942
Depth	978	1335	1280	1280	1489	1553	939	1000	3881	3881	3650
Si(wt.%)	3.32	1.96	1.50	3.88	-	-	-	-	-	-	-
Ti	-	-	1.20	-	-	-	-	-	.91	1.18	.71
Mn	10.4	12.2	22.2	19.4	25.0	23.4	26.0	24.8	17.5	-	19.1
Fe	6.78	7.19	15.2	7.58	19.3	19.6	17.2	19.4	18.7	19.9	18.9
Al	-	-	2.00	-	-	-	-	-	-	-	-
Co	.420	.180	1.000	.460	.730	.590	1.01	.900	.170	.060	.190
Ni	.610	.530	1.000	.920	.360	.410	.530	.360	.490	.160	.460
Cu	.080	.050	-	.100	.060	.090	.060	.040	.210	.220	.190
Ca	.37	8.69	2.00	3.79	-	-	-	-	-	-	-
Mg	-	-	1.50	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	.33	2.44	-	.97	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	18.1	8.3	22.7
As(ppm)	91	115	-	113	-	-	-	-	-	-	-
Ba	3100	-	-	4300	-	-	-	-	1200	100	1200
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	74	430	200	420	-	-	-	-	820	230	270
Pb	400	700	1500	700	-	-	-	-	-	-	-
Sr	1300	1400	-	1100	-	-	-	-	1100	230	810
V	-	-	500	-	-	-	-	-	730	610	360
Y	122	112	-	104	-	-	-	-	-	-	-
Zn	740	1100	-	1400	-	-	-	-	600	800	500
Sample type	Mn-coated rock	Mn-coated rock	Nodule -	Mn-coated rock	Nodule -	Nodule -	Nodule -	Unknown -	Crust -	Crust -	Crust -
Portion sampled	outer crust	outer crust	unknown -	outer crust	unknown -	unknown -	unknown -	unknown -	outer crust	nucleus -	outer crust
Nucleus	-	-	-	-	-	-	-	-	Clay	Clay	Clay
Reference	A388	A388	A260	A388	A333	A333	A333	A333	A227	A227	A227

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	1890013-01	1890016-00	1890016-01	1890022-01	1900007-00	1900014-00	1900014-01	1930004-00	1940005-00	1940005-01	1940005-02
Latitude	-33.042	-32.967	-32.967	-33.075	-39.850	-39.892	-39.892	-37.067	-35.967	-35.967	-35.967
Longitude	-83.942	-88.000	-88.000	-89.550	-96.867	-96.908	-96.908	-129.967	-134.300	-134.300	-134.300
Depth	3650	3619	3619	3795	3639	3557	3557	3548	4696	4696	4696
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	1.19	.37	1.17	-	.23	-	-	1.29	.78	.94	.96
Mn	-	22.5	-	17.8	28.6	27.2	21.7	21.9	22.6	21.7	18.3
Fe	19.6	15.8	20.6	8.60	10.3	15.1	13.0	16.8	13.6	14.4	16.5
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.020	.190	.040	.040	.120	.050	.050	1.02	.340	.390	.440
Ni	.110	1.060	.010	1.200	1.730	1.180	.600	.370	.750	.740	.390
Cu	.160	.370	.090	.490	.440	.490	.500	.060	.200	.180	.110
Ca	-	-	-	1.60	-	2.50	1.90	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	8.0	20.5	8.8	-	19.2	-	-	23.6	21.1	21.7	22.6
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	100	1200	100	-	1500	-	-	1200	1000	930	800
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	680	610	110	-	590	-	-	430	560	490	250
Pb	-	-	-	500	-	300	300	-	-	-	-
Sr	250	1000	160	-	840	-	-	1500	1300	1200	1300
V	410	740	460	-	740	-	-	770	540	600	550
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	800	800	200	1100	1200	1800	1600	300	400	400	300
Sample	Crust	Crust	Crust	Mn-encrusted	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	sediment	-	-	-	-	-	-	-
Portion	nucleus	outer	nucleus	half	outer	unknown	unknown	outer	outer	outer	outer
sampled	-	crust	-	-	crust	-	-	crust	crust	crust	crust
Nucleus	Clay	Clay	Clay	Sediment	Palagonite	-	-	-	-	-	Palagonite
Reference	A227	A227	A227	A459	A227	A459	A459	A227	A227	A227	A227

Sequence#	1940009-00	1970019-00	1970033-00	1980025-01	1980025-02	1980049-00	2010001-00	2010001-01	2010001-02	2010001-03	2040011-00
Latitude	-35.183	-32.675	-38.643	-35.850	-35.850	-33.000	-39.750	-39.750	-39.750	-39.750	-37.465
Longitude	-135.533	-160.013	-167.918	-178.517	-178.517	-171.652	159.650	159.650	159.650	159.650	120.255
Depth	4700	5300	1420	6715	6715	3225	-	-	-	-	4316
Si(wt.%)	-	7.38	-	-	6.03	-	-	-	9.40	7.80	-
Ti	1.34	-	-	-	-	1.01	-	-	-	-	-
Mn	19.6	14.6	23.4	20.5	17.6	16.9	26.2	27.3	22.0	23.4	2.30
Fe	14.2	23.3	16.1	20.4	19.5	21.5	8.19	7.33	7.89	7.20	5.90
Al	-	-	-	-	-	-	-	-	-	-	4.90
Co	.730	-	1.000	.250	.180	.460	.190	.180	.150	.130	.080
Ni	.330	.200	.540	.200	.210	.370	1.250	1.300	1.100	1.170	.070
Cu	.050	.420	.100	.070	.080	.090	.600	.600	.560	.550	.060
Ca	-	1.64	3.50	1.90	1.68	-	2.36	1.59	2.20	1.47	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	.19	-	-	-	.40	.09	-
H_2O-	-	47.1	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	260	-	-	-	94	122	-
Ba	90	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	14.0	14.0	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	31	-	-	-	-	-	-	-	-	-	53
Mo	330	-	-	-	700	-	-	-	410	440	100
Pb	600	-	2100	1800	1300	-	800	700	600	400	400
Sr	-	-	-	-	1000	-	-	-	570	480	-
V	440	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	174	-	-	-	151	68	-
Zn	-	800	800	320	400	-	1100	1100	1100	1100	210
Sample	Nodule	Mn-coated	Crust	Mn-encrusted	Mn-encrusted	Crust	Mn-coated	Mn-coated	Mn-coated	Mn-coated	Mn-encrusted
type	-	rock	-	sediment	sediment	-	organicmat.	rock	organicmat.	rock	sediment
Portion	half	unknown	fragments	outer	outer	unknown	unknown	unknown	outer	outer	whole
sampled	-	-	-	crust	crust	-	-	-	crust	crust	-
Nucleus	-	-	-	Clay	Clay	-	Bone	Pumice	Bone	Pumice	Sediment
Reference	A240	A293	A405	A200	A388	A343	A200	A200	A388	A388	A407

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2040014-00	2040016-00	2050067-00	2060016-00	2070001-00	2070001-01	2070019-00	2070085-00	2100024-01	2100027-00	2100027-01
Latitude	-37.500	-37.162	-38.185	-32.800	-31.500	-31.500	-31.283	-31.710	-30.443	-32.667	-32.667
Longitude	120.167	121.223	118.675	103.872	99.283	99.283	94.267	91.365	60.805	66.383	66.383
Depth	3736	4243	4023	5300	2412	2412	2074	4298	5731	4910	4910
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	.49	-	-	-	-	-	-	-
Mn	13.9	15.3	18.7	14.5	22.0	23.4	1.87	19.1	12.3	13.7	12.9
Fe	19.8	14.4	21.3	12.9	7.89	7.20	16.3	19.7	17.9	15.1	17.5
Al	-	-	-	-	-	-	5.66	-	2.55	3.71	3.26
Co	.170	.230	.280	.240	.150	.130	.080	.320	.280	.220	.210
Ni	.150	.470	.250	.490	1.100	1.170	.100	.300	.140	.300	.260
Cu	.140	.320	.110	.300	.560	.550	.070	.120	.090	.190	.180
Ca	2.90	1.50	2.90	-	-	-	2.30	3.70	2.14	1.91	1.34
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	690	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	6	-	-	-	-	-	-	-
Mo	-	-	-	380	410	440	-	-	-	-	-
Pb	800	900	1200	200	-	-	100	1200	1400	1100	1000
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	470	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	800	600	500	-	1100	1100	540	500	440	-	-
Sample	Crust	Crust	Crust	Crust	Mn-coated	Mn-coated	Mn-coated	Crust	Crust	Crust	Crust
type	-	-	-	-	organicmat.	rock	rock	-	-	-	-
Portion	fragments	fragments	fragments	outer	outer	outer	outer	fragments	unknown	unknown	unknown
sampled	-	-	-	crust	crust	crust	crust	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A405	A405	A405	A240	A388	A388	A467	A405	A467	A467	A467

Sequence#	2120046-00	2130069-00	2130069-04	2130070-00	2130070-01	2140009-00	2140010-00	2140022-01	2140058-00	2140071-00	2140073-00
Latitude	-36.750	-32.917	-32.917	-31.900	-31.900	-37.433	-38.633	-39.533	-39.350	-35.333	-35.783
Longitude	44.767	35.317	35.317	34.350	34.350	26.467	26.133	24.833	25.050	22.642	22.383
Depth	2265	1250	1250	2700	2700	2867	2960	2961	2875	320	1070
Si(wt.%)	-	3.30	1.60	4.40	-	-	-	-	-	3.20	4.90
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	19.5	15.2	19.1	16.2	16.0	15.0	11.8	17.2	23.6	10.9	15.8
Fe	17.8	9.60	15.5	15.2	19.0	20.2	19.7	2.18	11.0	9.00	18.4
Al	1.31	-	-	-	1.47	-	-	-	-	-	-
Co	.690	.530	.770	.620	.610	.540	.580	.300	.240	.180	.370
Ni	.370	.650	.320	.350	.340	.360	.580	.120	1.140	.420	.580
Cu	.080	.130	.050	.100	.090	.140	.170	.070	.190	.030	.040
Ca	2.01	5.46	1.89	1.37	1.23	1.50	1.15	2.74	-	6.50	5.30
Mg	-	-	-	-	-	-	-	1.23	-	-	-
Na	-	-	-	-	-	-	-	2.02	-	-	-
K	-	-	-	-	-	-	-	.49	-	-	-
P	-	1.65	.29	.23	-	-	-	-	-	4.10	1.80
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	310	360	243	-	-	-	-	-	209	380
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	430	720	490	-	-	-	-	-	182	430
Pb	2200	1500	2400	1800	2200	1700	1200	2500	-	500	700
Sr	-	1300	1700	1200	-	-	-	-	-	1600	1200
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	510	180	112	-	-	-	-	-	60	141
Zn	700	690	570	670	680	700	590	690	-	840	1000
Sample	Crust	Nodule	Nodule	Nodule	Unknown	Nodule	Nodule	Crust	Crust	Mn-coated	Crust
type	-	-	-	-	-	-	-	-	-	rock	-
Portion	unknown	half	outer	half	unknown	fragments	unknown	unknown	unknown	outer	unknown
sampled	-	-	crust	-	-	-	-	-	-	crust	-
Nucleus	-	-	-	-	-	-	-	-	-	Rock	-
Reference	A467	A388	A388	A388	A467	A422	A200	A368	A333	A466	A466

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2140074-00	2140074-01	2140075-00	2140076-00	2150025-01	2150026-01	2150026-02	2150054-04	2150058-02	2150086-00	2160038-00
Latitude	-35.433	-35.433	-35.617	-35.650	-37.550	-37.550	-37.550	-34.600	-34.700	-32.367	-32.325
Longitude	22.367	22.367	22.367	22.217	18.100	18.100	18.100	17.000	16.900	15.017	2.158
Depth	1700	1700	230	202	3147	1796	1796	2740	3200	2941	2047
Si(wt.%)	.90	1.10	1.70	.90	-	-	-	7.67	5.24	-	-
Ti	-	-	-	-	-	.43	.40	-	-	-	-
Mn	.18	13.6	11.2	.22	18.2	19.0	21.0	16.8	23.9	17.9	17.0
Fe	37.6	7.60	4.90	42.0	21.8	17.5	21.0	16.6	13.8	19.3	16.0
Al	-	-	-	-	-	.84	.65	-	-	-	-
Co	-	.160	.140	-	.370	.064	.700	.290	.230	.150	.840
Ni	.010	.660	.570	.020	.200	.360	.370	.540	.830	.350	.560
Cu	-	.020	.030	-	.040	.050	.040	.070	.110	.160	.100
Ca	4.29	6.70	9.20	2.39	2.19	7.12	4.96	1.63	1.70	1.91	-
Mg	-	-	-	-	1.12	1.60	1.00	-	-	1.54	-
Na	-	-	-	-	1.81	1.19	.21	-	-	2.11	-
K	-	-	-	-	.19	.36	.33	-	-	.72	-
P	1.50	4.10	4.80	1.00	-	1.96	1.43	.21	.21	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	630	203	144	1100	-	-	-	-	215	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	16	260	237	23	-	180	160	-	350	-	-
Pb	100	700	300	100	2700	1600	2000	-	300	1700	-
Sr	380	2800	2000	205	-	-	-	-	860	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	17	51	50	14	-	-	-	-	68	-	-
Zn	260	740	750	320	600	-	-	50	1200	1900	-
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Nodule -	Nodule -	Mn-coated material	Mn-coated material	Crust -	Unknown -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	outer crust	outer crust	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	organic	organic	-	-
Reference	A466	A466	A466	A466	A368	A419	A419	A388	A388	A368	A179

Sequence#	2160038-01	2160039-00	2160041-00	2160041-01	2160041-02	2160050-01	2160052-01	2160058-00	2190040-01	2190042-01	2190045-01
Latitude	-32.325	-32.367	-32.350	-32.350	-32.350	-31.483	-31.450	-33.517	-28.500	-28.533	-28.533
Longitude	2.158	2.150	2.117	2.117	2.117	1.033	.950	2.467	-28.967	-29.000	-29.000
Depth	2047	1786	1675	1675	1675	3043	4136	4477	3781	3566	4361
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	20.4	26.8	17.0	22.0	19.0	18.0	17.3	7.10	18.6	13.4	18.6
Fe	19.5	15.8	18.0	19.0	18.0	22.3	17.7	4.30	19.6	14.3	19.6
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.670	.700	.840	.670	.920	.630	.200	.050	.480	.370	.490
Ni	.250	.840	.360	.260	.360	.230	.300	.360	.310	.280	.280
Cu	.030	.180	.030	.030	.040	.060	.130	.200	.130	.130	.080
Ca	2.48	1.79	-	2.92	-	2.12	3.67	-	2.40	5.14	2.30
Mg	1.04	1.98	-	1.03	-	1.18	1.42	-	1.36	1.02	1.57
Na	1.48	1.50	-	1.42	-	1.46	2.32	-	1.78	3.36	1.87
K	.31	.48	-	.33	-	.35	.95	-	.64	2.71	.35
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	2900	2200	-	3000	-	1900	1700	-	1300	1000	1900
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	580	1100	-	1900	-	580	600	-	810	4600	580
Sample type	Nodule -	Nodule -	Unknown -	Nodule -	Nodule -	Nodule -	Crust -	Mn-coated rock	Crust -	Crust -	Crust -
Portion sampled	fragments -	unknown -	unknown -	fragments -	unknown -	unknown -	unknown -	outer crust	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	Sediment	-	-	-
Reference	A368	A368	A179	A368	A419	A368	A368	A333	A368	A368	A368

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2190045-02	2210032-01	2250007-01	2250007-05	2310033-00	2310055-01	2320002-00	2320002-01	2320015-00	2320015-01	2320019-00
Latitude	-28.533	-28.367	-25.517	-25.517	-20.610	-20.390	-22.583	-22.583	-24.683	-24.683	-24.812
Longitude	-29.000	-41.217	-85.233	-85.233	-147.588	-148.020	-150.800	-150.800	-155.250	-155.250	-157.488
Depth	4361	3280	920	920	4570	4630	807	807	4542	4542	4901
Si(wt.%)	-	-	2.60	-	-	-	-	-	4.40	5.10	-
Ti	-	-	.59	-	-	1.00	1.29	-	.88	.97	-
Mn	17.2	12.2	37.3	21.5	20.3	16.2	16.1	47.5	15.7	14.0	19.5
Fe	20.8	18.7	11.2	9.40	15.4	17.9	11.8	13.8	17.0	18.9	16.7
Al	-	-	.70	-	-	-	-	-	2.20	2.20	-
Co	.540	.330	.700	1.34	.510	.520	2.57	1.89	.570	.580	.580
Ni	.270	.230	.560	.340	.600	.420	.410	.830	.410	.270	.520
Cu	.140	.070	.160	.060	.300	.130	.050	.090	.260	.310	.310
Ca	3.65	-	2.10	-	2.50	-	-	-	1.73	1.69	2.70
Mg	1.23	-	2.10	-	-	-	-	-	-	-	-
Na	1.49	-	2.40	-	-	-	-	-	-	-	-
K	.44	-	.50	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	18.7	17.4	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	1800	-	-	-	5900	-	6500	6200	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	600	-	-	-	400	-	250	210	-
Pb	1600	-	1900	-	900	800	5100	4100	1500	1600	1200
Sr	-	-	740	-	-	-	-	-	1000	1100	-
V	-	-	600	-	-	210	690	-	-	-	-
Y	-	-	260	-	-	-	-	-	-	-	-
Zn	670	-	400	500	700	550	-	-	630	590	700
Sample type	Nodule -	Several crusts	Nodule -	Crust -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -
Portion sampled	unknown -	unknown -	outer crust	unknown -	half -	cross section	half -	cross section	cross section	outer crust	half -
Nucleus	-	-	-	-	Undetermined	Undetermined	-	-	-	-	Undetermined
Reference	A368	A333	A261	A323	A437	A248	A240	A166	A197	A197	A437

Sequence#	2320022-00	2320026-01	2320028-01	2320028-02	2320028-04	2330001-00	2330001-01	2330023-03	2330024-01	2330024-02	2330027-00
Latitude	-26.033	-29.583	-27.943	-27.943	-27.943	-27.523	-27.523	-23.535	-22.937	-22.937	-21.897
Longitude	-157.967	-159.100	-159.785	-159.785	-159.785	-160.652	-160.652	-162.902	-162.080	-162.080	-160.913
Depth	5038	5252	4558	4558	4558	4990	4990	4993	4848	4848	4817
Si(wt.%)	5.90	6.30	-	-	-	-	-	6.76	5.85	5.84	6.38
Ti	.98	.89	-	-	-	-	-	-	-	-	-
Mn	14.1	13.4	16.0	14.6	15.1	17.3	17.5	15.9	17.8	21.8	19.6
Fe	18.2	18.4	18.4	16.4	16.6	17.5	17.8	26.9	23.5	23.5	20.0
Al	2.50	3.10	-	-	-	-	-	2.75	2.86	2.86	3.18
Co	.730	.540	.500	.590	.500	.520	.510	.540	.580	.580	.520
Ni	.320	.330	.420	.250	.340	.430	.410	.230	.440	.440	.470
Cu	.140	.230	.250	.150	.210	.240	.210	.120	.250	.250	.230
Ca	1.37	1.19	1.50	1.70	1.60	1.70	1.60	1.88	1.68	1.72	2.14
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	16.4	17.1	-	-	-	-	-	41.9	32.9	32.9	29.4
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	7200	6800	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	200	210	-	-	-	-	-	200	300	300	400
Pb	1800	1700	1100	1100	1000	1100	1100	-	-	-	-
Sr	930	890	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	520	560	600	500	500	600	600	700	800	800	700
Sample type	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -
Portion sampled	cross section	cross section	half -	quarter -	cross section	whole -	whole -	outer crust	2-5nodules composite	outer crust	2-5nodules composite
Nucleus	-	-	non-apparent	Undetermined	Rock	Undetermined	Undetermined	Undetermined	Undetermined	volcanic	Undetermined
Reference	A197	A197	A405	A405	A405	A405	A405	A293	A293	A293	A293

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2330035-01	2330053-00	2330056-04	2330063-00	2330065-01	2330069-03	2330074-00	2330077-00	2330077-01	2330082-02	2330088-00
Latitude	-27.652	-22.598	-22.780	-22.758	-22.662	-22.667	-22.808	-22.802	-22.802	-22.693	-23.213
Longitude	-160.015	-160.708	-160.727	-160.780	-160.788	-160.822	-160.863	-160.872	-160.872	-160.920	-160.973
Depth	4982	4465	4850	4850	4830	4850	2950	3055	3055	4535	4630
Si(wt.%)	6.85	-	-	-	5.78	5.13	-	-	-	-	-
Ti	-	1.29	1.10	.06	1.27	1.35	1.08	1.27	1.27	1.19	1.00
Mn	16.0	14.8	15.6	39.3	15.3	15.2	15.0	18.6	19.1	16.3	15.1
Fe	26.4	18.4	14.7	1.74	18.7	19.6	18.8	22.8	19.9	14.1	19.8
Al	2.43	-	-	-	3.09	2.92	-	-	-	-	-
Co	.570	.440	.650	.060	.510	.550	.530	.710	.520	.760	.300
Ni	.260	.330	.320	.150	.290	.210	.280	.460	.410	.310	.340
Cu	.110	.180	.110	.100	-	-	.090	.100	.070	.090	.120
Ca	1.79	-	-	-	1.59	1.59	-	-	-	-	-
Mg	-	-	-	-	1.39	1.39	-	-	-	-	-
Na	-	-	-	-	1.48	1.56	-	-	-	-	-
K	-	-	-	-	.54	.52	-	-	-	-	-
P	-	-	-	-	.27	.24	-	-	-	-	-
H_2O-	38.8	-	-	-	8.3	8.1	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	200	-	-	-	-	-	-	-	-	-	-
Pb	-	-	1800	400	-	-	-	2700	1400	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	700	-	520	900	-	-	-	600	700	-	-
Sample	Nodule	Crust	Crust	Crust	Nodule	Nodule	Crust	Crust	Crust	Nodule	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	outer	unknown	unknown	unknown	2-5nodules	outer	unknown	topside	underside	underside	unknown
sampled	crust	-	-	-	composite	crust	-	-	-	-	-
Nucleus	Undetermined	-	-	-	-	-	-	-	-	-	-
Reference	A293	A343	A343	A343	A390	A390	A343	A343	A343	A343	A343

Sequence#	2330090-00	2330091-00	2330092-00	2330092-01	2360113-00	2360114-00	2360115-00	2420023-00	2420023-01	2430025-01	2450014-00
Latitude	-24.920	-23.218	-27.233	-27.233	-23.550	-22.090	-22.550	-21.200	-21.200	-22.363	-22.683
Longitude	-161.337	-161.417	-162.247	-162.247	168.808	168.500	167.963	102.800	102.800	91.633	76.017
Depth	4960	4875	4260	4260	1345	800	1875	4962	4962	5280	4940
Si(wt.%)	-	-	-	-	3.21	3.25	6.46	-	-	5.88	-
Ti	.43	1.17	1.18	1.22	-	-	-	-	-	.64	-
Mn	9.13	16.1	15.5	15.4	19.9	14.8	10.6	1.40	.70	19.1	1.80
Fe	9.93	17.9	20.4	21.4	25.1	24.0	32.2	4.20	4.60	13.1	6.36
Al	-	-	-	-	-	-	-	-	-	2.20	6.94
Co	.280	.520	.540	.500	.650	.370	.480	.010	.010	.280	.040
Ni	.500	.470	.230	.250	.510	.360	.420	.100	.040	.450	.050
Cu	.240	.110	.120	.110	.110	.120	.090	.050	.030	.180	.040
Ca	-	-	-	-	-	-	-	-	-	2.03	1.03
Mg	-	-	-	-	-	-	-	-	-	1.01	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	.27	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	1300	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	28	36	30	-	-	3	-
Mo	-	-	-	-	-	-	-	-	-	380	-
Pb	-	1700	-	-	-	-	-	-	-	-	200
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	450	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	1000	-	-	-	-	-	-	-	-	280
Sample	Crust	Nodule	Nodule	Nodule	Mn-coated	Mn-coated	Mn-coated	Crust	Crust	Crust	Crust
type	-	-	-	-	rock	rock	rock	-	-	-	-
Portion	unknown	average	outer	nucleus	average	average	outer	unknown	unknown	outer	unknown
sampled	-	analysis	crust	-	analysis	analysis	crust	-	-	crust	-
Nucleus	-	-	-	-	Basalt	Basalt	Basalt	-	-	-	-
Reference	A343	A343	A343	A343	A349	A349	A349	A333	A333	A220	A467

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2450016-01	2450016-03	2450028-01	2460021-06	2460037-00	2460040-00	2460041-01	2460041-05	2460041-06	2460049-00	2470085-00
Latitude	-23.267	-23.267	-24.117	-25.833	-27.250	-29.300	-29.298	-29.298	-29.298	-22.600	-25.220
Longitude	74.983	74.983	72.433	65.517	61.033	60.650	60.602	60.602	60.602	64.983	57.390
Depth	4520	4520	4050	4450	5588	5415	4564	4564	4564	4449	3977
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.57	-	-	-	-	-	-	-	-	-	-
Mn	13.2	19.0	10.8	13.8	10.4	8.50	11.8	13.7	8.76	4.60	15.2
Fe	16.0	11.9	24.0	19.2	15.0	12.9	18.7	19.1	15.8	11.9	20.0
Al	-	-	2.31	2.73	-	3.04	-	1.85	2.06	6.41	-
Co	.210	.170	.160	.300	.240	.160	.270	.340	.230	.040	.500
Ni	.410	.740	.230	.300	.140	.170	.160	.210	.150	.200	.220
Cu	.190	.440	.170	.140	.150	.110	.060	.090	.060	.150	.100
Ca	-	-	1.82	1.89	1.30	1.84	1.80	1.84	1.66	1.41	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	1900	1100	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	14	25	-	-	-	-	-	-	-	-	-
Mo	220	-	-	-	-	-	-	-	-	-	-
Pb	300	-	900	1100	1200	800	1200	1400	900	200	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	390	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	1000	570	540	500	340	500	510	380	-	-
Sample type	Crust -	Crust -	Crust -	Crust -	Mn-encrusted sediment	Crust -	Mn-encrusted sediment	Crust -	Crust -	Crust -	Nodule -
Portion sampled	fragments -	unknown -	unknown -	unknown -	unknown -	unknown -	without nucleus	unknown -	unknown -	unknown -	average analysis
Nucleus	-	-	-	-	-	-	Sediment	-	-	-	-
Reference	A240	A323	A467	A467	A422	A467	A405	A467	A467	A467	A426

Sequence#	2490034-01	2510100-00	2520084-00	2630033-00	2640048-00	2650020-00	2660032-01	2670023-00	2670071-00	2670098-00	2670098-01
Latitude	-29.100	-29.617	-28.200	-10.633	-12.732	-18.600	-15.383	-17.600	-11.983	-16.483	-16.483
Longitude	36.733	10.133	2.750	-109.600	-113.608	-126.500	-136.300	-141.917	-144.367	-145.550	-145.550
Depth	3880	4838	3129	2134	3455	3477	4480	2132	4875	1270	1270
Si(wt.%)	5.50	-	-	5.80	-	6.96	-	4.50	-	1.30	2.00
Ti	-	-	-	-	-	-	.21	1.40	-	1.18	1.40
Mn	12.2	13.2	18.8	19.7	11.6	19.2	21.5	22.8	17.2	22.4	29.7
Fe	15.4	6.00	18.8	17.8	34.0	19.1	8.14	23.1	13.1	13.8	17.5
Al	-	6.52	-	1.64	-	2.43	-	1.60	-	.70	1.30
Co	.220	.070	.590	.680	.010	.390	.070	.700	.250	1.10	1.40
Ni	.140	.800	.430	.320	.100	.880	1.290	.480	.380	.580	.770
Cu	.060	.330	.160	-	.200	.120	.740	.130	.380	.170	.140
Ca	1.15	-	-	3.72	1.80	-	-	2.80	2.10	2.92	2.60
Mg	-	-	-	.24	-	-	-	1.20	-	-	2.10
Na	-	-	-	-	-	-	-	2.20	-	-	2.20
K	-	-	-	3.15	-	-	-	.50	-	.32	-
P	.18	-	-	-	-	-	-	-	-	.17	-
H_2O-	-	-	-	-	-	-	-	-	-	27.5	-
As(ppm)	300	-	-	-	-	-	-	-	-	-	-
Ba	900	-	-	-	-	-	1300	1300	-	5100	1200
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	5	6	-	-	-
Mo	370	190	-	-	-	-	400	500	-	560	420
Pb	1500	300	-	-	600	-	200	800	600	2500	3100
Sr	1000	-	-	-	-	-	-	1100	-	1600	1500
V	-	-	-	-	-	-	270	800	-	-	700
Y	126	-	-	-	-	-	-	410	-	-	340
Zn	400	80	-	-	700	-	-	500	600	670	400
Sample type	Mn-encrusted sediment	Crust -	Nodule -	Mn-coated rock	Crust -	Mn-coated rock	Crust -	Nodule -	Crust -	Nodule -	Nodule -
Portion sampled	outer crust	outer crust	without nucleus	outer crust	fragments -	outer crust	fragments -	2-5nodules composite	outer crust	whole -	2-5nodules composite
Nucleus	-	-	Undetermined	-	-	-	-	-	-	-	-
Reference	A388	A333	A333	A230	A405	A230	A240	A261	A437	A197	A261

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2670098-02	2670098-03	2670098-05	2670098-06	2670098-07	2670098-08	2670098-10	2670098-11	2670098-12	2670098-13	2670098-14
Latitude	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483	-16.483
Longitude	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550	-145.550
Depth	1270	1270	1270	1270	1270	1270	1270	1270	1270	1270	1270
Si(wt.%)	1.50	1.70	-	-	2.40	2.00	2.60	1.26	-	-	1.68
Ti	1.50	1.30	-	1.14	1.10	1.10	-	1.23	.94	1.10	-
Mn	30.3	32.2	41.1	16.9	-	24.5	20.5	22.3	25.4	24.5	29.4
Fe	18.9	17.5	13.8	11.3	15.9	11.5	11.6	13.0	14.3	11.5	14.8
Al	.70	1.10	-	-	-	1.50	-	.69	-	-	-
Co	1.60	1.40	1.16	1.80	1.30	1.15	.770	1.06	1.09	1.15	1.64
Ni	.064	.720	.960	.620	.750	.700	.580	-	.680	.700	.860
Cu	.120	.120	.120	.090	.140	.250	.090	-	.130	.250	.140
Ca	3.10	3.00	-	-	-	2.10	.94	2.07	-	2.10	2.84
Mg	1.60	1.40	-	-	2.30	1.00	.58	-	-	-	-
Na	2.20	1.80	-	-	-	-	-	-	-	-	-
K	.40	-	-	-	-	.40	-	-	-	.40	-
P	-	-	-	-	-	-	1.32	.05	-	-	.33
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	270
Ba	1600	1900	-	5800	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	700	570	-	590	720	-	-	-	330	-	570
Pb	2000	1900	3300	4700	-	-	-	-	1100	-	1900
Sr	1400	1700	-	-	-	-	-	-	-	-	1400
V	1000	800	-	650	750	-	-	-	2300	-	-
Y	260	240	-	-	-	-	-	-	-	-	186
Zn	-	500	-	-	-	1000	-	-	1300	1000	820
Sample type	Crust -	Unknown -	Nodule -	Nodule -	Unknown -	Nodule -	Unknown -	Unknown -	Unknown -	Nodule -	Nodule -
Portion sampled	cross section	unknown -	cross section	half -	unknown -	cross section	unknown -	unknown -	unknown -	unknown -	whole -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A261	A261	A166	A240	A201	A232	A261	A261	A261	A381	A388

Sequence#	2670098-15	2670117-01	2670119-00	2670119-01	2670119-02	2670119-03	2670119-04	2670130-01	2670130-03	2670130-06	2670130-07
Latitude	-16.483	-16.167	-17.000	-17.000	-17.000	-17.000	-17.000	-18.917	-18.917	-18.917	-18.917
Longitude	-145.550	-146.000	-146.000	-146.000	-146.000	-146.000	-146.000	-146.383	-146.383	-146.383	-146.383
Depth	1270	1190	1700	1700	1700	1700	1700	4465	4465	4465	4465
Si(wt.%)	-	.70	.70	1.30	.52	-	-	6.30	-	-	-
Ti	-	-	1.11	1.50	1.04	1.16	-	1.20	-	-	-
Mn	-	9.50	23.2	27.8	23.9	21.2	41.9	15.0	25.2	21.2	19.1
Fe	-	7.00	12.6	18.2	11.5	10.8	13.7	16.1	18.3	17.8	18.6
Al	-	1.30	.40	1.20	.56	-	-	3.40	-	-	-
Co	1.20	.460	1.53	2.30	1.52	2.53	1.52	.500	.580	.650	.600
Ni	.800	.300	.580	.800	.310	.350	.910	.230	.460	.340	.300
Cu	.200	.080	.950	.100	.060	.070	.090	.170	.180	.140	.150
Ca	-	4.00	3.14	3.60	2.87	-	-	2.08	-	2.42	2.26
Mg	-	2.10	-	2.40	1.65	-	-	-	-	-	-
Na	-	1.30	-	2.70	-	-	-	-	-	-	-
K	-	-	.34	.30	-	-	-	.50	-	-	-
P	-	-	.12	-	.21	-	-	.21	-	-	-
H_2O-	-	-	24.5	-	-	-	-	17.7	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	6600	1200	-	16000	-	5400	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	3.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	8	-	-	-	-	-	-	-
Mo	-	110	500	640	-	580	-	310	-	-	-
Pb	-	1300	2800	4000	-	3900	3600	1200	2300	1200	1200
Sr	-	-	1500	1400	-	-	-	1200	-	-	-
V	-	-	-	1000	-	650	-	-	-	-	-
Y	-	-	-	450	-	-	-	-	-	-	-
Zn	-	-	620	600	-	-	-	570	-	450	460
Sample type	Nodule -	Crust -	Nodule -	Crust -	Crust -	Crust -	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -
Portion sampled	unknown -	unknown -	cross section	cross section	unknown -	half -	cross section	cross section	cross section	without nucleus	without nucleus
Nucleus	-	-	-	-	-	-	-	-	-	Clay	Clay
Reference	A381	A261	A197	A261	A178	A240	A166	A197	A166	A200	A200

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2670130-10	2670202-00	2670224-01	2670243-00	2670252-00	2670252-01	2670252-02	2680002-00	2680008-02	2680008-03	2680009-00
Latitude	-18.917	-11.433	-13.567	-16.583	-13.250	-13.250	-13.250	-14.483	-13.883	-13.883	-13.883
Longitude	-146.383	-149.283	-149.300	-146.400	-148.500	-148.500	-148.500	-150.017	-150.583	-150.583	-150.583
Depth	4465	5106	4520	1900	4650	4650	4650	1789	3623	3623	3695
Si(wt.%)	5.10	-	-	-	24.9	6.10	9.30	-	-	-	-
Ti	-	1.34	-	.40	.71	1.34	1.50	-	.68	.46	-
Mn	18.0	18.1	16.3	21.1	.55	20.4	15.6	12.5	14.4	17.4	19.0
Fe	16.9	15.5	15.6	14.4	9.20	17.4	14.6	16.7	15.8	17.4	17.0
Al	-	-	-	-	6.50	.30	.50	-	-	-	-
Co	.560	.650	.530	.500	-	-	-	.460	.500	.510	.500
Ni	.320	.800	.450	.400	.020	-	-	.400	.350	.330	.400
Cu	.160	.320	.190	.300	.050	-	-	.180	.220	.300	.200
Ca	2.07	-	-	1.90	1.10	2.30	1.90	-	-	-	-
Mg	-	-	-	-	2.60	1.35	1.28	-	-	-	-
Na	-	-	-	-	2.60	1.36	1.98	-	-	-	-
K	-	-	-	.20	2.95	.83	1.41	-	-	-	-
P	.22	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	165	-	-	-	-	-	-	-	-	-	-
Ba	-	2900	-	-	133	-	-	-	1100	780	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	46	-	-	-	-	-	-
Cr	-	8	-	-	-	-	-	-	7	5	-
Mo	320	580	-	-	-	-	-	-	250	290	-
Pb	800	400	-	-	-	-	-	-	300	200	-
Sr	1000	-	-	-	75	-	-	-	-	-	-
V	-	540	-	-	-	-	-	-	430	370	-
Y	164	-	-	-	-	-	-	-	-	-	-
Zn	530	-	-	1000	270	20	30	-	-	-	-
Sample type	Nodule	Nodule	Nodule	Nodule	Mn-encrusted sediment	Mn-encrusted sediment	Mn-encrusted sediment	Crust	Nodule	Nodule	Nodule
Portion sampled	without nucleus	whole	??	unknown	nucleus	outer crust	layer-adjacent to-nucleus	unknown	half	half	composite
Nucleus	Clay	-	-	-	Sediment	Sediment	Sediment	-	-	-	-
Reference	A388	A240	A389	A381	A463	A463	A463	A179	A240	A240	A379

Sequence#	2680009-01	2680009-02	2680009-07	2680009-09	2680026-00	2680027-00	2680028-00	2680035-00	2680039-00	2680041-00	2680060-00
Latitude	-13.883	-13.883	-13.883	-13.883	-17.817	-17.808	-17.792	-17.867	-17.867	-18.997	-11.583
Longitude	-150.583	-150.583	-150.583	-150.583	-154.017	-154.033	-154.058	-154.133	-154.883	-155.005	-158.517
Depth	3695	3695	3695	3695	1260	983	1586	1836	4790	4605	5338
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	2.00	1.50	-	-	-	-	-	-	-	-	1.24
Mn	19.3	18.8	19.6	-	8.10	20.7	23.0	15.6	14.0	16.0	14.8
Fe	17.2	16.8	18.8	-	13.6	16.5	18.0	12.9	15.5	19.1	14.4
Al	-	-	-	-	-	-	.80	-	-	-	-
Co	.600	.500	.520	.500	.540	1.48	1.20	.064	.580	.540	.730
Ni	.350	.400	.320	.400	.200	.500	.460	.420	.240	.270	.260
Cu	.200	.150	.180	.200	.090	.150	.080	.080	.080	.180	.180
Ca	1.30	1.40	2.50	-	-	-	3.12	3.80	-	2.30	-
Mg	-	-	-	-	-	-	1.32	-	-	-	-
Na	-	-	-	-	-	-	1.10	-	-	-	-
K	.25	.30	-	-	-	-	.40	-	-	-	-
P	-	-	-	-	-	-	.42	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	2300
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	8
Mo	-	-	-	-	-	-	280	-	-	-	380
Pb	-	-	1000	-	-	-	-	-	-	1200	300
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	610
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1500	500	500	-	-	-	-	-	-	600	-
Sample type	Nodule	Nodule	Nodule	Nodule	Crust	Crust	Nodule	Nodule	Nodule	Nodule	Nodule
Portion sampled	unknown	unknown	half	unknown	unknown	unknown	unknown	unknown	unknown	half	half
Nucleus	-	-	non-apparent	-	-	-	-	-	-	Sediment	-
Reference	A381	A381	A422	A381	A179	A179	A419	A179	A179	A437	A240

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2680069-00	2680070-00	2680076-01	2680076-02	2680077-01	2680077-02	2680078-01	2680095-00	2690013-00	2690013-01	2690019-00
Latitude	-11.667	-12.450	-13.917	-13.917	-14.050	-14.050	-13.833	-11.062	-12.700	-12.700	-12.700
Longitude	-159.267	-159.383	-150.550	-150.550	-150.633	-150.633	-150.550	-156.165	-160.617	-160.617	-160.750
Depth	5146	4990	3755	3755	3760	3760	-	4820	4753	4753	3953
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	1.12	-	-	-	-	-	-	.81	-	-	-
Mn	15.4	17.7	20.0	18.1	18.1	16.9	14.8	19.2	18.7	-	18.6
Fe	15.4	17.4	12.5	11.3	14.8	13.8	12.3	15.9	19.4	-	20.5
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.540	.500	.630	.570	.540	.500	.540	.360	.680	.560	.610
Ni	.980	.410	.460	.420	.580	.540	.420	.430	.330	-	.220
Cu	.430	.310	.220	.200	.250	.230	.270	.250	.210	-	.100
Ca	-	1.80	-	-	-	-	-	-	3.10	-	2.80
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	1200	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	5.0	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	15	-	-	-	-	-	-	-	-	-	-
Mo	400	-	-	-	-	-	-	-	-	340	-
Pb	100	900	-	-	-	-	-	-	1300	1300	1200
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	2400	1800	1200
Sample	Nodule	Nodule	Nodule	Nodule	Nodule	Nodule	Nodule	Crust	Nodule	Nodule	Nodule
type	-	-	-	-	-	-	-	-	-	-	-
Portion	whole	whole	??	without	??	without	without	unknown	unknown	unknown	fragments
sampled	-	-	-	nucleus	-	nucleus	nucleus	-	-	-	-
Nucleus	-	Undetermined	-	-	-	-	-	-	-	-	-
Reference	A240	A422	A389	A389	A389	A389	A389	A343	A422	A303	A422

Sequence#	2690019-03	2690022-01	2690022-02	2690023-00	2690023-01	2690023-02	2690030-00	2690033-00	2690056-00	2690065-00	2690132-01
Latitude	-12.700	-12.700	-12.700	-11.850	-11.850	-11.850	-12.750	-12.733	-12.275	-18.597	-12.910
Longitude	-160.750	-160.817	-160.817	-160.850	-160.850	-160.850	-160.925	-160.933	-161.058	-161.527	-160.747
Depth	3953	3587	3587	3803	3803	3803	3500	3610	2720	4998	4300
Si(wt.%)	-	-	-	-	-	-	-	-	-	5.84	-
Ti	-	-	-	.79	.81	.96	-	-	-	1.11	1.20
Mn	-	17.8	-	16.9	15.7	16.6	15.8	15.9	19.1	14.4	13.8
Fe	-	19.9	-	18.0	18.1	18.5	13.9	13.3	18.3	18.4	17.0
Al	-	-	-	-	-	-	-	-	-	3.96	-
Co	.500	-	.410	.510	.660	.590	.540	-	-	.560	.250
Ni	-	.240	-	.300	.240	.230	.350	.350	.410	.110	.360
Cu	-	.150	-	.170	.160	.220	.290	.260	.120	.120	.220
Ca	-	-	-	-	-	-	2.70	-	-	2.29	-
Mg	-	-	-	-	-	-	-	-	-	.78	-
Na	-	-	-	-	-	-	-	-	-	1.50	-
K	-	-	-	-	-	-	-	-	-	.67	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	20.2	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	1100	440	1300	-	-	-	-	-
Cd	4.0	-	1.0	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	5	4	7	-	-	-	-	-
Mo	340	-	270	270	240	210	-	-	-	-	-
Pb	1200	-	800	300	300	2200	700	-	-	1900	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	420	380	420	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1000	-	2000	-	-	-	1800	-	-	-	-
Sample	Nodule	Crust	Crust	Nodule	Nodule	Nodule	Crust	Crust	Crust	Nodule	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	fragments	fragments	unknown	half	whole	outer	unknown	fragments	unknown	without	fragments
sampled	-	-	-	-	-	crust	-	-	-	nucleus	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A303	A321	A303	A240	A240	A343	A405	A321	A321	A343	A343

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2690132-04	2690132-12	2690137-00	2690138-00	2690139-00	2690142-00	2690144-00	2690146-00	2690188-00	2690197-00	2710120-00
Latitude	-12.910	-12.910	-19.767	-19.710	-19.680	-19.775	-19.752	-15.573	-15.140	-11.917	-11.317
Longitude	-160.747	-160.747	-161.788	-161.833	-161.887	-161.908	-161.942	-164.590	-166.900	-169.533	178.200
Depth	4300	4300	4070	4825	4330	4985	5060	5540	5372	-	770
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	1.32	1.27	1.57	1.41	1.53	1.27	1.01	1.32	-	-	-
Mn	12.5	15.3	11.8	13.0	13.2	13.8	16.8	18.6	3.40	19.9	34.2
Fe	17.8	16.2	19.5	19.6	21.3	15.7	15.5	14.7	21.0	16.1	17.4
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.330	.570	.540	.310	.510	.320	.330	.550	.290	.690	.850
Ni	.390	.290	.280	.190	.350	.500	.064	.390	.030	.290	.540
Cu	.250	.140	.170	.110	.100	.220	.330	.210	.090	.010	.050
Ca	-	-	-	-	-	-	-	-	-	2.60	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	1300	-	1700	3500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	550	-	300	-
Sample type	Crust -	Nodule -	Nodule -	Crust -	Nodule -	Mn-coated rock	Mn-coated rock	Nodule -	Crust -	Crust -	Nodule -
Portion sampled	fragments -	layeradjacent tonucleus	without nucleus	unknown -	without nucleus	outer crust	outer crust	outer crust	whole -	unknown -	cross section
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A343	A343	A343	A343	A343	A343	A343	A343	A414	A437	A166

Sequence#	2710120-01	2720050-00	2770039-00	2770039-01	2780082-00	2780095-00	2780098-00	2790066-00	2790094-00	2790095-00	2790095-01
Latitude	-11.317	-17.450	-10.850	-10.850	-15.883	-10.833	-11.817	-13.250	-11.833	-17.883	-17.883
Longitude	178.200	163.667	113.017	113.017	102.950	104.633	102.900	93.200	96.967	99.100	99.100
Depth	770	1310	5150	5150	5579	3850	5078	5325	3080	5471	5471
Si(wt.%)	-	2.56	-	12.0	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	.63	-	-	-
Mn	11.0	23.0	18.4	16.0	20.8	10.6	15.8	15.4	1.60	10.6	15.2
Fe	10.8	18.6	12.6	12.2	15.4	14.3	12.8	10.5	18.1	10.6	12.4
Al	-	1.20	-	-	-	-	-	-	-	-	-
Co	.440	.600	.090	.050	.320	.270	.110	.120	.040	.170	.200
Ni	.260	.330	.680	.610	.530	.180	.510	.570	.030	.190	.540
Cu	.070	.070	.190	.190	.310	.120	.270	.830	.050	.130	.240
Ca	-	3.18	2.02	1.84	1.80	-	-	-	-	-	-
Mg	-	1.32	-	-	-	-	-	-	-	-	-
Na	-	1.64	-	-	-	-	-	-	-	-	-
K	-	.36	-	-	-	-	-	-	-	-	-
P	-	-	-	.07	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	890	-	-	-	-	-	-	1700	-	-	-
Cd	-	-	4.0	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	24	16	-	-	-	-	-	12	-	-	-
Mo	-	-	-	-	-	-	-	280	-	-	-
Pb	-	-	1000	-	1300	-	-	500	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	430	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	5000	-	850	1100	600	-	-	-	-	-	-
Sample type	Crust -	Crust -	Mn-encrusted sediment	Mn-encrusted sediment	Mn-coated rock	Crust -	Mn-coated rock	Crust -	Mn-coated rock	Crust -	Crust -
Portion sampled	unknown -	cross section	outer crust	outer crust	outer crust	unknown -	outer crust	fragments -	unknown -	whole -	outer crust
Nucleus	-	-	Clay	Clay	-	-	-	-	-	-	-
Reference	A323	A349	A200	A388	A422	A451	A451	A240	A333	A333	A333

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2790105-00	2790106-00	2790113-00	2790115-00	2790119-00	2790123-01	2790126-00	2790127-00	2800039-01	2800081-00	2800082-00
Latitude	-13.017	-13.017	-13.017	-12.583	-15.767	-15.767	-15.767	-15.767	-17.333	-12.767	-12.767
Longitude	91.250	91.250	91.250	95.400	99.900	99.900	99.900	99.900	84.383	88.900	88.900
Depth	4400	4260	4760	1500	5000	5600	3760	3420	5010	5180	4480
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	13.8	19.1	18.8	21.8	18.6	9.89	16.7	17.1	3.52	5.60	14.3
Fe	12.5	12.6	15.2	10.9	12.5	14.7	13.5	14.9	5.89	6.20	10.6
Al	-	-	-	-	-	-	-	-	7.60	-	-
Co	.240	.240	.270	.560	.260	.100	.680	.530	.070	.050	.170
Ni	.340	.470	.500	.560	.360	.530	.650	.280	.080	.180	.350
Cu	.180	.170	.090	.100	.130	.220	.130	.060	.060	.120	.190
Ca	-	-	-	-	-	-	-	-	.58	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	400	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	210	-	-
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Several crusts	Nodule -	Nodule -	Crust -	Crust -	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	outer crust	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A451	A451	A451	A451	A451	A451	A451	A451	A467	A451	A451

Sequence#	2800083-00	2800084-00	2800086-00	2810005-00	2820022-00	2820039-00	2820060-00	2820062-00	2820130-00	2840074-00	2890019-00
Latitude	-12.767	-12.767	-10.017	-18.800	-10.092	-17.588	-18.342	-10.417	-19.232	-14.167	-9.960
Longitude	88.900	88.900	88.017	78.150	66.418	65.653	63.638	63.250	61.022	41.567	-5.387
Depth	4750	4830	4620	4934	2422	2502	3451	3115	3260	1485	1394
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	15.2	19.3	15.4	12.8	1.50	14.8	6.93	11.9	11.8	14.7	24.0
Fe	10.6	8.55	13.7	11.2	9.61	22.7	15.7	22.0	23.8	17.3	18.0
Al	-	-	-	-	7.46	1.09	4.45	1.63	-	-	-
Co	.200	.140	.130	.160	.030	.180	.100	.170	.220	.280	1.44
Ni	.580	1.010	.360	.460	.060	.210	.120	.150	.170	.180	.430
Cu	.230	.480	.280	.270	.070	.090	.110	.090	.130	-	.050
Ca	-	-	-	1.50	1.47	2.95	2.22	2.05	2.31	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	200	600	400	700	800	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	350	540	370	590	580	-	-
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A451	A451	A451	A179	A467	A467	A467	A467	A467	A416	A179

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	2900014-00	2900014-01	2900024-00	2900024-01	2970068-00	2990009-00	2990022-00	2990080-00	3040029-00	3040103-00	3040105-00
Latitude	-5.783	-5.783	-8.350	-8.350	-1.762	-8.125	-7.833	-3.713	-5.817	-4.978	-4.982
Longitude	-11.417	-11.417	-13.200	-13.200	-85.903	-104.175	-108.133	-102.870	-154.650	-154.993	-154.983
Depth	2380	2380	2265	2265	2611	3814	1567	3649	4768	4800	4990
Si(wt.%)	-	-	-	-	-	4.70	12.1	-	-	-	-
Ti	-	-	-	-	-	.14	.88	-	-	-	-
Mn	25.2	11.3	12.4	11.5	23.9	23.0	5.59	23.2	4.20	-	14.1
Fe	22.9	21.5	23.1	21.7	15.2	14.3	13.0	24.3	9.50	9.70	8.90
Al	-	-	-	-	-	1.30	3.44	-	-	-	-
Co	.620	.240	.480	.440	.070	.550	-	.230	-	.140	.190
Ni	.340	.140	.150	.150	.880	1.000	-	.320	.270	.140	.890
Cu	.050	.070	.040	.030	.100	.700	-	.010	.250	.130	.580
Ca	-	2.90	5.30	4.80	-	1.39	4.54	.60	-	1.70	1.00
Mg	-	1.61	-	-	-	-	.02	-	-	-	-
Na	-	3.18	-	-	-	-	.00	-	-	-	-
K	-	.34	-	-	-	.49	.54	-	-	-	-
P	-	-	-	-	-	.11	-	-	-	-	-
H_2O-	-	-	-	-	-	17.8	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	5000	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	320	-	-	-	-	-
Pb	3500	1200	1100	1100	400	500	-	800	-	300	300
Sr	-	-	-	-	-	820	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	600	500	500	910	1100	-	190	-	500	1200
Sample	Nodule	Crust	Mn-coated	Mn-coated	Crust	Nodule	Mn-coated	Crust	Crust	Crust	Mn-coated
type	-	-	rock	rock	-	-	rock	-	-	-	rock
Portion	cross	unknown	without	without	??	whole	unknown	unknown	unknown	fragments	half
sampled	section	-	nucleus	nucleus	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	Undetermined	non-apparent	-
Reference	A166	A368	A405	A405	A291	A197	A230	A376	A321	A376	A376

Sequence#	3040105-01	3040115-00	3050010-00	3050029-00	3050029-03	3050039-00	3050039-02	3050039-03	3050072-01	3050076-01	3050090-00
Latitude	-4.982	-2.018	-8.080	-2.292	-2.292	-9.805	-9.805	-9.805	-4.233	-4.233	-8.275
Longitude	-154.983	-158.523	-160.550	-163.958	-163.958	-164.743	-164.743	-164.743	-168.283	-168.283	-168.508
Depth	4990	5080	4243	5243	5243	4199	4199	4199	5204	5230	4565
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	-	12.8	14.9	-	18.6	20.3	19.5	-	19.9	-	23.1
Fe	-	8.00	21.1	-	11.5	-	31.9	-	18.3	-	-
Al	-	-	-	-	-	-	-	-	-	-	2.36
Co	-	.150	-	.280	.330	.460	-	-	.580	.530	.500
Ni	-	.770	.100	-	.650	.200	.280	-	.300	-	.300
Cu	-	.540	.110	-	.410	.130	.100	-	.160	-	.150
Ca	-	2.20	-	-	1.90	-	-	-	2.60	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	33.0	-	27.8	-	-
As(ppm)	235	-	-	-	-	-	-	330	-	-	-
Ba	980	-	-	-	-	-	-	1800	-	-	3
Cd	12.0	-	-	4.0	-	4.0	-	4.0	-	4.0	5.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	25	-	-	-	-	17	-	13	-	-	-
Mo	-	-	-	260	-	450	-	-	-	310	270
Pb	-	500	-	700	700	-	-	-	1000	1200	1100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	690	-	-	-	-	630
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	800	-	520	800	690	-	-	600	570	490
Sample	Mn-coated	Mn-coated	Mn-coated	Crust	Crust	Crust	Crust	Crust	Nodule	Nodule	Nodule
type	rock	rock	rock	-	-	-	-	-	-	-	-
Portion	half	half	outer	fragments	fragments	fragments	unknown	unknown	cross	unknown	half
sampled	-	-	crust	-	-	-	-	-	section	-	-
Nucleus	-	-	Clay	-	-	-	-	-	Clay	-	non-apparent
Reference	A475	A376	A321	A303	A422	A301	A321	A475	A422	A303	A303

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3050091-00	3050092-00	3050095-03	3050095-04	3050095-05	3050095-06	3050095-07	3050095-08	3050100-00	3050100-01	3050104-00
Latitude	-8.283	-8.287	-8.817	-8.817	-8.817	-8.817	-8.817	-8.817	-7.517	-7.517	-7.675
Longitude	-168.520	-168.528	-168.550	-168.550	-168.550	-168.550	-168.550	-168.550	-168.817	-168.817	-161.613
Depth	4751	4758	4550	4550	4550	4550	4550	4550	5288	5288	4540
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	22.0	21.8	-	18.3	19.6	-	-	-	-	15.4	21.1
Fe	-	-	-	16.6	17.8	-	-	-	-	20.2	16.8
Al	-	2.16	-	-	-	-	-	-	-	-	-
Co	.530	.660	.350	-	-	-	-	.490	.310	.430	.390
Ni	.260	.330	-	.350	.380	-	-	-	-	.140	.390
Cu	.150	.110	-	.220	.280	-	-	-	-	.130	.130
Ca	-	-	-	-	-	-	-	-	-	2.20	.29
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	27.9	31.2	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	3	-	-	-	-	-	-	-	-	-
Cd	4.0	5.0	6.0	-	-	-	-	4.0	6.0	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	13	-	-	-	-	-	-	-	-	-	-
Mo	370	350	188	-	-	-	-	270	178	-	-
Pb	-	1100	900	-	-	-	-	800	1000	1000	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	660	660	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	600	470	500	-	-	-	-	390	460	600	570
Sample	Nodule	Nodule	Crust	Crust	Crust	Crust	Crust	Crust	Mn-encrusted	Mn-encrusted	Crust
type	-	-	-	-	-	-	-	-	sediment	sediment	-
Portion	unknown	half	whole	whole	unknown	unknown	unknown	unknown	outer	outer	unknown
sampled	-	-	-	-	-	-	-	-	crust	crust	-
Nucleus	-	Clay	-	-	-	-	-	-	Sediment	Sediment	-
Reference	A301	A303	A303	A321	A321	A303	A303	A303	A303	A422	A324

Sequence#	3050104-01	3050115-02	3050117-00	3050117-01	3050127-00	3050129-02	3050130-01	3060045-00	3140168-01	3150023-00	3150065-00
Latitude	-7.675	-1.265	-1.297	-1.297	-8.317	-7.740	-7.397	-6.233	-9.133	-5.383	-6.733
Longitude	-161.613	-168.243	-168.390	-168.390	-168.550	-168.553	-168.548	-176.717	104.667	97.483	90.267
Depth	4540	6965	6730	6730	4482	4700	5471	5853	5330	3558	3906
Si(wt.%)	-	-	-	-	4.90	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	.29	-
Mn	18.3	19.9	19.6	20.9	20.2	-	18.5	15.9	15.2	14.6	4.60
Fe	14.6	15.9	20.7	20.3	18.1	-	17.8	17.5	11.8	15.9	3.80
Al	-	-	-	-	1.75	-	-	-	-	-	-
Co	.480	.810	.320	.380	.660	.550	.520	.250	.090	.070	.090
Ni	.440	.360	.250	.230	.300	-	.440	.310	.580	.360	.210
Cu	.060	.090	.170	.140	.030	-	.320	.200	.260	.300	.180
Ca	.60	2.40	1.90	2.20	2.26	-	2.50	.90	-	-	-
Mg	-	-	-	-	1.21	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	1300	-
Cd	-	-	-	-	-	9.0	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	3	-
Mo	-	-	-	-	-	212	-	-	-	180	-
Pb	-	1000	900	1000	1200	900	900	-	-	400	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	350	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	630	400	400	400	540	480	600	580	-	-	-
Sample	Crust	Nodule	Crust	Crust	Nodule	Nodule	Nodule	Crust	Mn-coated	Crust	Mn-coated
type	-	-	-	-	-	-	-	-	rock	-	material
Portion	unknown	quarter	fragments	fragments	unknown	outer	half	unknown	outer	fragments	outer
sampled	-	-	-	-	-	crust	-	-	crust	-	crust
Nucleus	-	non-apparent	-	-	-	Rock	Tooth	-	Basalt	-	organic
Reference	A324	A405	A405	A405	A284	A303	A422	A324	A451	A240	A333

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3150077-00	3190018-00	3190028-00	3190029-00	3190029-01	3190044-00	3190044-01	3190078-00	3190078-01	3190078-02	3190080-00
Latitude	-9.600	-7.332	-2.133	-2.100	-2.100	-9.650	-9.650	-6.667	-6.667	-6.667	-6.600
Longitude	90.483	57.937	57.400	57.383	57.383	56.417	56.417	51.900	51.900	51.900	51.567
Depth	4850	2421	4133	4041	4041	2800	2800	2900	2900	2900	2990
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	1.76	.91	1.29	1.40	-	1.14	-	-	-
Mn	15.0	4.50	18.4	15.4	14.5	15.2	19.6	13.5	32.1	22.6	23.8
Fe	15.1	15.7	16.4	17.9	19.1	13.6	19.7	15.6	16.7	17.2	18.8
Al	-	4.29	-	-	-	-	-	-	-	-	-
Co	.160	.280	.810	.590	.350	1.000	.880	.880	.600	1.22	.680
Ni	.360	.090	.470	.340	.320	.390	.480	.340	.580	.530	.480
Cu	.220	.090	.050	.080	.060	.070	.130	.050	.080	.080	.300
Ca	-	2.50	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	29.3	-	-	32.3	29.6
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	1400	1400	1800	4000	-	2200	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	14	20	21	5	-	13	-	-	-
Mo	-	-	280	350	290	470	-	470	-	-	-
Pb	-	1600	800	400	1400	2600	-	2500	2400	-	-
Sr	-	-	810	-	-	-	-	-	-	-	-
V	-	-	860	590	840	740	-	650	-	-	-
Y	-	-	140	-	-	-	-	-	-	-	-
Zn	-	440	470	-	-	-	-	-	-	-	-
Sample type	Crust	Crust	Crust	Crust	Crust	Crust	Unknown	Crust	Nodule	Unknown	Unknown
Portion sampled	unknown	unknown	unknown	fragments	fragments	fragments	unknown	fragments	cross section	unknown	unknown
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A451	A467	A203	A240	A240	A240	A409	A240	A166	A409	A409

Sequence#	3190080-01	3190093-00	3190093-01	3190093-02	3190093-03	3190093-04	3190093-05	3190093-06	3190093-07	3190093-08	3190093-09
Latitude	-6.600	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555
Longitude	51.567	57.278	57.278	57.278	57.278	57.278	57.278	57.278	57.278	57.278	57.278
Depth	2990	3398	3398	3398	3398	3398	3398	3398	3398	3398	3398
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	.70	.70	.75	.70	.74	.71	.74
Mn	38.3	18.8	16.2	15.5	16.1	14.4	15.0	12.7	16.0	14.3	14.1
Fe	17.1	20.1	20.6	16.2	19.9	21.0	17.8	16.0	21.3	19.7	20.2
Al	-	-	1.63	2.55	1.62	1.06	2.02	2.50	.88	2.18	1.29
Co	.720	.590	.360	.180	.530	.300	.280	.260	.270	.240	.280
Ni	.710	.360	.270	.440	.260	.170	.240	.230	.180	.220	.190
Cu	.080	.070	.080	.260	.090	.050	.110	.110	.050	.080	.050
Ca	-	3.00	2.03	1.71	1.93	1.72	1.71	1.69	2.36	1.59	1.76
Mg	-	-	-	-	1.08	.95	1.02	1.09	1.04	1.04	1.03
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	7.0	5.0	6.0	6.0	6.0	5.0	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	2900	1300	1400	1100	1200	1200	1000	800	1100	1000	1100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	490	510	750	520	510	450	420	580	550	500
Sample type	Nodule	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
Portion sampled	cross section	fragments	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A166	A376	A433	A433	A433	A433	A433	A433	A433	A433	A433

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3190093-10	3190093-11	3190093-12	3190093-13	3190093-14	3190093-15	3190093-16	3190093-17	3190093-18	3190101-00	3190101-01
Latitude	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-2.555	-1.225	-1.225
Longitude	57.278	57.278	57.278	57.278	57.278	57.278	57.278	57.278	57.278	56.025	56.025
Depth	3398	3398	3398	3398	3398	3398	3398	3398	3398	4480	4480
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.58	.64	.58	.80	.81	.82	.75	.83	.69	-	1.13
Mn	14.5	13.4	12.8	16.5	15.8	14.9	19.6	13.4	15.4	18.3	19.1
Fe	20.5	19.6	18.2	20.7	18.3	17.7	20.4	21.5	21.1	19.4	18.0
Al	.87	2.15	2.48	.98	1.63	1.87	.59	1.68	1.01	1.43	-
Co	.230	.200	.170	.370	.340	.320	.410	.290	.270	.540	.630
Ni	.160	.190	.170	.210	.280	.250	.240	.240	.170	.290	.280
Cu	.050	.060	.060	.040	.090	.100	.050	.130	.080	.070	.050
Ca	2.18	1.77	1.80	2.12	2.80	1.70	2.38	2.01	1.84	1.85	1.80
Mg	.97	1.01	1.07	1.02	1.10	1.16	.98	1.10	.96	-	1.02
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	7.0	8.0	7.0	6.0	6.0	7.0	6.0	6.0	7.0	-	6.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1000	900	700	1200	1100	1100	1200	1000	1200	1600	1300
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	590	530	540	530	490	480	590	550	520	500	490
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Sequence#	3190101-02	3190101-03	3260221-00	3260221-01	3260221-02	3280016-01	3280016-02	3290001-00	3350037-00	3350037-01	3350075-00
Latitude	-1.225	-1.225	.350	.350	.350	6.050	6.050	9.650	9.950	9.950	9.138
Longitude	56.025	56.025	-17.517	-17.517	-17.517	-32.367	-32.367	-40.450	-108.800	-108.800	-105.450
Depth	4480	4480	1712	1712	1712	3020	3020	2388	1228	1228	2651
Si(wt.%)	-	-	-	-	-	-	-	-	4.40	-	-
Ti	1.22	1.14	-	-	-	-	-	-	-	.70	-
Mn	18.0	16.9	17.3	23.1	17.7	9.01	12.5	15.2	31.5	44.4	19.4
Fe	17.6	19.0	14.8	13.3	20.4	19.7	24.5	22.2	10.3	8.07	20.2
Al	1.23	1.77	-	-	-	-	-	-	-	-	-
Co	.530	.450	.320	.720	.500	.430	.280	.510	.500	.760	.130
Ni	.290	.280	.280	.430	.200	.140	.160	.170	.740	.940	.660
Cu	.090	.120	.060	.030	.070	.090	.070	.020	.030	.040	.290
Ca	1.83	1.66	-	5.10	-	-	2.66	2.42	-	-	2.00
Mg	1.05	1.09	-	1.25	-	-	1.43	1.40	-	-	-
Na	-	-	-	3.23	-	-	1.43	1.40	-	-	-
K	-	-	-	.40	-	-	.31	.20	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	5.0	6.0	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	700	-
Pb	13000	14000	-	1600	-	200	900	1400	2200	1800	400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	490	470	-	630	-	-	570	580	-	-	1000
Sample	Crust	Crust	Crust	Nodule	Nodule	Crust	Crust	Crust	Nodule	Nodule	Mn-coated
type	-	-	-	-	-	-	-	-	-	-	rock
Portion	unknown	unknown	unknown	unknown	unknown	fragments	unknown	unknown	nucleus	cross	topside
sampled	-	-	-	-	-	-	-	-	-	section	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A179	A368	A419	A240	A368	A368	A240	A166	A422

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3350075-01	3350075-02	3350075-03	3350075-04	3350090-08	3350090-09	3350109-00	3350124-00	3350124-03	3350124-06	3380111-02
Latitude	9.138	9.138	9.138	9.138	8.157	8.157	8.803	8.825	8.825	8.825	9.100
Longitude	-105.450	-105.450	-105.450	-105.450	-104.457	-104.457	-103.892	-103.917	-103.917	-103.917	-139.750
Depth	2651	2651	2651	2651	3325	3325	1822	2095	2095	2095	5040
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	.34	-	-	-	-	.01	.33
Mn	8.06	13.6	-	-	14.5	13.2	22.1	12.8	42.6	-	17.6
Fe	19.6	24.7	-	-	22.4	23.9	16.8	20.6	-	-	6.70
Al	-	-	-	-	-	-	-	-	-	.09	-
Co	-	-	.070	.060	.130	-	.670	.070	-	-	.064
Ni	.110	.150	-	-	.270	.140	.450	.170	-	-	1.090
Cu	.120	.100	-	-	.210	.120	.020	.040	-	-	1.220
Ca	-	-	-	-	1.90	-	3.00	3.10	9.00	-	1.00
Mg	-	-	-	-	-	-	-	-	-	.92	-
Na	-	-	-	-	-	-	-	-	-	3.14	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	920	-
Cd	-	-	10.0	4.0	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	310	175	-	-	-	-	-	-	-
Pb	-	-	200	200	400	-	1200	400	-	-	500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	1100	720	600	-	600	600	-	-	1000
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Crust -	Mn-coated rock	Crust -	Crust -	Crust -	Nodule -
Portion sampled	layer-adjacent to-nucleus	underside -	underside -	topside -	fragments -	fragments -	outer crust	fragments -	fragments -	fragments -	without nucleus
Nucleus	-	-	-	-	-	-	-	volcanic	-	-	-
Reference	A342	A342	A303	A303	A342	A342	A405	A437	A437	A465	A405

Sequence#	3390080-01	3390102-01	3390348-00	3400111-04	3400135-05	3400233-00	3400236-00	3400241-02	3400241-03	3400265-07	3410013-00
Latitude	8.033	8.897	9.293	7.750	7.433	8.718	8.695	9.333	9.333	7.970	5.872
Longitude	-149.900	-146.492	-146.050	-150.683	-151.783	-150.235	-150.312	-150.807	-150.807	-152.287	-160.848
Depth	5073	5225	5000	-	-	4978	5009	4839	4839	5189	1604
Si(wt.%)	-	-	-	13.7	1.54	-	-	-	-	-	-
Ti	.78	-	-	-	-	-	-	-	-	-	-
Mn	14.0	27.6	24.0	17.9	4.50	23.4	17.6	21.6	16.7	27.4	23.0
Fe	21.3	6.60	6.50	7.00	1.10	11.9	11.8	10.8	14.6	5.26	16.6
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.510	.220	-	.290	.050	.680	.530	.540	.560	.570	.550
Ni	.064	1.550	1.100	1.000	.250	.940	.630	.790	.670	1.530	.400
Cu	.950	1.130	.800	.860	.220	.520	.670	.630	.700	1.580	.020
Ca	-	1.40	-	-	-	2.20	1.70	-	-	1.70	7.20
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	28.6
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	7500	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	10	-	-	-	-	-	-	-	-	-	-
Mo	180	-	-	-	-	-	-	-	-	-	-
Pb	1600	500	-	500	200	900	800	-	-	400	1500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	420	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	1300	-	1100	600	800	800	600	700	1400	900
Sample type	Unknown -	Crust -	Crust -	Mn-coated rock	Mn-coated material	Nodule -	Nodule -	Nodule -	Nodule -	Nodule -	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	fragments -	whole -	half -	half -	half -	outer crust
Nucleus	-	-	-	volcanic	organic	-	-	-	-	Mn-oxide	-
Reference	A189	A405	A446	A326	A326	A376	A376	A448	A448	A376	A422

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3410013-01	3410021-00	3410021-01	3410021-02	3410021-03	3410170-00	3410170-01	3410170-02	3410170-03	3410170-04	3410186-00
Latitude	5.872	5.232	5.232	5.232	5.232	8.330	8.330	8.330	8.330	8.330	8.340
Longitude	-160.848	-161.497	-161.497	-161.497	-161.497	-164.362	-164.362	-164.362	-164.362	-164.362	-164.390
Depth	1604	1307	1307	1307	1307	1519	1519	1519	1519	1519	1640
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	.75
Ti	-	-	-	-	-	-	-	-	-	-	.89
Mn	-	18.9	26.0	-	-	28.5	27.7	-	-	34.9	26.3
Fe	-	11.8	14.5	-	-	11.8	22.8	-	-	13.4	9.88
Al	-	-	-	-	-	-	-	-	-	-	.47
Co	1.33	-	-	1.17	.410	-	-	1.24	.850	1.61	1.02
Ni	-	.620	.440	-	-	.680	.770	-	-	.830	.790
Cu	-	.020	.020	-	-	.030	.050	-	-	.050	.080
Ca	-	-	-	-	-	-	-	-	-	-	2.06
Mg	-	-	-	-	-	-	-	-	-	-	1.28
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	.27
H_2O-	-	35.1	34.4	-	-	35.9	33.7	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	4.0	-	-	3.0	5.0	-	-	4.0	6.0	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	1000	-	-	950	1100	-	-	860	810	-	-
Pb	1500	-	-	2000	1900	-	-	1900	2000	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	650	-	-	490	560	-	-	690	740	-	800
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Nodule	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	average
sampled	-	-	-	-	-	-	-	-	-	-	analysis
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A303	A321	A321	A303	A303	A321	A321	A303	A303	A418	A363

Sequence#	3420007-01	3420015-00	3420039-00	3420039-01	3420100-00	3420113-00	3420113-01	3430021-00	3470359-00	3470359-01	3470359-02
Latitude	9.817	7.067	7.317	7.317	.900	5.002	5.002	8.317	7.455	7.455	7.455
Longitude	-170.983	-171.700	-175.467	-175.467	-179.333	-173.012	-173.012	176.417	136.407	136.407	136.407
Depth	4875	5386	5190	5190	3091	5280	5280	5097	3555	3555	3555
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.69	.93	.98	.53	-	-	-	-	-	-	-
Mn	18.2	18.6	19.0	18.0	22.6	19.3	20.7	17.2	21.6	18.1	-
Fe	13.3	16.7	12.9	17.1	20.6	12.0	13.1	10.8	17.2	21.1	-
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.500	.510	.560	.690	.380	.540	.580	.370	-	-	.480
Ni	.860	.470	.830	.710	.340	.630	.680	1.040	.380	.200	-
Cu	.690	.210	.800	.790	.110	.540	.580	.600	.050	.050	-
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	24.3	25.9	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	1600	1900	2000	600	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	5.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	6	4	2	2	-	-	-	-	-	-	-
Mo	390	450	320	280	-	-	-	-	-	-	540
Pb	500	200	100	700	-	600	600	-	-	-	100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	390	600	460	370	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	680	720	-	-	-	680
Sample	Nodule	Unknown	Nodule	Nodule	Crust	Nodule	Nodule	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	quarter	fragments	half	half	unknown	whole	whole	unknown	fragments	fragments	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A240	A240	A240	A240	A333	A361	A361	A179	A342	A342	A303

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3470359-03	3470363-00	3470363-01	3470366-00	3530147-00	3540040-00	3540041-00	3540066-00	3540066-01	3540066-02	3540066-03
Latitude	7.455	7.433	7.433	5.028	.000	5.600	5.567	2.942	2.942	2.942	2.942
Longitude	136.407	133.715	133.715	130.400	73.033	61.883	61.867	60.057	60.057	60.057	60.057
Depth	3555	3869	3869	1600	1728	2176	2331	4042	4042	4042	4042
Si(wt.%)	-	-	-	-	-	-	-	8.70	19.5	7.10	7.90
Ti	-	-	-	-	-	.69	.50	.69	.33	.59	.62
Mn	-	.07	-	6.00	8.61	13.8	16.6	16.5	7.30	17.5	16.7
Fe	-	2.97	-	12.5	15.6	19.8	22.5	18.0	12.6	19.3	16.7
Al	-	-	-	-	1.91	-	-	-	-	-	-
Co	.350	-	.030	.260	.260	.410	.260	.240	.100	.230	.230
Ni	-	.030	-	.170	.190	.280	.250	.210	.190	.230	.250
Cu	-	.420	-	.020	.030	.030	.050	.090	.150	.060	.060
Ca	-	-	-	-	8.14	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	1800	1700	-	-	-	-
Cd	4.0	-	8.0	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	18	16	20	59	14	16
Mo	450	-	23	-	-	420	430	650	560	750	810
Pb	100	-	100	900	1100	600	200	1200	200	700	700
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	690	670	820	760	940	910
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	660	-	290	420	470	-	-	370	190	240	550
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	unknown -	fragments -	unknown -	unknown -	unknown -	fragments -	fragments -	topside -	underside -	unknown -	topside -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A303	A342	A303	A343	A467	A240	A240	A217	A217	A217	A217

Sequence#	3540066-04	3540066-27	3540066-28	3540066-29	3540066-30	3540066-31	3540066-32	3540070-00	3540070-01	3540070-02	3540070-03
Latitude	2.942	2.942	2.942	2.942	2.942	2.942	2.942	2.967	2.967	2.967	2.967
Longitude	60.057	60.057	60.057	60.057	60.057	60.057	60.057	60.047	60.047	60.047	60.047
Depth	4042	4042	4042	4042	4042	4042	4042	4093	4093	4093	4093
Si(wt.%)	14.8	-	-	-	-	-	-	8.10	10.1	6.40	9.50
Ti	.28	.59	.71	.44	.61	.54	.56	.43	.55	.45	.78
Mn	11.3	17.3	15.5	21.4	17.1	17.7	16.7	20.9	15.1	16.0	18.7
Fe	13.9	16.8	18.1	12.6	15.8	14.9	16.9	13.1	15.4	17.0	14.7
Al	-	1.14	1.69	1.55	1.56	1.44	1.90	-	-	-	-
Co	.150	.170	.180	.100	.140	.110	.160	.160	.260	.220	.360
Ni	.210	.350	.270	.830	.420	.480	.340	.960	.350	.280	.350
Cu	.160	.140	.120	.310	.220	.170	.200	.220	.100	.050	.060
Ca	-	1.90	1.86	1.70	1.61	1.87	1.55	-	-	-	-
Mg	-	1.05	1.11	1.30	1.17	1.15	1.13	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	5.0	4.0	11.0	6.0	6.0	6.0	-	-	-	-
Co	-	-	-	-	-	-	-	-	-	-	-
Cr	27	-	-	-	-	-	-	25	18	9	17
Mo	530	-	-	-	-	-	-	500	470	550	360
Pb	500	1000	1100	800	1100	900	1200	700	700	700	700
Sr	-	-	-	-	-	-	-	-	-	-	-
V	650	-	-	-	-	-	-	820	840	890	690
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	250	660	580	940	700	680	660	660	490	410	330
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	underside -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	topside -	underside -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A433	A433	A433	A433	A433	A433	A217	A217	A217	A217

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3540072-01	3540072-10	3540072-11	3540072-12	3540072-13	3540072-14	3540072-19	3540072-20	3540072-21	3540072-22	3540072-23
Latitude	2.790	2.790	2.790	2.790	2.790	2.790	2.790	2.790	2.790	2.790	2.790
Longitude	60.042	60.042	60.042	60.042	60.042	60.042	60.042	60.042	60.042	60.042	60.042
Depth	3816	3816	3816	3816	3816	3816	3816	3816	3816	3816	3816
Si(wt.%)	13.4	7.80	5.90	7.10	8.90	6.70	-	-	-	-	-
Ti	.49	1.00	.90	1.02	.88	.35	.62	.71	.90	.96	.82
Mn	11.4	16.0	18.5	17.2	15.6	16.9	16.2	15.4	15.9	15.8	17.7
Fe	15.4	15.3	15.2	16.0	15.2	16.1	18.8	18.8	16.6	14.7	14.8
Al	-	-	-	-	-	-	1.58	1.70	2.11	1.88	2.27
Co	.230	.530	.064	.680	.450	.190	.140	.180	.310	.270	.220
Ni	.280	.430	.520	.400	.390	.400	.290	.210	.270	.350	.550
Cu	.120	.080	.100	.040	.050	.140	.150	.110	.100	.130	.210
Ca	-	-	-	-	-	-	1.58	1.72	1.89	2.62	1.54
Mg	-	-	-	-	-	-	1.11	1.04	1.15	1.23	1.52
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	10.0	5.0	5.0	6.0	6.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	31	25	13	11	18	15	-	-	-	-	-
Mo	73	550	570	400	470	480	-	-	-	-	-
Pb	1100	1500	1100	1000	1000	700	900	1100	1100	1200	1000
Sr	-	-	-	-	-	-	-	-	-	-	-
V	620	1000	860	810	860	1000	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	330	400	410	440	390	510	540	540	530	570	680
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	Clay	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A433	A433	A433	A433	A433

Sequence#	3540072-24	3540088-01	3540088-02	3540088-03	3540088-04	3540088-05	3540088-06	3540088-07	3540088-08	3540088-09	3540088-10
Latitude	2.790	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872
Longitude	60.042	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893
Depth	3816	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.85	-	-	.44	.40	.52	.51	.28	.41	.58	.53
Mn	14.4	17.2	18.1	16.3	15.7	17.1	13.4	24.3	18.9	-	11.0
Fe	15.3	21.7	18.3	20.2	19.8	20.0	19.4	9.40	17.0	23.0	23.2
Al	1.91	1.14	1.55	1.17	1.01	1.05	1.44	1.88	1.51	1.71	1.73
Co	.200	.370	.210	.180	.170	.170	.170	.180	.210	.180	.210
Ni	.270	.250	.270	.210	.170	.200	.170	.380	.440	.200	.210
Cu	.110	.090	.100	.050	.040	.050	.060	.220	.190	.100	.110
Ca	1.75	1.76	1.68	1.79	1.82	1.83	1.68	1.16	1.10	1.46	1.28
Mg	1.20	-	-	1.00	1.01	1.00	.95	2.04	1.72	1.32	1.15
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	4.0	-	-	5.0	6.0	6.0	6.0	5.0	6.0	5.0	5.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1000	1300	1000	1000	1000	900	1100	500	800	1300	1200
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	490	490	550	510	500	500	530	550	720	690	690
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3540088-11	3540088-12	3540088-13	3540088-14	3540088-15	3540088-16	3540088-17	3540088-18	3540088-19	3540088-20	3540088-21
Latitude	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872
Longitude	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893
Depth	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.40	.63	.60	.59	.42	.63	.56	.70	.65	.61	.48
Mn	21.2	16.4	9.80	10.8	21.0	11.8	11.6	15.8	13.7	15.7	16.6
Fe	13.1	19.2	23.4	22.5	17.3	24.1	23.3	19.5	21.0	20.4	20.2
Al	1.85	1.81	1.96	2.19	1.70	1.43	1.67	1.40	1.48	2.35	.94
Co	.210	.320	.200	.240	.210	.200	.180	.260	.230	.220	.200
Ni	.420	.540	.170	.200	.430	.220	.200	.230	.170	.280	.200
Cu	.220	.210	.100	.110	.160	.090	.110	.040	.070	.100	.040
Ca	1.02	1.10	1.06	1.23	1.31	1.26	1.07	1.70	1.71	1.29	1.67
Mg	1.88	1.61	1.09	1.25	1.46	1.02	1.01	1.13	1.02	1.20	1.07
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	6.0	8.0	6.0	7.0	9.0	6.0	7.0	9.0	7.0	6.0	8.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	700	1100	1100	1200	900	1200	1200	1000	700	1000	1100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	580	820	620	590	650	710	670	500	490	500	520
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Sequence#	3540088-22	3540088-23	3540088-24	3540088-25	3540088-26	3540088-27	3540088-28	3540088-29	3540088-30	3540088-31	3540088-32
Latitude	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872
Longitude	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893
Depth	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.48	.49	.60	.52	.47	.47	.46	.83	.27	.43	.57
Mn	15.2	17.0	15.3	14.9	12.3	12.2	13.2	14.7	22.4	20.2	13.0
Fe	20.3	19.3	20.4	21.6	19.7	18.6	20.3	22.1	8.60	15.4	22.1
Al	1.14	1.01	1.33	1.45	1.54	2.99	-	.98	1.77	1.73	1.41
Co	.170	.150	.190	.180	.170	.170	.190	.270	.140	.210	.190
Ni	.160	.190	.180	.180	.130	.210	.160	.170	.360	.500	.240
Ca	.040	.060	.070	.080	.070	.110	.100	.070	.230	.230	.110
Ca	2.54	1.76	1.54	2.21	1.80	3.82	1.80	1.70	1.04	1.35	1.18
Mg	1.05	1.04	1.02	-	1.01	1.22	1.07	1.04	1.90	1.61	1.13
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	6.0	5.0	5.0	5.0	6.0	5.0	5.0	5.0	5.0	5.0	5.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1000	900	1200	1100	1100	800	1000	1100	500	800	1100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	510	440	460	320	500	480	470	500	500	690	720
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3540088-33	3540088-34	3540088-35	3540088-36	3540088-37	3540088-38	3540088-39	3540088-40	3540088-41	3540088-42	3540088-43
Latitude	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872	6.872
Longitude	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893	62.893
Depth	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640	3640
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.55	.46	.34	.41	.58	.49	.47	.47	.52	.45	.50
Mn	11.0	9.50	20.5	21.9	10.7	1.00	14.6	15.4	12.5	12.8	9.10
Fe	22.8	20.3	10.6	13.5	20.9	23.0	18.6	18.7	22.2	18.9	17.1
Al	1.71	2.13	1.81	1.70	1.77	1.79	1.06	1.12	1.61	2.22	3.79
Co	.180	.160	.190	.220	.180	.160	.160	.160	.160	.170	.080
Ni	.120	.160	.500	.490	.220	.200	.170	.220	.140	.200	.170
Cu	.190	.110	.260	.240	.120	.130	.040	.070	.070	.100	.110
Ca	1.40	1.42	.99	1.13	1.27	1.27	2.01	-	1.60	1.49	1.39
Mg	1.04	1.03	1.97	1.68	1.09	1.11	1.02	1.06	1.03	1.20	1.23
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	4.0	3.0	6.0	5.0	4.0	4.0	6.0	3.0	3.0	4.0	4.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1200	1200	600	700	1100	1200	900	900	1100	900	500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1000	620	600	630	660	700	470	510	490	470	430
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Sequence#	3540090-01	3540090-02	3550004-00	3550004-01	3550004-02	3550004-03	3550004-04	3550004-05	3550004-06	3550004-07	3550004-08
Latitude	5.010	5.010	2.755	2.755	2.755	2.755	2.755	2.755	2.755	2.755	2.755
Longitude	61.548	61.548	59.903	59.903	59.903	59.903	59.903	59.903	59.903	59.903	59.903
Depth	3000	3000	3975	3975	3975	3975	3975	3975	3975	3975	3975
Si(wt.%)	-	-	7.80	4.30	9.90	11.4	5.90	6.60	8.50	15.7	8.30
Ti	-	-	.80	.99	.71	.61	1.02	1.16	.52	.37	1.10
Mn	18.1	13.6	14.1	16.5	13.4	13.1	17.0	15.6	14.1	9.10	15.6
Fe	22.3	20.4	14.1	15.2	13.1	13.7	14.2	15.2	14.7	10.2	14.2
Al	.44	1.60	-	-	-	-	-	-	-	-	-
Co	.180	.160	.400	.490	.270	.250	.590	.560	.180	.120	.520
Ni	.230	.190	.310	.280	.230	.280	.350	.280	.170	.400	.310
Cu	.030	.050	.060	.050	.060	.070	.060	.030	.040	.110	.040
Ca	2.19	2.26	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	19	12	16	23	12	10	14	46	12
Mo	-	-	350	380	330	280	430	320	420	204	410
Pb	1200	1000	700	800	700	600	1000	800	700	300	700
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	670	820	610	580	820	650	700	400	690
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	510	560	130	150	250	200	300	230	250	230	200
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A217	A217	A217	A217	A217	A217	A217	A217	A217

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3550004-09	3550004-10	3550004-11	3550004-12	3550004-13	3550004-14	3550008-00	3550008-02	3550008-03	3550013-00	3550013-01
Latitude	2.755	2.755	2.755	2.755	2.755	2.755	2.783	2.783	2.783	2.823	2.823
Longitude	59.903	59.903	59.903	59.903	59.903	59.903	59.883	59.883	59.883	59.862	59.862
Depth	3975	3975	3975	3975	3975	3975	3374	3374	3374	3563	3563
Si(wt.%)	4.90	7.90	14.1	5.60	12.1	6.00	-	-	-	8.00	8.80
Ti	.76	.58	.59	1.08	.71	.64	1.17	.94	1.11	1.36	.90
Mn	18.9	14.4	10.7	16.3	13.9	15.9	15.5	15.4	13.8	17.9	15.7
Fe	17.5	15.5	13.2	14.2	14.5	15.2	20.6	13.0	14.2	17.7	17.0
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.420	.230	.290	.500	.300	.220	.450	.530	.660	.700	.430
Ni	.310	.200	.230	.280	.260	.200	.080	.190	.270	.380	.300
Cu	.100	.040	.100	.060	.070	.040	.040	.030	.020	.050	.060
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	13	13	22	8	20	9	9	5	5	9	18
Mo	330	470	114	330	520	500	350	570	570	520	570
Pb	1200	600	700	900	700	700	1000	700	300	900	900
Sr	-	-	-	-	-	-	-	-	-	-	-
V	730	750	610	690	780	840	750	670	690	800	890
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	400	180	300	320	240	200	-	-	-	300	290
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Nodule	Nodule	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	fragments	whole	whole	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A240	A240	A240	A217	A217

Sequence#	3550013-02	3550013-03	3550013-04	3550013-05	3550013-06	3550013-07	3550013-08	3550013-09	3550013-10	3550013-11	3550013-12
Latitude	2.823	2.823	2.823	2.823	2.823	2.823	2.823	2.823	2.823	2.823	2.823
Longitude	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.862
Depth	3563	3563	3563	3563	3563	3563	3563	3563	3563	3563	3563
Si(wt.%)	7.20	14.7	7.30	7.10	12.2	8.40	7.50	1.00	10.1	7.30	6.70
Ti	.62	.56	1.27	1.17	.51	.50	.64	.93	.80	.67	.49
Mn	16.0	12.6	17.3	16.6	15.0	15.7	14.7	14.0	15.5	16.0	17.1
Fe	14.0	13.7	17.0	16.8	14.2	16.5	15.3	18.5	16.4	17.0	18.0
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.500	.330	.064	.660	.250	.270	.260	.450	.380	.490	.260
Ni	.570	.390	.420	.380	.420	.270	.210	.280	.280	.350	.290
Cu	.120	.130	.080	.050	.140	.060	.040	.040	.040	.050	.050
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	20	47	13	11	28	12	18	20	15	23	17
Mo	400	570	520	450	350	550	490	450	570	660	650
Pb	1000	800	900	1200	1200	700	800	700	800	1000	900
Sr	-	-	-	-	-	-	-	-	-	-	-
V	950	790	800	850	1100	780	730	800	820	1200	1200
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	480	270	290	350	480	300	290	280	350	230	350
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3550013-13	3550013-14	3550013-15	3550014-00	3550014-01	3550014-02	3550015-00	3550015-01	3550015-02	3550015-03	3550015-04
Latitude	2.823	2.823	2.823	2.798	2.798	2.798	2.863	2.863	2.863	2.863	2.863
Longitude	59.862	59.862	59.862	59.862	59.862	59.862	59.855	59.855	59.855	59.855	59.855
Depth	3563	3563	3563	3776	3776	3776	3617	3617	3617	3617	3617
Si(wt.%)	9.50	8.70	9.60	4.80	5.30	8.50	13.9	7.20	6.10	6.20	14.3
Ti	.59	.68	.50	.89	.71	.53	.42	.72	.90	.81	.42
Mn	15.7	15.8	15.5	17.2	18.4	15.8	11.4	15.3	16.3	16.3	10.9
Fe	17.1	18.5	16.6	13.9	13.3	14.7	13.2	15.2	16.2	16.7	13.0
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.310	.300	.280	.460	.420	.240	.270	.470	.570	.560	.240
Ni	.310	.270	.360	.300	.390	.260	.400	.330	.340	.410	.430
Cu	.040	.040	.070	.040	.070	.050	.160	.060	.040	.050	.120
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	17	13	21	26	8	10	34	22	22	16	48
Mo	600	500	640	410	350	630	370	520	350	450	340
Pb	1100	800	900	700	700	600	800	1200	1300	1200	700
Sr	-	-	-	-	-	-	-	-	-	-	-
V	1100	850	1000	710	670	880	880	980	880	1000	740
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	560	480	430	110	230	250	460	330	430	320	270
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	topside	underside
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Sequence#	3550015-05	3550015-06	3550015-07	3550015-08	3550015-09	3550015-10	3550015-11	3550015-12	3550015-13	3550015-15	3550018-00
Latitude	2.863	2.863	2.863	2.863	2.863	2.863	2.863	2.863	2.863	2.863	2.803
Longitude	59.855	59.855	59.855	59.855	59.855	59.855	59.855	59.855	59.855	59.855	59.768
Depth	3617	3617	3617	3617	3617	3617	3617	3617	3617	3617	3432
Si(wt.%)	6.10	12.5	6.90	11.3	8.70	8.40	9.30	8.70	10.7	11.4	9.00
Ti	1.04	.46	1.24	.93	.67	.65	.67	.55	.60	.63	.60
Mn	14.2	11.1	17.3	14.5	14.5	14.8	15.6	15.6	13.0	14.0	15.2
Fe	16.4	13.2	16.1	17.0	17.0	15.7	8.20	17.1	15.7	14.7	15.3
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.490	.210	.660	.300	.360	.220	.250	.300	.370	.290	.270
Ni	.280	.360	.420	.230	.240	.280	.310	.250	.290	.390	.250
Cu	.050	.150	.030	.040	.040	.080	.070	.040	.050	.100	.040
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	19	38	11	19	20	79	18	15	26	20	16
Mo	390	330	540	810	500	700	610	320	480	330	460
Pb	1300	1000	1200	900	1100	700	800	800	1000	1100	600
Sr	-	-	-	-	-	-	-	-	-	-	-
V	860	620	930	1000	950	1100	1200	700	950	850	850
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	250	370	370	300	360	450	480	400	300	490	190
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Mn-coated	Crust
type	-	-	-	-	-	-	-	-	-	rock	-
Portion	topside	underside	topside	underside	unknown	unknown	unknown	unknown	unknown	outer	unknown
sampled	-	-	-	-	-	-	-	-	-	crust	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3550018-01	3550018-02	3550018-03	3550018-04	3550018-05	3550018-06	3550066-00	3550069-00	3550069-01	3550069-02	3550069-03
Latitude	2.803	2.803	2.803	2.803	2.803	2.803	1.210	1.365	1.365	1.365	1.365
Longitude	59.768	59.768	59.768	59.768	59.768	59.768	56.615	56.612	56.612	56.612	56.612
Depth	3432	3432	3432	3432	3432	3432	930	2940	2940	2940	2940
Si(wt.%)	7.50	7.50	7.50	7.20	7.90	9.80	-	-	-	-	-
Ti	.65	.61	.58	.75	.51	.63	-	-	-	.91	1.07
Mn	14.4	16.9	17.8	17.9	16.9	15.5	3.72	6.20	13.0	8.10	6.50
Fe	15.2	18.1	18.5	17.5	17.6	18.2	7.94	29.0	15.8	25.9	26.7
Al	-	-	-	-	-	-	.54	1.66	3.18	1.49	1.85
Co	.310	.320	.310	.660	.300	.360	.230	.220	.180	.300	.220
Ni	.230	.230	.240	.300	.280	.300	.200	.120	.180	.130	.130
Cu	.040	.040	.040	.040	.060	.050	.030	.040	.120	.040	.050
Ca	-	-	-	-	-	-	6.80	1.39	2.37	1.62	1.52
Mg	-	-	-	-	-	-	-	-	-	1.25	1.22
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	5.0	6.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	11	13	13	15	19	18	-	-	-	-	-
Mo	410	710	770	630	710	570	-	-	-	-	-
Pb	700	800	700	900	1000	700	1200	1700	700	1400	1400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	720	890	920	850	1000	880	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	310	270	230	290	330	300	380	550	400	590	540
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A217	A217	A217	A217	A217	A217	A467	A433	A433	A433	A433

Sequence#	3550071-00	3550071-01	3550071-02	3550071-03	3550071-04	3550071-05	3550071-06	3550071-07	3550071-08	3550071-09	3550071-10
Latitude	1.320	1.320	1.320	1.320	1.320	1.320	1.320	1.320	1.320	1.320	1.320
Longitude	56.593	56.593	56.593	56.593	56.593	56.593	56.593	56.593	56.593	56.593	56.593
Depth	2180	2180	2180	2180	2180	2180	2180	2180	2180	2180	2180
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	.72	.80	.89	.69	.63	.69	.72	.67	.71	.74
Mn	16.0	16.8	12.6	10.8	20.8	17.3	20.7	19.7	16.2	17.0	18.4
Fe	21.7	19.6	22.2	20.5	14.3	19.0	16.4	19.1	17.8	19.7	17.4
Al	1.18	.71	1.27	1.93	1.85	.55	1.27	.94	1.56	.63	1.22
Co	.410	.540	.350	.440	.440	.420	.370	.390	.390	.510	.390
Ni	.260	.260	.230	.240	1.030	.280	.660	.380	.420	.250	.410
Cu	.050	.030	.050	.060	.160	.040	.100	.060	.060	.030	.080
Ca	1.95	2.48	1.50	1.40	1.60	2.15	1.93	-	1.87	2.12	1.84
Mg	-	1.12	1.22	1.21	2.03	.98	1.39	1.07	1.32	-	1.10
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	7.0	4.0	6.0	10.0	6.0	9.0	7.0	11.0	7.0	8.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	2100	1800	1600	1600	1300	1700	1700	1600	1300	1700	1500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	580	630	610	560	1000	600	720	620	640	550	570
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3550073-00	3550075-00	3550075-01	3550075-02	3550076-00	3550076-01	3550076-02	3550076-03	3550076-04	3550076-05	3550076-06
Latitude	1.283	.177	.177	.177	.187	.187	.187	.187	.187	.187	.187
Longitude	56.575	55.605	55.605	55.605	55.588	55.588	55.588	55.588	55.588	55.588	55.588
Depth	1865	1358	1358	1358	1600	1600	1600	1600	1600	1600	1600
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	.75	.79	-	.62	.70	.65	.60	.70	.80
Mn	16.9	17.6	17.6	19.3	18.9	18.7	9.80	18.7	18.8	7.80	13.5
Fe	30.7	16.7	15.5	16.5	19.3	19.9	18.5	19.5	19.4	18.9	22.8
Al	.34	.56	.55	.39	.83	.53	2.87	.77	.46	3.08	1.70
Co	.390	.890	.980	.930	.300	.350	.320	.360	.340	.300	.440
Ni	.250	.320	.300	.310	.340	.270	.150	.270	.230	.120	.130
Cu	.050	.020	.020	.020	.040	.040	.070	.050	.020	.070	.070
Ca	1.79	5.98	4.74	3.06	2.04	-	1.37	1.87	2.31	1.47	2.07
Mg	-	-	1.10	1.14	-	-	.99	.98	.94	-	1.04
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	8.0	6.0	-	6.0	5.0	5.0	5.0	6.0	5.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1900	2300	1900	2200	1800	1600	1400	1600	1700	1500	2100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	450	470	500	500	610	600	500	600	580	520	760
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A467	A433	A433	A433	A433	A433	A433	A433	A433	A433	A433

Sequence#	3550076-07	3550076-08	3550076-09	3550076-10	3550079-00	3550081-00	3550081-01	3550081-02	3550081-03	3630202-00	3640015-00
Latitude	.187	.187	.187	.187	.178	.145	.145	.145	.145	15.350	17.900
Longitude	55.588	55.588	55.588	55.588	55.518	55.165	55.165	55.165	55.165	-21.867	-31.950
Depth	1600	1600	1600	1600	1200	1800	1800	1800	1800	-	4868
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.55	.57	.77	-	-	-	-	.69	1.11	-	-
Mn	18.3	19.4	7.70	2.23	24.7	20.1	16.5	18.5	5.50	18.9	15.2
Fe	-	15.8	-	15.2	15.5	23.4	18.3	19.3	15.3	23.2	23.8
Al	.37	1.53	2.76	.51	.58	-	1.73	.83	4.12	-	-
Co	.300	.340	.230	1.45	1.04	.610	.530	.510	.230	1.23	.300
Ni	.280	.920	.140	-	-	.320	.360	.250	.180	.190	.170
Cu	.030	.160	.060	.420	.480	.060	.040	.040	.030	.010	.120
Ca	2.15	1.48	1.42	2.20	3.07	-	2.29	1.67	6.86	3.00	1.50
Mg	.96	1.73	1.02	-	-	-	-	1.02	1.03	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	4.0	8.0	2.0	-	-	-	-	11.0	3.0	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1600	1200	1800	2400	2500	-	1900	1800	600	2500	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	610	950	570	170	430	-	580	600	470	100	-
Sample	Crust	Crust	Crust	Crust	Crust	Nodule	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	quarter	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A433	A433	A433	A467	A467	A418	A433	A433	A433	A459	A179

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3710037-00	3710047-00	3710047-01	3710131-00	3710149-00	3710149-02	3710153-00	3710153-01	3710154-01	3710159-03	3710167-00
Latitude	12.833	12.833	12.833	10.402	13.767	13.767	14.725	14.725	12.525	11.500	11.497
Longitude	-100.533	-107.150	-107.150	-108.793	-101.872	-101.872	-102.575	-102.575	-103.200	-103.292	-103.957
Depth	3455	3517	3517	1130	1693	1693	1843	1843	2077	2703	2635
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	7.20	18.0	16.0	30.7	22.0	18.8	7.90	19.8	17.1	13.3	11.8
Fe	4.00	4.20	8.40	16.5	18.3	20.9	13.3	19.6	21.4	23.7	20.9
Al	-	-	-	.40	-	-	-	-	-	-	-
Co	.020	.050	.070	1.10	.570	.810	.280	.520	.250	.010	-
Ni	.240	.790	.550	.560	.430	.280	.130	.310	.280	.170	.130
Cu	1.220	.820	.460	.040	.110	.070	.010	.080	.090	.160	.110
Ca	-	-	-	-	2.90	2.40	4.20	2.50	2.40	2.00	2.70
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	42	-	-	-	-	-	-	-
Mo	-	-	-	1300	-	-	-	-	-	-	-
Pb	-	-	-	1700	1200	1400	800	1200	800	400	400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	125	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	710	600	400	400	500	500	600	500
Sample type	Crust -	Crust -	Crust -	Nodule -	Crust -	Unknown -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock
Portion sampled	unknown -	fragments -	fragments -	whole -	fragments -	fragments -	fragments -	fragments -	fragments -	fragments -	without nucleus
Nucleus	-	-	-	-	-	-	-	-	volcanic	-	Basalt
Reference	A333	A333	A333	A334	A437	A437	A437	A437	A437	A437	A437

Sequence#	3720055-00	3720078-01	3720079-00	3730005-00	3730026-01	3740019-00	3740063-00	3750069-01	3750090-00	3750090-06	3750099-00
Latitude	14.607	16.083	13.450	12.275	13.052	14.370	11.017	13.167	10.008	10.008	11.050
Longitude	-117.293	-112.633	-118.417	-120.158	-125.480	-133.115	-139.967	-147.750	-143.320	-143.320	-140.000
Depth	4035	3069	4208	4471	4400	4684	4877	5610	5075	5075	4780
Si(wt.%)	-	-	-	-	11.2	-	-	-	-	-	-
Ti	-	-	-	-	.29	-	-	1.67	-	-	-
Mn	8.80	40.5	31.5	31.5	27.8	28.4	31.5	20.6	28.4	26.6	8.00
Fe	7.00	.70	4.20	5.08	2.40	-	5.60	14.2	5.30	8.60	7.30
Al	-	-	-	-	4.60	-	-	2.70	-	-	-
Co	.050	-	.550	.160	.100	.560	.700	.240	.700	.680	.170
Ni	.580	.320	.990	1.680	.900	1.300	.840	.330	1.430	1.290	.530
Cu	.570	.120	1.100	1.400	1.000	.970	.920	.360	.980	.770	.570
Ca	.70	-	-	1.30	.90	-	-	2.00	1.80	1.90	.70
Mg	-	-	-	-	2.00	-	-	1.28	-	-	-
Na	-	-	-	-	2.60	-	-	1.06	-	-	-
K	-	-	-	-	1.40	-	-	.80	-	-	-
P	-	-	-	-	-	-	-	.20	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	23000	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	12	-	-	-	-	-	-
Mo	-	-	-	-	380	-	-	280	-	-	-
Pb	300	-	-	-	300	-	-	800	400	500	200
Sr	-	-	-	-	990	-	-	-	-	-	-
V	-	-	-	-	600	-	-	-	-	-	-
Y	-	-	-	-	60	-	-	-	-	-	-
Zn	700	-	-	-	400	-	-	-	1700	1200	800
Sample type	Mn-encrusted sediment	Mn-coated rock	Nodule -	Crust -	Crust -	Unknown -	Nodule -	Mn-encrusted sediment	Nodule -	Nodule -	Crust -
Portion sampled	whole -	unknown -	unknown -	unknown -	whole -	unknown -	unknown -	unknown -	without nucleus	topside -	unknown -
Nucleus	non-apparent	-	-	-	-	-	-	-	-	-	-
Reference	A437	A333	A333	A179	A261	A395	A419	A419	A376	A405	A405

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3750101-00	3750101-01	3750103-02	3750103-03	3750125-00	3750128-03	3750131-01	3750131-02	3750131-03	3750132-02	3750156-23
Latitude	11.100	11.100	11.100	11.100	11.035	11.043	10.950	10.950	10.950	10.965	11.100
Longitude	-140.017	-140.017	-140.017	-140.017	-140.088	-140.070	-140.158	-140.158	-140.158	-140.148	-147.500
Depth	4800	4800	4800	4800	4909	4895	4223	4223	4223	4619	-
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	7.60
Ti	-	-	-	-	-	-	-	-	1.18	-	1.20
Mn	16.0	17.8	18.0	-	20.2	24.5	25.0	21.7	-	29.4	18.6
Fe	6.90	7.30	8.60	-	2.60	8.50	10.2	10.7	11.4	5.20	11.8
Al	-	-	-	-	-	-	-	-	-	-	4.60
Co	.240	.340	.320	-	.130	.510	.410	.590	-	.510	.290
Ni	1.090	1.200	1.110	-	.890	1.100	1.080	.980	-	1.580	.600
Cu	.810	.840	.770	-	.810	.900	.590	.660	-	1.200	.280
Ca	1.00	1.20	1.30	-	9.60	1.50	1.90	2.10	-	1.90	.98
Mg	-	-	-	-	-	-	-	-	-	-	.51
Na	-	-	-	-	-	-	-	-	1.64	-	5.80
K	-	-	-	-	-	-	-	-	-	-	1.20
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	208	-	-	-	-	-	-	-
Ba	-	-	-	3900	-	-	-	-	-	-	4800
Cd	-	-	-	8.0	-	-	-	-	-	-	13.0
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	17	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	590
Pb	400	500	500	-	200	1100	700	900	-	400	600
Sr	-	-	-	-	-	-	-	-	-	-	68
V	-	-	-	-	-	-	-	-	-	-	400
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	1100	1200	1000	-	1800	1500	1100	900	-	1800	520
Sample type	Crust -	Several crusts	Crust -	Crust -	Mn-coated rock	Nodule -	Mn-coated rock	Mn-coated rock	Crust -	Nodule -	Crust -
Portion sampled	unknown -	cross section	fragments -	fragments -	half -	whole -	outer crust	outer crust	fragments -	whole -	unknown -
Nucleus	-	-	-	-	Rock	non-apparent	-	-	-	non-apparent	-
Reference	A405	A422	A422	A475	A438	A438	A438	A438	A465	A376	A474

Sequence#	3750156-24	3750156-25	3750156-26	3750163-02	3750183-01	3750358-03	3750390-00	3750410-01	3750438-00	3760027-00	3760034-00
Latitude	11.100	11.100	11.100	11.028	11.018	11.513	13.567	13.160	12.583	14.317	11.850
Longitude	-147.500	-147.500	-147.500	-140.113	-140.147	-148.578	-140.633	-141.008	-142.150	-152.617	-152.950
Depth	-	-	-	4868	-	5125	4721	6010	-	5490	5221
Si(wt.%)	1.00	10.3	14.6	-	-	-	9.19	-	-	13.2	-
Ti	.88	.88	.84	-	-	-	-	-	-	-	1.22
Mn	15.3	8.40	10.7	13.2	22.7	11.5	22.0	24.5	31.3	18.4	11.0
Fe	8.50	5.30	5.70	9.90	17.1	11.1	9.24	-	4.91	16.2	6.92
Al	3.90	5.20	6.30	-	-	-	3.04	-	-	1.67	-
Co	.270	.130	.180	.330	.390	.090	.520	.500	.210	.500	.800
Ni	1.020	.720	.760	.750	.440	.350	.890	.530	1.250	1.000	.540
Cu	.360	.310	.320	.500	.130	.320	.480	.390	1.210	1.500	.570
Ca	.88	.14	.98	1.30	2.70	1.20	.14	-	-	1.54	-
Mg	.56	1.14	.89	-	-	-	1.88	-	-	1.18	-
Na	5.16	5.58	6.08	-	-	-	1.32	-	-	-	-
K	1.78	2.12	2.20	-	-	-	.50	-	-	-	-
P	-	-	-	-	-	-	.25	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	8.9	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	5300	4200	4200	-	-	-	-	-	-	-	2500
Cd	16.0	16.0	14.0	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	10	9	7	-	-	-	-	-	-	-	6
Mo	400	390	300	-	-	-	-	-	620	-	200
Pb	500	500	300	600	1200	1000	-	-	-	-	400
Sr	40	248	160	-	-	-	-	-	-	-	-
V	340	240	200	-	-	-	-	-	-	-	410
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	640	500	600	700	570	1000	-	-	-	-	-
Sample type	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Mn-encrusted sediment	Nodule -	Nodule -	Crust -	Nodule -	Nodule -
Portion sampled	unknown -	unknown -	unknown -	cross section	outer crust	whole -	unknown -	composite -	unknown -	whole -	whole -
Nucleus	-	-	-	-	Basalt	Sediment	-	-	-	-	-
Reference	A474	A474	A474	A405	A376	A437	A392	A393	A392	A012	A240

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3760118-00	3760145-01	3760145-02	3760147-02	3760147-03	3760147-04	3760208-00	3760223-00	3760223-01	3770020-00	3770020-01
Latitude	15.817	19.100	19.100	18.350	18.350	18.350	10.938	18.717	18.717	16.100	16.100
Longitude	-157.067	-158.233	-158.233	-158.450	-158.450	-158.450	-153.303	-158.283	-158.283	-161.750	-161.750
Depth	5118	3131	3131	1317	1317	1317	4800	475	475	2400	2400
Si(wt.%)	-	-	-	-	-	-	-	-	-	6.00	4.20
Ti	-	-	-	-	-	-	.87	-	-	.84	.88
Mn	20.3	-	-	19.9	-	-	23.5	6.30	-	16.0	15.0
Fe	15.3	16.0	-	16.9	12.9	-	12.6	8.40	-	17.2	7.60
Al	-	-	-	-	-	-	-	-	-	1.69	1.76
Co	.300	.300	.200	.870	.520	.280	.320	.790	.360	.730	.600
Ni	.540	.150	-	.420	.170	-	.530	.700	-	.250	.250
Cu	.380	.040	-	.040	.020	-	.420	.090	-	.040	.050
Ca	2.80	2.50	-	2.90	1.70	-	-	7.30	-	2.01	1.70
Mg	-	-	-	-	-	-	-	-	-	-	1.00
Na	-	-	-	-	-	-	-	-	-	-	.89
K	-	-	-	-	-	-	-	-	-	-	.68
P	-	-	-	-	-	-	-	-	-	-	.24
H_2O-	-	-	-	-	-	-	-	-	-	20.6	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	4500	700
Cd	-	-	5.0	-	-	4.0	-	-	9.0	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	125	-	-	132	-	-	710	250	100
Pb	800	1000	800	1900	1000	700	-	1400	1600	1900	-
Sr	-	-	-	-	-	-	-	-	-	1200	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	800	600	490	560	400	340	-	860	810	530	-
Sample type	Crust -	Mn-encrusted sediment	Mn-encrusted sediment	Nodule -	Mn-encrusted sediment	Mn-encrusted sediment	Crust -	Crust -	Crust -	Nodule -	Nodule -
Portion sampled	half -	fragments -	fragments -	outer crust	fragments -	unknown -	unknown -	fragments -	fragments -	cross section	unknown -
Nucleus	Undetermined	-	-	-	-	-	-	-	-	-	-
Reference	A437	A376	A303	A376	A376	A303	A343	A376	A303	A197	A290

Sequence#	3770022-02	3770025-01	3770025-02	3770026-01	3770026-02	3770026-03	3770055-00	3770055-01	3770056-00	3770061-00	3770061-01
Latitude	18.783	19.383	19.383	19.367	19.367	19.367	10.500	10.500	12.070	15.600	15.600
Longitude	-162.050	-162.167	-162.167	-162.317	-162.317	-162.317	-165.550	-165.550	-165.838	-166.667	-166.667
Depth	3148	4160	4160	4868	4868	4868	4341	4341	1488	5440	5440
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	2.00
Ti	-	-	-	-	-	-	1.38	1.12	-	1.22	1.20
Mn	14.8	-	15.0	15.2	-	-	14.2	14.8	26.0	16.7	19.5
Fe	18.4	-	24.0	13.9	13.1	-	16.4	14.2	5.60	17.0	14.6
Al	-	-	-	-	-	-	-	-	-	-	1.10
Co	.570	.260	.410	.710	.490	.370	.880	.680	.400	.840	.550
Ni	.310	-	.100	.300	.210	-	.660	.540	1.060	.340	.300
Cu	.160	-	.050	.140	.090	-	.320	.420	.140	.160	.090
Ca	2.10	-	2.00	3.80	4.40	-	-	-	2.40	-	1.10
Mg	-	-	-	-	-	-	-	-	-	-	1.10
Na	-	-	-	-	-	-	-	-	-	-	1.80
K	-	-	-	-	-	-	-	-	-	-	.50
P	-	-	-	-	-	-	-	-	-	-	.18
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	3500	3400	-	1500	820
Cd	-	6.0	-	-	-	5.0	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	4	3	-	9	-
Mo	-	280	-	-	-	235	360	350	-	430	300
Pb	1100	1500	1600	800	1200	900	400	100	1000	700	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	540	470	-	630	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	720	690	590	480	490	440	-	-	1400	-	-
Sample type	Nodule -	Crust -	Crust -	Nodule -	Crust -	Crust -	Nodule -	Nodule -	Mn-coated rock	Unknown -	Nodule -
Portion sampled	whole -	unknown -	fragments -	fragments -	fragments -	fragments -	half -	half -	without nucleus	fragments -	unknown -
Nucleus	-	-	-	-	-	-	-	-	Rock	-	-
Reference	A376	A303	A376	A376	A376	A303	A240	A240	A405	A240	A290

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3770073-00	3770101-00	3770101-01	3770103-00	3770103-01	3770103-03	3770121-00	3770123-00	3770138-00	3770138-01	3770138-02
Latitude	14.933	19.117	19.117	19.117	19.117	19.117	10.063	10.362	18.300	18.300	18.300
Longitude	-167.567	-169.733	-169.733	-169.733	-169.733	-169.733	-165.330	-166.983	-161.767	-161.767	-161.767
Depth	4315	1740	1740	1740	1740	1740	1330	2865	3060	3060	3060
Si(wt.%)	-	3.70	-	-	3.30	3.00	1.39	1.98	-	-	-
Ti	-	1.40	1.19	-	1.13	1.50	.58	1.04	1.20	-	-
Mn	21.3	24.6	13.4	40.1	20.5	-	18.8	22.3	39.8	18.8	-
Fe	16.1	20.3	12.7	18.3	14.5	-	8.69	13.1	20.4	18.0	-
Al	-	1.30	-	-	1.00	.70	.76	.51	-	-	-
Co	.590	1.40	1.28	.710	.950	1.50	.800	.880	.520	.064	.520
Ni	.400	.630	.440	.064	.420	.700	.610	.530	.310	.340	.060
Cu	.270	.090	.070	.100	.100	.150	.060	.090	.060	.100	.110
Ca	2.30	3.60	-	-	2.07	7.00	10.5	2.04	-	2.70	-
Mg	-	1.40	-	-	-	1.50	1.24	.99	-	-	-
Na	-	2.40	-	-	-	3.00	-	-	-	-	-
K	-	.30	-	-	.40	.70	-	-	-	-	-
P	-	-	-	-	.03	-	3.67	.28	-	-	-
H_2O-	-	-	-	-	28.2	-	-	-	24.0	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	1300	3300	-	5000	1500	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	1500	-	-	-	-	-
Cr	-	25	6	-	-	7	-	-	-	-	-
Mo	-	700	560	-	600	700	-	-	1100	-	-
Pb	1000	1900	2600	3700	2400	3000	-	-	-	1200	-
Sr	-	1300	-	-	1500	3000	-	-	-	-	-
V	-	700	570	-	-	700	-	-	-	-	-
Y	-	350	-	-	-	300	-	-	-	-	-
Zn	500	-	-	-	620	-	800	600	-	600	-
Sample	Nodule	Unknown	Crust	Nodule	Nodule	Nodule	Crust	Crust	Nodule	Nodule	Nodule
type	-	-	-	-	-	-	-	-	-	-	-
Portion	quarter	fragments	fragments	cross	cross	unknown	average	average	without	cross	unknown
sampled	-	-	-	section	section	-	analysis	analysis	nucleus	section	-
Nucleus	non-apparent	-	-	-	-	-	-	-	-	-	Undetermined
Reference	A437	A261	A240	A166	A197	A262	A363	A366	A346	A376	A395

Sequence#	3770138-04	3770138-05	3770145-00	3770153-00	3770153-01	3770153-02	3770153-03	3770153-04	3770153-05	3780004-00	3780004-02
Latitude	18.300	18.300	19.978	19.512	19.512	19.512	19.512	19.512	19.512	10.383	10.383
Longitude	-161.767	-161.767	-166.083	-168.875	-168.875	-168.875	-168.875	-168.875	-168.875	-170.950	-170.950
Depth	3060	3060	4938	1805	1805	1805	1805	1805	1805	4469	4469
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	1.11	.99
Mn	16.7	20.8	6.59	21.5	23.2	19.2	21.6	23.4	22.4	17.0	20.0
Fe	19.3	19.4	11.0	13.1	17.2	15.1	16.2	15.8	16.7	14.5	16.2
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.500	.660	.100	.690	.850	.750	.890	.900	.910	.690	.880
Ni	.200	.290	.360	.510	.470	.370	.470	.540	.480	.770	.940
Cu	.040	.070	.220	.110	.040	.040	.080	.120	.060	.630	.690
Ca	2.20	2.90	-	5.70	2.90	5.20	2.70	-	2.70	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	2800	850
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	2
Mo	-	-	-	-	-	-	-	-	-	390	350
Pb	1600	1500	-	1700	1700	1500	1600	1500	1500	100	500
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	490	530
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	500	540	460	700	600	500	600	600	600	-	-
Sample	Crust	Nodule	Crust	Nodule	Nodule	Nodule	Nodule	Nodule	Nodule	Nodule	Nodule
type	-	-	-	-	-	-	-	-	-	-	-
Portion	fragments	without	unknown	whole	whole	half	without	half	cross	half	half
sampled	-	nucleus	-	-	-	-	nucleus	-	section	-	-
Nucleus	-	-	-	non-apparent	Nodule-fragment	Rock	Bone	Nodule-fragment	Nodule-fragment	-	-
Reference	A376	A376	A383	A422	A422	A422	A422	A422	A422	A240	A240

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3780005-00	3780005-01	3780005-02	3780005-05	3780020-00	3780022-00	3780028-00	3780032-00	3780032-01	3780032-02	3780035-00
Latitude	19.417	19.417	19.417	19.417	12.267	12.517	18.333	15.713	15.713	15.713	17.900
Longitude	-171.000	-171.000	-171.000	-171.000	-172.800	-172.850	-173.383	-174.050	-174.050	-174.050	-174.267
Depth	1409	1409	1409	1409	2708	5464	3861	5670	5670	5670	1749
Si(wt.%)	2.70	-	-	-	-	-	7.10	4.66	3.53	6.00	8.40
Ti	1.13	1.54	-	-	1.26	1.38	1.10	1.00	.80	1.00	1.10
Mn	22.7	12.3	27.4	22.2	13.0	15.9	13.1	16.5	18.0	15.7	17.1
Fe	13.3	11.7	16.2	13.2	16.0	12.9	14.6	14.9	13.9	13.6	21.7
Al	1.00	-	-	-	-	-	2.30	1.55	1.00	2.41	2.30
Co	.950	1.17	.610	.800	.900	.720	.420	.360	.390	.340	.560
Ni	.600	.470	.900	.520	.310	.530	.300	.200	.240	.210	.240
Cu	.150	.060	.140	-	-	.430	.170	.100	.110	.140	.030
Ca	2.24	-	-	-	-	-	1.51	1.87	1.98	1.93	3.20
Mg	-	-	-	-	-	-	-	1.07	.98	.91	1.20
Na	-	-	-	-	-	-	-	-	-	-	1.90
K	.38	-	-	-	-	-	.52	-	-	-	.40
P	.07	-	-	-	-	-	-	.17	.24	.21	-
H_2O-	23.9	-	-	-	-	-	25.2	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	5800	2300	-	-	2900	4300	6100	-	-	-	1100
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	6	-	-	4	4	-	-	-	-	18
Mo	710	480	-	-	390	360	270	-	-	-	470
Pb	2300	700	2700	-	800	100	2200	1100	-	-	1400
Sr	1400	-	-	-	-	-	1200	-	-	-	1100
V	-	710	-	-	750	540	-	-	-	-	700
Y	-	-	-	-	-	-	-	-	-	-	300
Zn	620	-	-	-	-	-	430	530	-	-	-
Sample	Nodule	Nodule	Nodule	Nodule	Unknown	Nodule	Crust	Crust	Crust	Crust	Unknown
type	-	-	-	-	-	-	-	-	-	-	-
Portion	cross	whole	cross	whole	fragments	whole	outer	outer	middle	layer-adjacent	fragments
sampled	section	-	section	-	-	-	crust	crust	layer	to-nucleus	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A197	A240	A166	A255	A240	A240	A197	A178	A178	A178	A261

Sequence#	3780046-00	3780046-01	3780046-02	3780046-03	3780068-00	3780068-01	3780070-00	3780070-01	3780084-00	3780089-01	3780090-00
Latitude	17.800	17.800	17.800	17.800	17.167	17.167	17.067	17.067	19.243	12.000	17.282
Longitude	-174.367	-174.367	-174.367	-174.367	-177.167	-177.167	-177.250	-177.250	-179.668	-175.717	-176.303
Depth	2288	2288	2288	2288	2050	2050	2013	2013	2870	5340	4400
Si(wt.%)	-	4.90	-	3.00	-	-	4.10	-	-	-	-
Ti	-	.89	.82	1.50	-	.87	1.00	.81	-	-	-
Mn	35.9	14.4	11.1	-	35.4	15.0	13.0	21.0	18.0	17.7	17.2
Fe	15.9	14.0	14.5	-	15.9	13.3	10.7	13.4	16.6	12.1	12.2
Al	-	1.80	-	.70	-	-	2.20	.39	-	-	-
Co	.700	.700	.890	1.50	.740	.880	.450	.540	.490	.500	.290
Ni	.560	.290	.230	.300	.660	.340	.470	.580	.320	.430	.280
Cu	.050	.070	.080	.150	.090	.090	.190	.470	.130	.230	.160
Ca	-	6.85	-	7.00	-	-	8.48	-	-	-	-
Mg	-	-	-	1.50	-	-	-	-	-	-	-
Na	-	-	-	1.50	-	-	-	-	-	-	-
K	-	.39	-	.70	-	-	.43	-	-	-	-
P	-	.08	-	-	-	-	.14	.54	-	-	-
H_2O-	-	19.4	-	-	-	-	22.5	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	4300	1500	1500	-	2600	5600	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	1500	-	-	-	-	-	-	-
Cr	-	-	11	15	-	36	-	-	-	-	-
Mo	-	430	280	300	-	370	490	-	420	-	-
Pb	3000	2000	1900	3000	2700	1800	1900	-	-	-	-
Sr	-	1400	-	3000	-	-	1700	-	-	-	-
V	-	-	440	700	-	560	-	-	-	-	-
Y	-	-	-	300	-	-	-	-	-	-	-
Zn	-	400	-	-	-	-	570	-	-	-	-
Sample	Nodule	Crust	Crust	Nodule	Nodule	Crust	Crust	Unknown	Mn-coated	Nodule	Mn-coated
type	-	-	-	-	-	-	-	-	rock	-	rock
Portion	cross	cross	fragments	unknown	cross	fragments	cross	unknown	outer	??	??
sampled	section	section	-	-	section	-	section	-	crust	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	Undetermined
Reference	A166	A197	A240	A262	A166	A240	A197	A165	A352	A389	A249

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3780090-01	3780090-04	3780090-05	3780090-06	3780090-09	3780091-00	3780095-00	3780096-00	3780096-01	3780096-02	3780096-03
Latitude	17.282	17.282	17.282	17.282	17.282	13.115	19.980	18.517	18.517	18.517	18.517
Longitude	-176.303	-176.303	-176.303	-176.303	-176.303	-173.988	-170.667	-175.100	-175.100	-175.100	-175.100
Depth	4400	4400	4400	4400	4400	5610	2150	1052	1052	1052	1052
Si(wt.%)	-	-	-	-	-	6.11	-	-	-	-	-
Ti	-	-	-	-	-	.84	1.25	.84	.69	.53	.72
Mn	13.2	15.7	14.6	12.1	13.2	19.3	17.5	22.1	18.8	10.7	20.6
Fe	20.5	12.0	10.4	18.8	10.1	10.6	15.4	11.0	12.1	6.55	10.1
Al	-	-	-	-	-	2.50	-	-	-	-	-
Co	.370	.420	.250	.340	.350	.300	.580	.830	.650	.180	.940
Ni	.210	.590	.240	.190	.500	.750	.440	.900	.620	.420	.610
Cu	.130	.300	.140	.120	.250	.300	.200	.090	.100	.090	.070
Ca	-	-	-	-	-	1.67	-	-	-	-	-
Mg	-	-	-	-	-	1.36	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	.23	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	600	-	-	-	-	-
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Nodule -	Crust -	Crust -	Crust -	Crust -
Portion sampled	?? -	?? -	outer crust	outer crust	outer crust	average analysis	average analysis	average analysis	outer crust	middle layer	underside -
Nucleus	Undetermined	Undetermined	Undetermined	Undetermined	Undetermined	-	-	-	-	-	-
Reference	A249	A249	A249	A249	A249	A363	A343	A343	A343	A343	A343

Sequence#	3780097-00	3790020-00	3790020-01	3790044-00	3790045-00	3790046-00	3790046-01	3800024-01	3800024-02	3800025-00	3800025-02
Latitude	18.320	19.313	19.313	18.527	18.617	19.047	19.047	12.050	12.050	11.950	11.950
Longitude	-178.347	176.735	176.735	177.187	171.977	171.148	171.148	165.000	165.000	164.983	164.983
Depth	1630	1753	1753	2000	2440	1300	1300	2090	2090	2105	2105
Si(wt.%)	-	-	-	-	-	-	-	.90	-	1.70	-
Ti	.96	-	-	1.20	1.02	.77	.43	.70	1.18	1.10	-
Mn	21.8	19.0	-	20.8	18.7	21.8	16.0	24.0	23.6	19.5	43.3
Fe	14.6	16.2	-	15.1	16.7	15.8	5.56	10.5	15.6	11.5	13.1
Al	-	-	-	-	-	-	-	.50	.29	.50	-
Co	.790	.680	-	.530	.660	.710	.330	.340	.610	1.05	1.12
Ni	.600	.440	-	.410	.350	.490	.670	.750	.610	.420	1.020
Cu	.120	.130	-	.120	.180	.090	.140	.090	.470	.110	.140
Ca	-	2.50	-	-	-	-	-	2.20	-	1.60	-
Mg	-	-	-	-	-	-	-	1.60	-	-	-
Na	-	-	-	-	-	-	-	2.30	-	-	-
K	-	-	-	-	-	-	-	-	-	.20	-
P	-	-	-	-	-	-	-	-	.41	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	203	-	-	-	-	-	-	-	-
Ba	-	-	2000	-	-	-	-	2100	-	1500	-
Cd	-	-	24.0	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	13	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	700	-	390	-
Pb	-	1500	-	-	-	-	-	1800	-	1500	2600
Sr	-	-	-	-	-	-	-	1900	-	1100	-
V	-	-	-	-	-	-	-	700	-	-	-
Y	-	-	-	-	-	-	-	570	-	-	-
Zn	-	600	-	-	-	-	-	600	-	-	-
Sample type	Crust -	Crust -	Crust -	Mn-coated rock	Nodule -	Mn-coated rock	Mn-coated rock	Crust -	Nodule -	Unknown -	Nodule -
Portion sampled	average analysis	fragments -	fragments -	outer crust	average analysis	topside -	underside -	outer crust	unknown -	unknown -	cross section
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A343	A405	A475	A343	A343	A343	A343	A261	A165	A197	A166

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3800025-06	3800027-00	3800027-01	3800031-00	3800031-01	3800084-01	3800085-00	3810070-00	3810070-01	3810070-02	3820417-00
Latitude	11.950	12.050	12.050	12.150	12.150	11.800	11.950	16.892	16.892	16.892	17.445
Longitude	164.983	164.950	164.950	164.683	164.683	165.000	164.950	155.133	155.133	155.133	144.565
Depth	2105	2105	2105	1830	1830	1620	1330	5775	5775	5775	3857
Si(wt.%)	2.60	-	4.10	2.80	-	-	-	-	-	-	-
Ti	1.70	-	1.20	1.70	1.35	-	-	-	-	-	-
Mn	29.7	38.4	25.9	29.7	19.4	45.5	50.3	16.7	18.0	18.0	5.00
Fe	17.5	16.0	21.0	18.9	13.5	13.0	15.8	15.7	16.0	16.0	11.0
Al	.70	-	1.10	.70	-	-	-	-	2.08	-	-
Co	1.60	.840	1.10	1.30	1.60	.790	1.50	.540	.500	.500	.010
Ni	.064	.720	.600	.630	.520	1.000	.880	.220	.220	.220	.030
Cu	.160	.110	.170	.180	.040	.120	.090	.230	.140	.140	.050
Ca	2.40	-	2.00	2.40	-	-	-	1.90	1.96	-	2.40
Mg	1.50	-	1.50	1.30	-	-	-	-	1.14	-	-
Na	2.30	-	2.00	1.90	-	-	-	-	1.70	-	-
K	.30	-	.30	.30	-	-	-	-	.60	-	-
P	-	-	-	-	-	-	-	-	.23	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	2200	-	1400	1700	5100	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	590	-	420	590	470	-	-	-	320	-	-
Pb	2300	2900	3200	1600	2500	2500	3100	900	1000	-	200
Sr	1700	-	1600	1300	-	-	-	-	-	-	-
V	700	-	800	700	440	-	-	-	-	-	-
Y	250	-	200	230	-	-	-	-	-	-	-
Zn	-	-	500	500	-	-	-	7300	-	-	400
Sample	Crust	Nodule	Crust	Crust	Crust	Nodule	Nodule	Nodule	Nodule	Nodule	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	fragments	cross	fragments	fragments	fragments	cross	cross	quarter	unknown	unknown	whole
sampled	-	section	-	-	-	section	section	-	-	-	-
Nucleus	-	-	-	-	-	-	-	Undetermined	-	-	-
Reference	A261	A166	A261	A261	A240	A166	A166	A405	A419	A419	A405

Sequence#	3820533-00	3830052-00	3830063-00	3830210-00	3830211-00	3830273-00	3830273-01	3840299-00	3920032-00	3980907-00	3990010-02
Latitude	12.283	15.533	18.953	19.667	19.667	13.313	13.313	18.613	12.728	26.517	25.750
Longitude	144.533	136.400	135.793	135.950	135.950	134.560	134.560	128.130	47.373	-11.775	-20.233
Depth	6125	4184	3195	1717	2678	2010	2010	4550	1170	1600	2791
Si(wt.%)	-	-	-	-	-	-	-	-	4.40	-	2.80
Ti	-	.80	-	-	-	-	-	-	.43	.74	1.30
Mn	11.8	15.7	19.5	17.2	15.6	12.3	13.9	12.9	17.7	12.3	21.5
Fe	19.6	24.6	13.8	20.4	19.8	15.7	17.3	17.6	16.6	18.8	25.9
Al	-	2.34	-	-	-	-	-	-	-	1.48	1.40
Co	.280	.310	.540	.500	.380	.290	.240	.180	.460	.550	.680
Ni	.260	.190	.520	.280	.280	.260	.270	.280	.370	.240	.310
Cu	.230	.140	.100	.050	.140	.110	.120	.140	.020	.040	.050
Ca	-	1.12	-	-	-	-	-	-	-	1.70	3.40
Mg	-	.88	-	-	-	-	-	-	-	-	1.40
Na	-	2.82	-	-	-	-	-	-	-	-	1.60
K	-	.60	-	-	-	-	-	-	-	-	-
P	-	.27	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	690	-	-	-	-	-	-	-	1200
Cd	-	-	-	-	-	-	-	-	-	10.0	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	27	150	11
Mo	-	360	-	-	-	-	-	-	660	-	560
Pb	-	1500	-	-	-	1000	1200	-	1300	2600	800
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	900	-	1100
Y	-	-	-	-	-	-	-	-	-	-	1400
Zn	-	-	700	-	-	450	550	-	460	580	-
Sample	Mn-coated	Mn-encrusted	Nodule	Mn-coated	Crust	Crust	Crust	Crust	Crust	Unknown	Unknown
type	rock	sediment	-	organic	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	fragments	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A333	A419	A323	A333	A333	A343	A343	A343	A195	A467	A261

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	3990101-00	3990102-00	3990103-00	4010035-03	4010046-00	4010064-00	4010081-00	4010081-01	4010090-00	4010103-00	4020004-00
Latitude	26.067	26.008	28.875	23.367	26.333	24.517	23.768	23.768	23.950	24.390	24.778
Longitude	-22.367	-22.367	-25.442	-43.650	-44.850	-45.517	-46.617	-46.617	-47.483	-48.990	-50.435
Depth	2300	2286	4648	4565	2500	3400	3155	3155	4124	5396	5726
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	18.1	16.3	17.6	11.8	10.5	8.95	10.4	11.2	7.88	13.0	14.0
Fe	25.7	24.3	21.8	13.5	19.1	26.2	19.0	24.8	29.3	23.9	18.8
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.600	.470	.410	.880	.340	.250	.380	.440	.210	.260	.360
Ni	.310	.250	.260	.330	.110	.120	.180	.150	.140	.230	.300
Cu	.090	.070	.130	.070	.050	.090	.120	.080	.130	.090	.150
Ca	-	2.18	1.72	-	.44	3.86	-	6.25	1.51	1.38	-
Mg	-	1.35	1.25	-	1.21	1.56	-	1.35	2.17	1.68	-
Na	-	1.53	1.56	-	2.37	1.56	-	.82	2.02	1.89	-
K	-	.24	.37	-	.26	.30	-	.19	1.54	.61	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	2200	1500	-	1100	700	-	900	700	1000	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	620	590	-	410	530	-	510	550	490	-
Sample	Nodule	Crust	Crust	Micronodules	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A354	A368	A368	A419	A368	A368	A179	A368	A368	A368	A179

Sequence#	4020004-01	4020045-01	4020058-00	4020070-00	4020092-00	4020094-00	4030005-00	4030014-00	4030109-01	4040109-02	4040232-00
Latitude	24.778	21.850	29.283	26.430	27.417	26.583	25.967	27.433	20.817	22.453	24.742
Longitude	-50.435	-56.150	-57.383	-58.630	-59.717	-59.867	-60.317	-61.300	-66.917	-71.602	-73.777
Depth	5726	4049	5840	5141	5842	5297	5868	5762	4878	5192	5312
Si(wt.%)	-	-	6.30	-	-	-	-	-	-	-	-
Ti	-	-	.65	-	-	-	-	-	-	-	-
Mn	13.9	15.0	16.2	20.0	15.4	14.0	12.5	16.0	13.0	42.5	16.4
Fe	25.1	18.9	15.9	9.44	16.6	18.2	20.8	17.0	29.3	15.0	21.7
Al	-	-	4.30	-	1.14	.95	-	-	-	-	-
Co	.330	.270	.540	.240	.390	.280	.560	.530	.240	3.00	.070
Ni	.270	.310	.490	1.560	.340	.180	.440	.410	.160	.900	.220
Cu	.130	.120	.280	.410	.090	.090	.600	.180	.140	.800	.200
Ca	1.42	2.38	.41	-	-	-	-	-	1.59	-	2.08
Mg	1.51	2.03	-	-	-	-	-	-	1.36	-	2.78
Na	1.86	3.96	-	-	-	-	-	-	1.59	-	2.85
K	.44	.47	.51	-	-	-	-	-	.35	-	.74
P	-	-	.10	-	-	-	-	-	-	-	-
H_2O-	-	-	18.1	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	6900	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	310	-	-	-	-	-	-	-	-
Pb	1000	900	1300	-	-	-	-	-	1100	-	600
Sr	-	-	770	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	500	490	670	-	400	460	-	-	720	-	670
Sample	Crust	Crust	Nodule	Crust	Crust	Crust	Nodule	Micronodules	Crust	Nodule	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	outer	unknown	unknown	outer	unknown	unknown	unknown	unknown	unknown
sampled	-	-	crust	-	-	crust	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A368	A197	A179	A333	A333	A179	A419	A368	A419	A368

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4040837-00	4040839-00	4040840-00	4070161-01	4070166-00	4070166-01	4070195-02	4070216-00	4070216-01	4070217-00	4070218-00
Latitude	27.233	26.875	26.883	22.833	22.817	22.817	22.838	21.450	21.450	23.050	20.150
Longitude	-76.433	-76.633	-76.637	-109.278	-109.242	-109.242	-109.753	-108.300	-108.300	-108.750	-109.000
Depth	4710	1535	1545	1125	846	846	1326	1540	1540	-	1900
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	9.30	13.9	15.3	14.7	13.0	16.3	13.7	15.1	12.3	29.2	23.8
Fe	21.3	24.0	24.0	13.0	13.3	15.3	16.0	22.2	13.3	10.8	13.0
Al	-	-	-	-	-	-	-	-	-	-	-
Co	1.03	.540	.460	.180	.170	.180	.220	.350	.190	.140	.160
Ni	.160	.220	.260	.180	.200	.270	.180	.150	.180	.500	.390
Cu	.180	.060	.080	.010	.020	.020	.010	.060	.080	.090	.090
Ca	-	3.65	2.33	1.40	1.40	1.70	1.70	1.60	1.30	1.40	1.30
Mg	-	1.63	1.67	-	-	-	-	-	-	-	-
Na	-	1.05	1.19	-	-	-	-	-	-	-	-
K	-	.21	.24	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	600	1300	1400	1000	1200	1300	1500	1400	900	300	400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	500	530	600	400	400	500	300	500	300	1100	1000
Sample type	Nodule -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Several crusts	Several crusts	Several crusts	Several crusts
Portion sampled	unknown -	unknown -	unknown -	cross section	fragments -	fragments -	fragments -	fragments -	fragments -	fragments -	fragments -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A272	A368	A368	A422	A422	A422	A422	A437	A437	A437	A437

Sequence#	4070225-00	4080106-00	4080106-01	4080121-05	4080121-06	4080253-00	4080253-01	4080253-02	4080306-00	4080310-01	4080310-02
Latitude	20.850	20.750	20.750	21.800	21.800	29.517	29.517	29.517	27.717	25.250	25.250
Longitude	-109.217	-112.783	-112.783	-113.050	-113.050	-117.283	-117.283	-117.283	-119.283	-119.667	-119.667
Depth	1825	1711	1711	3450	3450	820	820	820	1310	64	64
Si(wt.%)	-	-	-	-	-	-	-	1.10	7.90	-	1.70
Ti	-	-	-	-	-	-	.84	-	.70	-	.60
Mn	10.2	18.8	19.0	30.0	24.5	42.2	17.3	21.1	17.7	42.4	29.7
Fe	23.7	22.1	21.2	5.90	12.3	14.4	12.8	15.6	23.1	13.5	19.6
Al	-	-	-	-	-	-	-	-	2.10	-	1.00
Co	.240	-	-	.090	.180	.650	.920	.730	.430	.680	.900
Ni	.080	.250	.180	.700	.660	.660	.220	.220	.200	.680	.520
Cu	.070	.080	.010	.500	.480	.090	.030	.040	.010	.040	.070
Ca	1.40	-	-	-	-	-	-	2.14	1.60	-	3.10
Mg	-	-	-	-	-	-	-	-	1.40	-	2.10
Na	-	-	-	-	-	-	-	-	3.50	-	2.50
K	-	-	-	-	-	-	-	.29	.30	-	.40
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	3700	4400	-	4200	8800	1100	-	1100
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	15	33	-	15	-	14	-	-
Mo	-	-	-	-	-	-	750	-	470	-	1500
Pb	1100	-	-	-	-	5000	3100	-	1000	3400	1500
Sr	-	-	-	-	-	-	-	1800	1300	-	1100
V	-	-	-	-	-	-	670	-	700	-	1100
Y	-	-	-	-	-	-	-	-	200	-	260
Zn	500	-	-	2000	1600	-	-	-	-	-	-
Sample type	Several crusts	Crust -	Crust -	Crust -	Crust -	Nodule -	Several crusts	Crust -	Crust -	Nodule -	Nodule -
Portion sampled	fragments -	underside -	topside -	unknown -	unknown -	cross section	composite >12crusts	unknown -	cross section	cross section	outer crust
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A437	A342	A342	A323	A323	A166	A189	A197	A261	A166	A261

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4080336-00	4080336-01	4080342-00	4080386-00	4080399-00	4080464-00	4090002-04	4090002-05	4090021-00	4100004-00	4100063-01
Latitude	20.883	20.883	21.100	20.500	20.517	22.000	21.450	21.450	23.717	20.067	23.283
Longitude	-114.083	-114.083	-114.150	-114.350	-114.533	-114.000	-126.717	-126.717	-124.100	-130.067	-138.250
Depth	2560	2560	3560	3790	3100	3400	4300	4300	3787	4959	4890
Si(wt.%)	-	-	-	-	-	-	7.00	21.5	-	-	6.50
Ti	-	-	-	-	-	.30	1.10	.40	-	-	1.61
Mn	18.4	20.4	25.9	17.6	13.1	26.5	24.6	7.00	6.10	25.0	15.9
Fe	20.4	-	10.9	16.8	19.6	9.50	18.2	7.90	11.7	6.10	14.1
Al	-	.79	-	-	-	-	2.30	6.30	-	-	2.50
Co	-	.350	.590	-	-	1.000	.500	.070	.230	.360	.520
Ni	.310	.330	1.020	.370	.260	1.250	.460	.390	.450	1.040	.350
Cu	.030	.040	.670	.120	.160	.250	.360	.280	.210	1.000	.200
Ca	-	-	1.40	-	-	1.40	1.80	.60	.90	-	1.35
Mg	-	-	-	-	-	-	1.30	1.60	-	-	-
Na	-	-	-	-	-	-	2.00	3.50	-	-	-
K	-	-	-	-	-	.30	.70	2.80	-	-	.62
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	21.9
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	1600	700	-	3000	7900
Cd	-	3.0	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	15	-	23	-
Mo	-	590	-	-	-	-	610	100	-	-	280
Pb	-	-	500	-	-	-	1500	500	900	-	1700
Sr	-	-	-	-	-	-	900	420	-	-	1100
V	-	930	-	-	-	-	600	190	-	-	-
Y	-	-	-	-	-	-	170	63	-	-	-
Zn	-	530	1600	-	-	1500	-	-	650	1100	640
Sample type	Crust -	Crust -	Nodule -	Crust -	Crust -	Nodule -	Nodule -	Crust -	Crust -	Crust -	Nodule -
Portion sampled	unknown -	unknown -	quarter -	fragments -	quarter -	unknown -	outer crust	cross section	fragments -	unknown -	cross section
Nucleus	-	-	Nodule-fragment	-	-	-	-	-	-	-	-
Reference	A298	A303	A422	A298	A298	A381	A261	A261	A376	A323	A197

Sequence#	4120320-01	4120323-00	4120379-00	4120379-01	4120380-00	4120382-00	4120382-01	4120383-00	4120383-01	4120383-02	4120389-00
Latitude	28.400	23.017	21.617	21.617	21.892	21.925	21.925	21.833	21.833	21.833	21.718
Longitude	-159.183	-159.350	-158.688	-158.688	-158.767	-158.550	-158.550	-158.617	-158.617	-158.617	-158.700
Depth	5676	4856	1680	1680	1495	1330	1330	1255	1255	1255	700
Si(wt.%)	-	-	4.41	-	-	4.57	4.02	6.31	1.75	2.46	4.00
Ti	-	-	2.66	-	-	1.46	2.19	2.01	.80	1.02	2.90
Mn	5.43	.40	14.9	23.5	4.37	15.2	17.1	21.0	17.5	19.1	8.96
Fe	25.5	3.00	22.4	8.17	10.5	22.9	18.4	15.7	13.9	16.8	24.8
Al	-	-	1.28	-	-	1.41	2.08	3.42	.46	.99	1.77
Co	.080	.010	-	.310	.180	-	-	-	-	-	-
Ni	.150	.010	.260	.490	.240	.140	.210	.890	.230	.490	.090
Cu	.250	.020	-	.070	.030	-	-	-	-	-	-
Ca	-	-	1.74	-	1.88	1.80	1.92	1.22	1.78	1.80	1.26
Mg	-	-	1.16	-	-	1.01	1.03	3.39	.98	1.30	1.28
Na	-	-	.98	-	-	1.28	.85	1.51	1.48	1.85	2.52
K	-	-	.29	-	-	.32	.36	.38	.18	.25	.33
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	29.4	-	-	29.5	31.8	17.5	47.0	36.5	31.9
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	2300	-	-	340	-	640	2000	4300	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	1700	410	-	-	-	-	-	-
Sample type	Mn-encrusted sediment	Crust -	Mn-coated rock	Crust -	Crust -	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock
Portion sampled	unknown -	unknown -	middle layer	unknown -	unknown -	outer crust	middle layer	middle layer	outer crust	middle layer	outer crust
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A419	A179	A254	A324	A324	A254	A254	A254	A254	A254	A254

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4120390-00	4120453-00	4120453-01	4120457-00	4120458-00	4120459-00	4120461-00	4120462-00	4120463-00	4120463-01	4120464-00
Latitude	21.820	20.137	20.137	21.727	21.675	21.692	21.850	21.905	21.965	21.965	21.782
Longitude	-158.803	-156.265	-156.265	-158.292	-158.457	-158.495	-158.687	-158.635	-158.610	-158.610	-158.743
Depth	1300	1220	1220	795	920	985	1340	1840	1985	1985	1120
Si(wt.%)	2.79	-	-	-	-	-	-	-	-	-	-
Ti	1.24	1.23	1.51	1.21	1.13	1.12	1.17	1.27	-	1.83	-
Mn	22.1	14.9	8.20	24.3	24.3	27.4	22.4	19.5	24.0	22.1	25.8
Fe	17.9	10.8	10.8	20.3	22.4	19.5	17.5	21.8	19.3	20.8	17.2
Al	.94	3.40	-	-	-	-	-	-	-	-	-
Co	-	.060	.020	1.10	.920	1.17	.870	.590	.800	.740	.760
Ni	.250	.120	.030	.340	.260	.440	.400	.280	.370	.360	.690
Cu	-	.010	.010	.030	.020	.030	.030	.030	.030	.040	.070
Ca	1.71	-	-	-	-	-	-	-	-	-	-
Mg	1.08	-	-	-	-	-	-	-	-	-	-
Na	1.52	-	-	-	-	-	-	-	-	-	-
K	.31	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	31.6	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-	-
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	outer crust	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A254	A380	A380	A380	A380	A380	A380	A380	A380	A380	A380

Sequence#	4120466-00	4120466-01	4120466-02	4120466-03	4120466-04	4120466-05	4120466-06	4120467-00	4120468-00	4120468-01	4120468-02
Latitude	21.833	21.833	21.833	21.833	21.833	21.833	21.833	21.923	21.872	21.872	21.872
Longitude	-158.667	-158.667	-158.667	-158.667	-158.667	-158.667	-158.667	-158.795	-158.823	-158.823	-158.823
Depth	1265	1265	1265	1265	1265	1265	1265	1910	1115	1115	1115
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	1.49	1.04	1.25	1.20	1.31	1.36	1.08	.25	1.35	1.04	1.00
Mn	4.70	24.6	21.6	21.6	18.0	13.0	22.5	7.60	8.90	17.2	27.2
Fe	11.6	19.3	18.3	20.5	17.1	15.8	18.6	22.6	13.6	16.0	16.3
Al	5.40	-	-	-	-	-	-	-	-	-	-
Co	.180	.800	.780	.670	.550	.390	.760	.060	.380	.540	.860
Ni	.140	.340	.320	.260	.280	.280	.340	.380	.150	.300	.710
Cu	.020	.020	.040	.030	.030	.040	.030	.050	.030	.020	.060
Ca	-	-	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	-	-
Sample type	Mn-coated rock	Crust -	Mn-coated rock	Crust -	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A380	A380	A380	A380	A380	A380	A380	A380	A380	A380	A380

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4120475-00	4130055-00	4130055-01	4130165-00	4130165-01	4130165-02	4130216-00	4130216-01	4130216-02	4130216-03	4130217-00
Latitude	21.847	28.138	28.138	21.535	21.535	21.535	25.675	25.675	25.675	25.675	25.488
Longitude	-159.372	-162.278	-162.278	-167.930	-167.930	-167.930	-168.697	-168.697	-168.697	-168.697	-168.657
Depth	900	2561	2561	1690	1690	1690	-	-	-	-	-
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	.93	.97	1.12	.89	.73
Mn	19.6	13.4	19.7	16.9	17.7	18.8	23.5	21.6	19.8	22.0	23.7
Fe	20.2	12.1	14.2	17.1	17.0	15.4	16.9	15.9	15.7	17.5	15.4
Al	-	-	-	-	-	-	.80	1.40	1.70	1.00	1.20
Co	.650	.600	.740	.730	.770	.760	.800	.740	.670	.770	.780
Ni	.140	.370	.460	.390	.370	.420	.410	.590	.440	.350	.530
Cu	.070	.090	.170	.010	.060	.080	.070	.120	.080	.070	.070
Ca	-	3.30	2.60	2.70	2.40	4.10	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	400	-	-	-	-	-	-	-	-	-	-
Pb	-	1000	1200	1400	1600	1700	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	500	600	700	600	500	-	-	-	-	-
Sample	Nodule	Mn-coated	Nodule	Nodule	Nodule	Nodule	Crust	Crust	Mn-coated	Crust	Crust
type	-	rock	-	-	-	-	-	-	rock	-	-
Portion	composite	cross	without	quarter	quarter	half	unknown	unknown	unknown	unknown	unknown
sampled	-	section	nucleus	-	-	-	-	-	-	-	-
Nucleus	-	Pumice	volcanic	-	Sediment	Rock	-	-	Undetermined	-	-
Reference	A386	A405	A405	A405	A405	A422	A380	A380	A380	A380	A380

Sequence#	4130217-01	4130227-00	4130230-00	4130232-00	4130251-00	4140067-01	4140067-02	4140067-03	4140067-04	4140067-05	4140221-00
Latitude	25.488	24.292	23.817	23.367	28.965	23.917	23.917	23.917	23.917	23.917	28.817
Longitude	-168.657	-166.730	-164.420	-163.567	-162.022	-173.655	-173.655	-173.655	-173.655	-173.655	-178.950
Depth	-	-	-	-	3050	4000	4000	4000	4000	4000	-
Si(wt.%)	-	-	-	-	-	4.41	4.56	5.06	4.96	11.7	-
Ti	.83	.89	.76	.83	-	-	-	-	-	-	.67
Mn	24.4	23.5	23.5	26.2	20.9	18.5	18.7	19.0	18.2	19.1	31.8
Fe	16.2	16.7	16.7	14.4	18.9	12.7	14.5	13.5	15.4	13.4	11.7
Al	1.20	.80	.90	.50	-	-	-	-	-	-	.30
Co	1.000	1.04	1.000	1.36	.760	-	-	-	-	-	1.64
Ni	.490	.300	.300	.370	.270	-	-	.370	.340	.380	.620
Cu	.070	.030	.040	.040	.050	-	-	-	-	-	.050
Ca	-	-	-	-	2.90	1.81	1.93	1.73	1.80	1.60	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	.30	.40	.42	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	1800	-	-	-	-	-	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	300	-	-	-	-	-	-
Sample	Crust	Mn-coated	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	rock	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	outer	middle	middle	middle	middle	whole	unknown
sampled	-	-	-	-	crust	layer	layer	layer	layer	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A380	A380	A380	A380	A459	A276	A276	A276	A276	A276	A380

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4140223-00	4140230-00	4140230-01	4140230-03	4140230-04	4140232-00	4150100-00	4150104-00	4150104-01	4150106-00	4150106-01
Latitude	27.702	20.695	20.695	20.695	20.695	20.517	20.750	20.752	20.752	20.788	20.788
Longitude	-175.683	-170.548	-170.548	-170.548	-170.548	-170.830	173.667	173.440	173.440	173.340	173.340
Depth	-	1930	1930	1930	1930	2980	3385	1623	1623	1278	1278
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.63	.91	.95	1.12	.84	1.09	-	-	-	-	-
Mn	28.6	20.2	17.3	17.1	19.8	15.4	18.4	22.1	-	23.8	24.1
Fe	7.10	14.4	15.3	15.9	15.1	17.4	17.5	16.3	-	17.4	16.3
Al	1.80	-	-	-	-	-	-	-	-	-	-
Co	.600	.570	.520	.590	.590	.380	.390	.920	-	1.01	1.06
Ni	.490	.470	.420	.600	.530	.330	.290	.460	-	.450	.500
Cu	.070	.130	.130	.140	.150	.280	.160	.050	-	.040	.030
Ca	-	-	-	-	-	-	-	3.00	-	2.90	2.80
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	350	-	-
Ba	-	-	-	-	-	-	-	-	1900	-	-
Cd	-	-	-	-	-	-	-	-	5.0	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	10	-	-
Mo	-	-	-	-	-	-	420	-	-	-	-
Pb	-	-	-	-	-	-	-	1700	-	1800	1900
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	600	-	500	400
Sample	Mn-coated	Crust	Nodule	Nodule	Crust	Crust	Mn-coated	Crust	Crust	Crust	Crust
type	rock	-	-	-	-	-	rock	-	-	-	-
Portion	unknown	unknown	without	without	unknown	unknown	outer	fragments	fragments	fragments	fragments
sampled	-	-	nucleus	nucleus	-	-	crust	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A380	A343	A343	A343	A343	A343	A352	A405	A475	A405	A405

Sequence#	4150176-00	4150177-00	4160105-00	4160105-01	4160105-02	4160136-00	4160136-01	4160136-02	4160196-00	4160196-01	4160224-01
Latitude	26.977	22.133	21.145	21.145	21.145	21.160	21.160	21.160	21.688	21.688	24.065
Longitude	177.302	175.370	163.397	163.397	163.397	163.147	163.147	163.147	161.875	161.875	160.765
Depth	2750	1500	1575	1575	1575	1437	1437	1437	1479	1479	3951
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	5.44
Ti	.82	.64	-	-	-	-	-	-	-	-	1.08
Mn	16.0	20.2	21.2	14.5	-	22.3	23.9	-	18.3	20.8	22.8
Fe	16.0	13.9	17.5	14.3	-	16.8	9.50	-	14.8	16.7	13.2
Al	-	-	-	-	-	-	-	-	-	-	1.70
Co	.500	.470	.730	.540	-	.780	.590	-	.630	.700	.510
Ni	.290	.550	.410	.320	-	.430	.710	-	.500	.420	.490
Cu	.080	.150	.070	.040	-	.150	.120	-	.140	.020	.150
Ca	-	-	-	3.60	-	2.60	7.50	-	-	2.80	2.21
Mg	-	-	-	-	-	-	-	-	-	-	.72
Na	-	-	-	-	-	-	-	-	-	-	1.68
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	20.6
As(ppm)	-	-	-	-	310	-	-	270	-	-	-
Ba	-	-	-	-	1600	-	-	1800	-	-	-
Cd	-	-	-	-	3.0	-	-	5.0	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	34	-	-	14	-	-	-
Mo	-	-	640	-	-	-	-	-	500	-	-
Pb	1900	2300	-	1400	-	1700	1400	-	-	1800	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	530	990	-	500	-	500	1000	-	-	500	-
Sample	Nodule	Crust	Mn-coated	Mn-encrusted	Mn-encrusted	Crust	Crust	Crust	Mn-coated	Mn-coated	Nodule
type	-	-	rock	sediment	sediment	-	-	-	rock	rock	-
Portion	outer	unknown	outer	cross	cross	fragments	fragments	fragments	outer	outer	outer
sampled	crust	-	crust	section	section	-	-	-	crust	crust	crust
Nucleus	-	-	-	-	-	-	-	-	-	Rock	-
Reference	A343	A343	A352	A405	A475	A405	A422	A475	A352	A405	A343

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4160231-00	4160237-00	4160237-01	4160238-02	4160238-03	4160239-00	4160240-00	4170002-00	4170004-00	4170005-01	4170035-00
Latitude	25.550	21.167	21.167	27.853	27.853	22.333	22.658	21.483	24.027	23.815	29.495
Longitude	168.020	163.220	163.220	162.928	162.928	161.527	160.870	159.538	159.450	159.437	153.362
Depth	2870	3047	3047	3090	3090	1315	1280	1265	3332	1711	1719
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	.85	.79	.98	.91	1.27	.77	.77	-	-	-	-
Mn	20.3	18.4	19.8	16.1	23.0	23.0	19.6	21.6	22.6	19.4	19.6
Fe	13.4	16.7	16.0	16.3	12.2	14.6	15.4	16.3	14.8	16.9	17.2
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.570	.530	.580	.130	.830	.790	.780	.780	.620	.580	.560
Ni	.420	.500	.370	.200	.550	.530	.370	.460	.450	.360	.360
Cu	.150	.140	.130	.060	.130	-	-	.090	.150	.070	.040
Ca	-	-	-	-	-	-	-	-	-	2.50	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	500	540	-	560
Pb	-	-	-	-	-	-	-	-	-	1700	-
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-	500	-
Sample type	Nodule -	Nodule -	Nodule -	Crust -	Crust -	Nodule -	Nodule -	Mn-coated rock	Nodule -	Unknown -	Mn-coated rock
Portion sampled	without nucleus	without nucleus	without nucleus	middle layer	underside -	without nucleus	without nucleus	outer crust	whole -	fragments -	outer crust
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A343	A343	A343	A343	A343	A343	A343	A352	A352	A405	A352

Sequence#	4170035-01	4170035-02	4170066-00	4170066-01	4170067-02	4180009-00	4180011-00	4180011-01	4180272-00	4180403-01	4340358-00
Latitude	29.495	29.495	23.533	23.533	26.553	28.383	27.933	27.933	20.912	27.818	34.867
Longitude	153.362	153.362	157.393	157.393	152.217	148.250	147.650	147.650	142.532	145.700	-16.517
Depth	1719	1719	1425	1425	3200	2423	2728	2728	2423	1116	1480
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	.77	.88	1.49	-	-	-	-	-	-
Mn	23.6	27.7	22.4	20.8	18.2	21.0	25.7	8.70	9.50	28.6	15.9
Fe	13.8	10.5	13.1	14.2	15.4	19.8	12.5	5.40	13.4	10.3	17.5
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.660	.750	.650	.630	.700	.580	.050	.170	.070	.520	.630
Ni	.600	.850	.840	.620	.350	.330	.210	.220	.110	1.290	.270
Cu	.060	.110	.230	.120	.120	.020	.060	.080	.060	.070	.030
Ca	2.90	2.90	-	-	-	2.60	3.50	4.10	-	2.10	4.42
Mg	-	-	-	-	-	-	-	-	-	-	2.11
Na	-	-	-	-	-	-	-	-	-	-	3.04
K	-	-	-	-	-	-	-	-	-	-	.27
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	1100	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	23	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1700	1600	-	-	-	2000	300	600	-	1200	3400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	600	800	-	-	-	500	600	400	500	1100	550
Sample type	Crust -	Nodule -	Nodule -	Nodule -	Nodule -	Crust -	Crust -	Crust -	Crust -	Nodule -	Crust -
Portion sampled	fragments -	fragments -	without nucleus	without nucleus	underside -	fragments -	fragments -	fragments -	unknown -	cross section	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	Undetermined	-
Reference	A405	A405	A343	A343	A343	A405	A405	A405	A323	A422	A368

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4340396-00	4340397-00	4340397-01	4340397-02	4340397-03	4340397-04	4340397-05	4340398-00	4340399-00	4340399-01	4360183-00
Latitude	36.308	36.292	36.292	36.292	36.292	36.292	36.292	36.033	35.133	35.133	36.943
Longitude	-12.575	-12.583	-12.583	-12.583	-12.583	-12.583	-12.583	-12.850	-12.933	-12.933	-33.065
Depth	3800	3700	3700	3700	3700	3700	3700	4600	1450	1450	2670
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	7.80
Ti	.58	.42	.46	.50	.48	.54	.56	.45	.81	.91	.05
Mn	2.60	11.8	6.96	11.4	7.00	7.82	8.10	9.63	13.9	13.8	26.8
Fe	27.9	15.5	26.4	13.4	14.3	12.7	17.2	20.5	19.5	18.7	11.4
Al	3.23	3.18	2.84	3.26	3.76	5.09	3.82	2.97	1.70	1.66	.90
Co	.030	.140	.110	.130	.180	.220	.190	.170	.790	.740	.010
Ni	.140	.190	.200	.200	.110	.160	.130	.220	.250	.300	.060
Cu	.200	.150	.200	.140	.120	.120	.130	.180	.040	.050	.030
Ca	.31	1.80	.49	1.50	.82	1.60	.97	.69	3.60	6.70	1.60
Mg	-	-	-	-	-	-	-	-	-	-	2.23
Na	-	-	-	-	-	-	-	-	-	-	1.83
K	-	-	-	-	-	-	-	-	-	-	.81
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	590
Cd	6.0	8.0	7.0	14.0	10.0	13.0	12.0	7.0	10.0	10.0	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	65	38	68	50	55	80	45	45	80	50	13
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1100	1100	1300	1100	900	900	1300	1500	2600	2700	-
Sr	-	-	-	-	-	-	-	-	-	-	350
V	-	-	-	-	-	-	-	-	-	-	320
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	540	550	660	490	420	420	550	560	570	520	130
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Unknown	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown	unknown
sampled	-	-	-	-	-	-	-	-	-	-	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A467	A467	A467	A467	A467	A467	A467	A467	A467	A467	A464

Sequence#	4360184-00	4360185-00	4360186-00	4360187-00	4360188-00	4360189-00	4360190-00	4370030-01	4370045-00	4380089-00	4380090-00
Latitude	36.968	36.950	36.945	36.953	36.950	36.833	36.937	31.817	30.817	32.428	32.428
Longitude	-33.063	-33.058	-33.067	-33.078	-33.070	-33.178	-33.167	-43.417	-44.550	-58.968	-58.968
Depth	2100	2680	2690	2560	2700	-	-	3700	3540	3453	3453
Si(wt.%)	3.50	3.50	4.10	3.70	4.10	6.10	4.00	4.21	2.60	-	-
Ti	1.07	.76	.02	.80	.86	.98	.66	-	.87	-	-
Mn	12.4	9.20	29.0	10.2	9.60	7.90	7.40	14.5	11.5	11.9	14.4
Fe	25.7	20.1	9.60	24.1	26.6	23.2	21.2	26.6	25.9	20.2	14.0
Al	2.40	1.90	.40	2.40	2.80	4.10	2.40	-	2.60	-	-
Co	.300	.230	.010	.250	.230	.190	.180	.620	.790	.340	.420
Ni	.110	.070	.020	.080	.100	.070	.070	.230	.160	.240	.320
Cu	.040	.030	.010	.040	.050	.050	.040	.120	.070	.140	.140
Ca	5.20	5.20	5.20	8.00	5.90	6.50	5.30	2.45	2.03	-	-
Mg	2.21	1.88	1.62	1.79	1.80	2.13	1.39	-	-	-	-
Na	.95	.67	1.09	.59	.99	.95	.65	-	-	-	-
K	.17	.12	.66	.09	.18	.19	.17	-	-	-	-
P	-	-	-	-	-	-	-	.46	-	-	-
H_2O-	-	-	-	-	-	-	-	-	17.1	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	920	740	700	970	850	670	750	-	6700	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	75	86	9	110	82	190	71	-	-	-	-
Mo	-	-	-	-	-	-	-	-	170	-	-
Pb	-	-	-	-	-	-	-	-	2000	-	-
Sr	3200	2300	620	2800	2500	1700	2500	-	900	-	-
V	1500	1300	108	1600	1500	1300	1400	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	380	280	40	420	380	300	320	630	510	-	-
Sample	Mn-coated	Mn-coated	Crust	Mn-coated	Mn-coated	Mn-coated	Mn-coated	Unknown	Nodule	Crust	Crust
type	rock	rock	-	rock	rock	rock	rock	-	-	-	-
Portion	outer	outer	unknown	outer	outer	outer	outer	unknown	whole	unknown	unknown
sampled	crust	crust	-	crust	crust	crust	crust	-	-	-	-
Nucleus	volcanic	volcanic	-	volcanic	volcanic	volcanic	volcanic	-	-	-	-
Reference	A464	A464	A464	A464	A464	A464	A464	A388	A197	A179	A179

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4380090-01	4380112-00	4380113-00	4390002-01	4390042-00	4390213-00	4390353-00	4390358-00	4390358-02	4390358-03	4390358-04
Latitude	32.428	32.033	32.133	38.067	34.867	31.015	39.000	39.000	39.000	39.000	39.000
Longitude	-58.968	-59.000	-59.025	-60.217	-62.500	-67.113	-61.000	-60.950	-60.950	-60.950	-60.950
Depth	3453	2150	3475	3007	1460	4764	-	2000	2000	2000	2000
Si(wt.%)	-	-	-	-	.90	-	.88	-	1.10	2.30	3.20
Ti	-	-	-	-	.57	-	.52	-	.55	.50	.55
Mn	15.2	19.8	21.1	14.0	16.9	13.3	16.1	20.8	16.4	16.1	13.5
Fe	23.0	19.8	17.9	25.2	18.9	20.6	13.0	24.6	19.3	18.6	18.5
Al	-	-	-	-	1.40	-	.31	-	.83	1.20	.98
Co	.510	.600	.600	.360	.910	.180	.200	.630	.200	.220	.290
Ni	.250	.270	.740	.200	.270	.200	.130	.330	.110	.250	.100
Cu	.110	.090	.210	.100	.040	.120	.070	.110	.050	.060	.070
Ca	1.89	2.80	1.64	1.98	2.23	-	7.60	-	2.00	1.90	2.00
Mg	1.55	1.29	2.62	1.56	-	-	-	-	-	-	-
Na	1.83	1.32	1.25	1.50	-	-	-	-	-	-	-
K	.80	.28	.31	.23	-	-	.32	-	.47	.74	.74
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	21.5	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	190	-	190	250	190
Ba	-	-	-	-	7100	-	1900	-	1600	1700	1200
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	390	-	360	-	370	320	280
Pb	1300	1500	1100	1400	2300	-	800	-	600	600	600
Sr	-	-	-	-	1300	-	2400	-	1700	1600	1500
V	-	-	-	-	-	-	1200	-	1500	1300	1600
Y	-	-	-	-	-	-	410	-	250	250	290
Zn	570	590	980	610	530	-	900	-	850	900	750
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Crust	Nodule	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	cross	unknown	unknown	unknown	topside	middle	underside
sampled	-	-	-	-	section	-	-	-	-	layer	-
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A368	A368	A368	A197	A179	A283	A354	A283	A283	A283

Sequence#	4390358-05	4400456-00	4400536-01	4400536-03	4400539-00	4400539-01	4400548-00	4400564-02	4400565-00	4400569-01	4440097-00
Latitude	39.000	30.000	30.850	30.850	31.213	31.213	31.383	30.883	31.680	31.253	31.283
Longitude	-60.950	-77.000	-78.450	-78.450	-78.483	-78.483	-78.667	-78.783	-78.800	-78.983	-117.583
Depth	2000	2640	732	732	648	648	512	815	543	546	2100
Si(wt.%)	-	-	2.00	1.31	.51	.61	1.26	-	.61	.28	12.5
Ti	-	-	.49	-	.26	.35	.09	-	.06	.26	.25
Mn	17.7	40.9	-	19.5	12.3	12.1	6.95	17.9	13.1	11.1	13.4
Fe	22.4	14.6	18.7	16.7	6.78	12.5	1.60	13.4	5.10	6.64	11.4
Al	-	-	-	-	.58	1.85	.74	-	.95	.37	3.90
Co	.390	.660	.550	.730	-	-	-	.270	-	-	.080
Ni	.170	.840	.520	.600	.310	.310	.220	.430	.440	.300	.340
Cu	.030	.060	.070	.080	.100	.110	.100	.050	.180	.120	.060
Ca	1.89	-	-	7.72	7.08	9.93	8.73	.16	2.01	1.08	.94
Mg	1.10	-	3.70	-	1.33	1.93	1.51	2.13	2.05	1.09	-
Na	1.27	-	-	-	-	-	-	1.04	-	-	-
K	.25	-	-	-	.23	.17	.24	.26	.36	.24	.92
P	-	-	-	.32	2.40	.10	.43	-	5.63	3.84	-
H_2O-	-	-	-	-	-	-	-	-	-	-	15.4
As(ppm)	-	-	-	390	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	4100
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	680	600	-	-	-	-	-	-	360
Pb	1800	2500	-	1100	-	-	-	1500	-	-	800
Sr	-	-	-	1400	2500	840	1700	-	2200	3400	740
V	-	-	840	-	-	-	-	-	-	-	-
Y	-	-	-	219	-	-	-	-	-	-	-
Zn	620	-	-	550	-	-	-	540	-	-	670
Sample	Crust	Nodule	Nodule	Nodule	Crust	Crust	Crust	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	cross	unknown	whole	unknown	unknown	unknown	unknown	unknown	unknown	cross
sampled	-	section	-	-	-	-	-	-	-	-	section
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A166	A201	A388	A374	A374	A374	A368	A374	A374	A197

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4440102-00	4440102-01	4440102-02	4440106-01	4440106-02	4440137-00	4440137-01	4440318-01	4460084-00	4460085-00	4460085-01
Latitude	30.200	30.200	30.200	30.300	30.300	31.383	31.383	31.083	32.933	38.538	38.538
Longitude	-117.633	-117.633	-117.633	-117.667	-117.667	-118.050	-118.050	-118.617	-132.500	-133.650	-133.650
Depth	1300	1300	1300	1060	1060	1040	1040	1650	702	4427	4427
Si(wt.%)	10.9	-	-	-	-	9.80	-	-	-	-	-
Ti	.53	.58	-	-	.46	.63	.53	.24	-	-	-
Mn	10.7	14.2	16.4	33.4	14.4	13.7	19.4	14.6	25.6	12.6	3.40
Fe	14.7	15.1	20.8	18.3	11.9	14.5	12.9	9.22	11.4	5.90	5.60
Al	3.50	-	-	-	-	2.70	-	-	-	-	-
Co	.400	.560	-	.550	.590	.530	.580	.200	.900	.100	.020
Ni	.180	.200	.180	.350	.590	.230	.450	.480	.400	.810	.250
Cu	.040	.030	.020	.040	.040	.050	.060	.130	-	.460	.170
Ca	1.48	-	-	-	-	1.65	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	.55	-	-	-	-	.42	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	19.0	-	-	-	-	20.6	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	4600	3900	-	-	4400	6100	6400	5700	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	49	-	-	86	-	46	12	-	-	-
Mo	4100	290	-	-	340	480	420	320	-	-	-
Pb	2400	1100	-	3400	300	2100	1200	400	-	-	-
Sr	1300	-	-	-	-	1500	-	-	-	-	-
V	-	540	-	-	670	-	930	520	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	360	-	-	-	-	400	-	-	-	-	-
Sample type	Crust -	Crust -	Mn-coated rock	Nodule -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	cross section	fragments -	without nucleus	unknown -	fragments -	cross section	fragments -	fragments -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A197	A240	A321	A166	A240	A197	A240	A240	A255	A333	A333

Sequence#	4460089-03	4470008-00	4480024-01	4480030-08	4490019-00	4490039-04	4490043-00	4490047-00	4490047-01	4490048-00	4490048-01
Latitude	32.927	35.700	30.717	36.000	30.350	31.730	32.143	33.928	33.928	31.935	31.935
Longitude	-133.883	-140.850	-159.567	-157.000	-163.852	-165.717	-160.272	-162.095	-162.095	-162.240	-162.240
Depth	5385	5207	5770	-	2476	5597	4000	2430	2430	2800	2800
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	1.76	-	-	-	-	-	-	-	-	-
Mn	2.80	3.00	18.4	21.3	24.0	6.70	16.9	21.9	22.1	21.0	16.8
Fe	7.70	31.0	17.8	13.6	18.2	7.90	16.3	14.7	16.9	18.8	14.3
Al	-	2.17	-	-	-	-	-	-	-	-	-
Co	.050	.140	.280	.520	.760	.010	.440	.770	.690	.710	.510
Ni	.080	.010	.200	.600	.370	.120	.400	.660	.570	.300	.350
Cu	.080	.100	.170	.260	.050	.160	.290	.170	.130	.100	.180
Ca	-	.36	-	-	-	1.40	1.70	2.80	2.50	2.50	2.80
Mg	-	.70	-	-	-	-	-	-	-	-	-
Na	-	.35	-	-	-	-	-	-	-	-	-
K	-	.50	-	-	-	-	-	-	-	-	-
P	-	.28	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	1000	-	-	740	-	-	-	-	-	-
Pb	-	1600	-	-	-	500	1200	1200	1400	1400	900
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	400	400	500	500	300	500
Sample type	Crust -	Mn-encrusted sediment	Mn-encrusted sediment	Nodule -	Mn-coated rock	Mn-encrusted sediment	Crust -	Nodule -	Mn-coated rock	Mn-coated rock	Mn-coated rock
Portion sampled	unknown -	unknown -	unknown -	whole -	outer crust	whole -	outer crust	outer crust	without nucleus	outer crust	outer crust
Nucleus	-	-	-	-	-	Pumice	-	Basalt	Rock	Rock	-
Reference	A333	A419	A419	A277	A352	A437	A459	A459	A459	A459	A459

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4490049-00	4490050-00	4490051-00	4490051-01	4490051-02	4490052-00	4490052-01	4490054-00	4490054-01	4490055-00	4490055-01
Latitude	33.217	31.118	31.802	31.802	31.802	31.645	31.645	31.660	31.660	33.627	33.627
Longitude	-162.338	-162.365	-162.843	-162.843	-162.843	-162.872	-162.872	-163.017	-163.017	-165.098	-165.098
Depth	2900	2400	2500	2500	2500	2600	2600	2450	2450	2770	2770
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	20.6	23.1	18.5	19.4	20.4	20.5	17.2	19.9	17.3	21.0	20.9
Fe	17.4	15.1	17.5	19.4	19.7	18.6	14.5	18.6	18.8	16.6	16.2
Al	-	-	-	-	-	-	-	-	-	-	-
Co	1.000	.870	.580	.780	.800	.860	.810	.750	.790	.770	.790
Ni	.360	.610	.320	.270	.250	.300	.500	.250	.270	.410	.480
Cu	.060	.160	.130	.080	.080	.060	.170	.100	.090	.160	.140
Ca	2.30	2.60	2.60	2.30	2.50	2.50	2.40	2.40	2.20	2.60	2.30
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1600	1400	1200	1400	1400	1600	1300	1500	1600	1200	1400
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	300	500	400	300	300	300	500	300	400	400	400
Sample type	Mn-coated rock	Nodule -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Mn-coated rock	Nodule -	Mn-coated rock
Portion sampled	without nucleus	without nucleus	layeradjacent tonucleus	middle layer	outer crust	outer crust	outer crust	outer crust	outer crust	outer crust	outer crust
Nucleus	Rock	Rock	Basalt	Basalt	Basalt	-	-	-	Rock	Nodulefragment	Rock
Reference	A459	A459	A459	A459	A459	A459	A459	A459	A459	A459	A459

Sequence#	4490055-02	4490056-00	4490056-01	4490057-00	4490058-00	4490058-01	4500034-00	4500037-00	4500042-02	4510017-00	4510023-00
Latitude	33.627	32.468	32.468	34.077	33.863	33.863	37.725	38.677	38.940	32.137	35.582
Longitude	-165.098	-165.800	-165.800	-166.502	-166.515	-166.515	-174.485	-177.390	-178.622	172.262	170.953
Depth	2770	3000	3000	4500	3450	3450	5500	6401	5396	1309	1607
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	20.6	17.5	20.5	16.5	18.1	21.8	22.4	21.7	10.9	12.8	2.20
Fe	15.5	14.3	18.9	10.6	13.9	16.2	8.20	7.80	9.60	9.70	1.00
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.710	.530	.830	.300	.510	.690	.090	.120	.020	.450	.040
Ni	.500	.440	.300	1.060	.430	.470	.330	1.150	.350	.360	.090
Cu	.150	.190	.080	.610	.250	.190	.360	.700	.310	.040	.020
Ca	2.50	2.70	2.40	2.30	2.40	2.40	-	-	1.20	5.20	4.20
Mg	-	-	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	300	300	-	-	-
Pb	1200	1100	1500	700	900	1200	-	-	800	1100	100
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	400	500	600	1100	600	500	-	-	500	500	500
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Nodule -	Nodule -	Crust -	Crust -	Mn-encrusted sediment	Crust -	Crust -
Portion sampled	middle layer	outer crust	outer crust	fragments -	outer crust	without nucleus	composite -	composite -	without nucleus	fragments -	fragments -
Nucleus	Rock	Basalt	Basalt	-	non-apparent	Basalt	-	-	Sediment	-	-
Reference	A459	A459	A459	A459	A459	A459	A386	A386	A437	A422	A422

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4520015-01	4520015-02	4540006-00	4540006-01	4540010-00	4540010-02	4540030-00	4540033-00	4540200-00	4540200-01	4670471-00
Latitude	37.267	37.267	32.018	32.018	32.383	32.383	38.000	34.010	36.028	36.028	38.563
Longitude	162.400	162.400	149.273	149.273	148.425	148.425	146.000	145.945	143.412	143.412	14.180
Depth	1295	1295	1605	1605	5751	5751	3500	2515	-	-	740
Si(wt.%)	-	-	-	-	-	-	3.30	-	-	-	12.2
Ti	-	-	-	-	.30	-	.50	-	-	-	.14
Mn	25.7	22.0	18.4	19.7	8.80	13.0	19.8	15.5	7.10	3.76	8.30
Fe	12.5	14.1	17.0	15.3	16.0	17.0	13.9	20.0	6.81	3.61	17.6
Al	-	-	-	-	-	-	.62	-	-	-	5.60
Co	.610	.500	.550	.490	.080	.110	.290	.410	.130	.070	.080
Ni	.670	.370	.810	.850	.060	.110	.380	.190	.070	.040	.180
Cu	.120	.070	.130	.150	.060	.090	.100	.020	.080	.040	.070
Ca	3.68	2.30	1.50	1.50	2.04	1.20	2.12	2.30	-	-	1.20
Mg	-	-	-	-	.32	.38	-	-	-	-	1.60
Na	-	-	-	-	1.36	1.40	-	-	-	-	-
K	-	-	-	-	.46	.46	-	-	-	-	-
P	-	-	-	-	.15	.19	-	-	-	-	-
H_2O-	-	-	-	-	-	-	21.7	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	7200	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	160
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	260	180	480	-	-	-	-
Pb	1800	2200	1600	1500	500	1100	1500	1600	-	-	-
Sr	-	-	-	-	-	-	1300	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	360
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	900	400	800	900	-	-	570	500	-	-	-
Sample type	Nodule -	Crust -	Mn-coated rock	Mn-coated rock	Mn-encrusted sediment	Mn-encrusted sediment	Crust -	Mn-encrusted sediment	Mn-coated rock	Mn-coated rock	Mn-coated rock
Portion sampled	outer crust	fragments -	quarter -	without nucleus	unknown -	unknown -	cross section	outer crust	?? -	outer crust	outer crust
Nucleus	-	-	Rock	Rock	-	-	-	-	-	Undetermined	volcanic
Reference	A405	A405	A405	A405	A419	A419	A197	A405	A249	A249	A477

Sequence#	4670471-01	4670471-02	4670471-03	4670471-04	4670472-00	4670472-01	4670472-02	4700278-00	4700278-01	4700280-00	4700280-01
Latitude	38.563	38.563	38.563	38.563	38.640	38.640	38.640	41.350	41.350	42.858	42.858
Longitude	14.180	14.180	14.180	14.180	14.017	14.017	14.017	-14.475	-14.475	-19.933	-19.933
Depth	740	740	740	740	690	690	690	5005	5005	2692	2692
Si(wt.%)	11.6	13.9	20.4	2.00	13.5	17.7	9.20	-	-	-	-
Ti	.71	.04	.19	.02	.10	.07	.02	-	-	-	-
Mn	11.3	1.22	4.60	.29	.73	4.80	2.00	15.4	20.3	19.1	21.5
Fe	11.0	28.0	8.60	7.20	25.8	19.6	35.5	23.1	20.0	20.7	16.3
Al	7.70	3.40	6.20	.08	3.20	2.80	.80	-	-	-	-
Co	.080	.030	.040	-	.030	.030	.020	.320	.300	.420	.480
Ni	.290	-	.130	.010	-	.020	.010	.230	.370	.260	.530
Cu	.080	.010	.050	-	-	.030	-	.100	.170	.070	.180
Ca	1.80	.43	1.50	19.7	.68	.51	.47	1.77	1.87	2.29	2.08
Mg	1.80	.48	1.10	2.40	.60	1.00	.36	1.59	1.56	1.23	1.91
Na	-	-	-	-	-	-	-	1.54	1.75	1.28	1.42
K	-	-	-	-	-	-	-	.25	.44	.28	.52
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	160	42	138	15	62	30	56	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	2400	2700	1700	1200
Sr	-	-	-	-	-	-	-	-	-	-	-
V	370	95	240	300	105	59	165	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	510	650	630	850
Sample type	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Mn-coated rock	Crust -	Crust -	Crust -	Crust -
Portion sampled	outer crust	outer crust	outer crust	outer crust	outer crust	outer crust	outer crust	unknown -	unknown -	unknown -	unknown -
Nucleus	volcanic	volcanic	volcanic	volcanic	volcanic	volcanic	volcanic	-	-	-	-
Reference	A477	A477	A477	A477	A477	A477	A477	A368	A368	A368	A368

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4710180-00	4710180-01	4710182-00	4710183-00	4710184-00	4710185-00	4710185-01	4710187-00	4710188-00	4710189-00	4710190-00
Latitude	42.900	42.900	42.910	42.903	42.907	42.900	42.900	44.088	44.038	44.135	45.583
Longitude	-20.142	-20.142	-20.187	-20.213	-20.223	-20.250	-20.250	-21.927	-21.948	-22.295	-27.050
Depth	3288	3288	3292	3194	3294	3345	3345	1675	2275	2885	2262
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	19.5	18.3	18.2	27.4	17.0	18.1	17.9	22.5	19.5	17.5	13.7
Fe	16.5	21.1	20.9	7.51	20.5	20.2	19.9	17.1	19.4	20.6	22.8
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.290	.530	.550	.200	.560	.440	.520	1.01	.540	.520	.420
Ni	.530	.270	.270	.680	.260	.260	.310	.320	.350	.300	.180
Cu	.240	.100	.100	.340	.080	.080	.120	.040	.060	.090	.040
Ca	1.99	1.87	1.95	2.33	2.99	2.75	2.09	3.34	2.46	2.44	2.71
Mg	2.20	1.39	1.41	2.66	1.37	1.26	1.61	1.41	1.62	1.64	2.05
Na	1.85	1.33	1.39	2.39	1.37	1.54	1.78	1.46	1.35	1.60	1.89
K	.96	.32	.28	1.70	.29	.30	.26	.30	.30	.27	.25
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1100	1500	1500	600	1500	1400	1600	3000	1900	2000	1000
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	850	610	600	1400	610	640	670	490	630	720	590
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A368	A368	A368	A368	A368	A368	A368	A368	A368	A368

Sequence#	4710190-01	4710192-00	4710193-00	4710194-00	4710195-00	4710196-00	4710197-00	4710198-00	4710199-00	4710200-00	4710201-00
Latitude	45.583	45.350	45.300	45.617	45.767	45.833	45.750	45.700	45.767	45.800	45.750
Longitude	-27.050	-27.167	-27.383	-27.717	-27.967	-28.300	-28.947	-28.933	-28.983	-29.117	-29.233
Depth	2262	2097	2575	2231	1938	2421	2189	2865	2558	2295	2096
Si(wt.%)	-	-	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-	-	-
Mn	12.2	12.7	13.3	12.5	5.59	6.88	11.9	14.0	14.4	16.6	15.0
Fe	23.8	21.9	24.3	23.9	22.9	15.5	20.9	22.0	21.6	21.7	20.3
Al	-	-	-	-	-	-	-	-	-	-	-
Co	.280	.290	.320	.190	.150	.250	.420	.410	.430	.460	.460
Ni	.180	.140	.130	.120	.100	.160	.150	.210	.190	.190	.270
Cu	.040	.030	.040	.050	.060	.030	.030	.060	.050	.030	.070
Ca	2.67	2.46	2.35	4.40	3.64	5.97	4.26	2.58	2.77	2.39	1.57
Mg	2.32	1.91	1.46	1.50	5.39	.14	2.01	1.81	1.53	1.39	1.88
Na	1.91	2.03	1.39	1.28	1.66	.70	1.71	1.27	1.38	1.20	1.51
K	.28	.29	.21	.25	.59	.11	.30	.28	.21	.22	.31
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-	-	-
Pb	1200	1100	1200	600	500	500	1200	1100	1100	1100	1000
Sr	-	-	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-	-	-
Zn	650	590	620	530	480	340	550	600	590	520	670
Sample type	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -	Crust -
Portion sampled	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -	unknown -
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A368	A368	A368	A368	A368	A368	A368	A368	A368	A368

Table 9. Composition of crusts from the Scripps Nodule Databank (cont'd).

Sequence#	4710202-00	4710203-00	4710204-00	4710204-01	4710206-00	4710207-00	4810487-01	4810487-03	4810492-00	4840006-04	4840006-05
Latitude	45.267	45.517	45.233	45.233	45.233	45.217	40.383	40.383	42.750	40.235	40.235
Longitude	-29.433	-29.567	-29.800	-29.800	-29.833	-29.867	-127.983	-127.983	-128.050	-155.917	-155.917
Depth	2660	2752	2468	2468	2468	2395	1260	1260	2520	5033	5033
Si(wt.%)	-	-	-	-	-	-	-	-	13.5	-	-
Ti	-	-	-	-	-	-	-	-	.41	-	-
Mn	15.7	15.9	15.4	16.3	15.4	16.2	21.0	1.00	15.2	15.0	-
Fe	22.3	22.2	22.9	22.5	20.1	21.6	14.1	15.5	21.7	7.60	9.00
Al	-	-	-	-	-	-	-	-	1.80	-	-
Co	.360	.420	.430	.450	.410	.570	.500	.280	.170	.210	.290
Ni	.200	.190	.180	.200	.360	.280	.420	.140	.160	.530	.200
Cu	.030	.030	.040	.040	.140	.080	.020	.040	.060	.440	.210
Ca	2.23	2.62	2.72	2.31	2.03	2.60	2.38	-	1.80	-	-
Mg	1.53	1.33	1.45	1.48	4.18	1.99	-	-	1.00	-	-
Na	1.00	1.05	1.19	1.09	1.23	1.34	-	-	2.10	-	-
K	.20	.21	.22	.21	.26	.24	-	-	.50	-	-
P	-	-	-	-	-	-	-	-	-	-	-
H_2O-	-	-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	1200	3100	1800
Cd	-	-	-	-	-	-	3.0	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	50	14	-	26
Mo	-	-	-	-	-	-	-	-	500	-	-
Pb	1100	1100	1300	1000	900	1000	1400	-	1000	-	-
Sr	-	-	-	-	-	-	-	-	1300	-	-
V	-	-	-	-	-	-	-	-	460	-	-
Y	-	-	-	-	-	-	-	-	170	-	-
Zn	550	510	550	540	700	610	390	400	400	800	400
Sample	Crust	Crust	Crust	Crust	Crust	Crust	Nodule	Crust	Crust	Crust	Crust
type	-	-	-	-	-	-	-	-	-	-	-
Portion	unknown	unknown	unknown	unknown	unknown	unknown	fragments	unknown	cross	outer	middle
sampled	-	-	-	-	-	-	-	-	section	crust	layer
Nucleus	-	-	-	-	-	-	-	-	-	-	-
Reference	A368	A368	A368	A368	A368	A368	A200	A323	A261	A323	A323

Sequence#	4870015-00	4870015-01	4870025-04	5190054-01	5200002-02	5200003-00
Latitude	40.267	40.267	40.340	56.167	52.783	54.537
Longitude	170.333	170.333	175.630	-145.250	-150.083	-150.368
Depth	2037	2037	5304	-	-	972
Si(wt.%)	-	-	-	-	-	-
Ti	.04	.65	-	-	-	-
Mn	29.6	26.5	10.4	20.9	23.2	18.0
Fe	13.0	17.4	8.30	13.4	9.60	26.0
Al	1.10	-	-	-	-	-
Co	.510	.550	.020	.400	.500	.860
Ni	.610	.480	.380	.370	.630	.240
Cu	.050	.050	.300	-	-	.040
Ca	1.19	-	1.60	-	-	-
Mg	1.08	-	-	-	-	-
Na	2.00	-	-	-	-	-
K	.50	-	-	-	-	-
P	.40	-	-	-	-	-
H_2O-	16.3	-	-	-	-	-
As(ppm)	-	-	-	-	-	-
Ba	-	-	-	-	-	-
Cd	-	-	-	-	-	-
Ce	-	-	-	-	-	-
Cr	-	-	-	-	-	-
Mo	760	2800	-	-	-	-
Pb	2300	-	500	-	-	-
Sr	-	-	-	-	-	-
V	-	-	-	-	-	-
Y	-	-	-	-	-	-
Zn	-	-	600	-	-	-
Sample	Unknown	Nodule	Mn-encrusted	Crust	Crust	Nodule
type	-	-	sediment	-	-	-
Portion	unknown	without	without	unknown	unknown	unknown
sampled	-	nucleus	nucleus	-	-	-
Nucleus	-	-	Sediment	-	-	-
Reference	A290	A346	A437	A255	A255	A419

Table 10. Trace Analyses of crusts from Scripps Nodule Databank

Sequence#	0870004-00	0910005-01	0910005-02	1130061-00	1140051-00	1140081-01	1140081-02	1150001-00	1180019-00	1230002-00	1230002-01
Latitude	-64.517	-63.100	-63.100	-53.042	-55.733	-56.267	-56.267	-57.050	-52.017	-52.167	-52.167
Longitude	-145.967	177.617	177.617	-48.883	-56.050	-58.275	-58.275	-60.017	-99.950	-142.133	-142.133
Depth(m)	3775	3383	3383	3118	3914	4087	4087	3438	4418	2295	2295
Sn (ppm)	80*	80*	130*	80*	150*	50*	60*	130*	200*	400*	-
Zr	760	90	550	760	480	330	790	420	-	400	400
Reference	A227	A227	A227	A227	A227	A227	A227	A227	A227	A227	A227

Sequence#	1230006-00	1230007-00	1230011-00	1270003-00	1280029-00	1290010-00	1290062-00	1300013-00	1300013-01	1300013-02	1300013-03
Latitude	-59.850	-58.083	-59.133	-50.317	-50.783	-56.367	-56.683	-56.417	-56.417	-56.417	-56.417
Longitude	-144.867	-144.950	-145.133	176.383	169.958	158.467	158.767	140.017	140.017	140.017	140.017
Depth(m)	3219	3025	3155	2377	896	1595	1280	3750	3750	3750	3750
B (ppm)	-	-	-	700*	900*	-	-	-	-	-	-
Be	-	-	-	10*	10*	-	-	-	-	100*	100*
C	-	-	-	-	-	-	-	300	1600	4300	3300
Cl	-	-	-	-	-	-	-	400	3900	-	-
Ga	-	-	-	-	-	-	17	-	-	-	-
S	-	-	-	-	-	-	-	500	1100	800	1000
Sn	260*	220*	130*	-	-	10*	-	-	-	-	-
Tl	-	-	-	-	-	-	-	100	200	-	100
Zr	-	680	1200	-	-	2100	950	200	500	200	500
Reference	A227	A227	A227	A260	A260	A227	A388	A247	A247	A247	A247

Sequence#	1300013-04	1300013-05	1300013-06	1300013-07	1300013-08	1300013-09	1530001-00	1530003-00	1550005-07	1580001-01	1630063-00
Latitude	-56.417	-56.417	-56.417	-56.417	-56.417	-56.417	-42.067	-42.083	-41.983	-42.017	-49.667
Longitude	140.017	140.017	140.017	140.017	140.017	140.017	-81.983	-86.050	-102.017	-130.033	179.883
Depth(m)	3750	3750	3750	3750	3750	3750	3200	3012	4200	4839	2286
B (ppm)	-	-	-	-	-	-	-	-	-	-	800*
Be	-	-	-	100*	100*	-	-	-	-	-	10*
C	2000	2500	4000	5200	2900	2300	-	-	-	-	-
Cl	-	-	-	-	4300	4600	-	-	-	-	-
S	500	800	1400	1600	600	1000	-	-	-	-	-
Sc	-	-	-	-	-	-	-	-	7	-	-
Sn	-	-	-	-	-	-	80*	80*	-	80*	-
Th	-	-	-	-	-	-	-	-	8	-	-
Tl	100	100	-	-	200	100	-	-	-	-	-
Zr	200	200	200	200	300	400	420	760	-	760	-
Reference	A247	A247	A247	A247	A247	A247	A227	A227	A323	A227	A260

Sequence#	1630064-00	1630064-01	1630065-01	1630066-00	1630066-01	1890007-00	1890007-01	1890013-00	1890013-01	1890016-00	1890016-01
Latitude	-49.400	-49.400	-49.983	-49.367	-49.367	-33.050	-33.050	-33.042	-33.042	-32.967	-32.967
Longitude	177.983	177.983	177.533	176.267	176.267	-82.050	-82.050	-83.942	-83.942	-88.000	-88.000
Depth(m)	978	978	1335	1280	1280	3881	3881	3650	3650	3619	3619
B (ppm)	400*	-	-	600*	-	-	-	-	-	-	-
Be	10*	-	-	10*	-	-	-	-	-	-	-
Ga	-	10	13	-	18	-	-	-	-	-	-
Sn	100*	-	-	-	-	180*	360*	200*	260*	180*	260*
Yb	100*	-	-	-	-	-	-	-	-	-	-
Zr	300	230	380	-	270	440	260	660	430	410	100
Reference	A260	A388	A388	A260	A388	A227	A227	A227	A227	A227	A227

Sequence#	1900007-00	1930004-00	1940005-00	1940005-01	1940005-02	1980025-01	1980025-02	2010001-00	2010001-01	2010001-02	2010001-03
Latitude	-39.850	-37.067	-35.967	-35.967	-35.967	-35.850	-35.850	-39.750	-39.750	-39.750	-39.750
Longitude	-96.867	-129.967	-134.300	-134.300	-134.300	-178.517	-178.517	159.650	159.650	159.650	159.650
Depth(m)	3639	3548	4696	4696	4696	6715	6715	-	-	-	-
Bi (ppm)	-	-	-	-	-	10	-	3	1	-	-
Ga	-	-	-	-	-	-	14	-	-	17	14
S	-	-	-	-	-	-	22000*	-	-	18000*	18000*
Sn	180*	40*	60*	130*	60*	-	-	-	-	-	-
Tl	-	-	-	-	-	100	100	118	175	118	175
Zr	210	-	510	440	440	-	570	-	-	243	220
Reference	A227	A227	A227	A227	A227	A200	A388	A200	A200	A388	A388

Table 10. Trace Analyses of crusts from Scripps Nodule Databank

Sequence#	2130069-00	2130069-04	2130070-00	2140009-00	2140010-00	2140071-00	2140073-00	2140074-00	2140074-01	2140075-00	2140076-00
Latitude	-32.917	-32.917	-31.900	-37.433	-38.633	-35.333	-35.783	-35.433	-35.433	-35.617	-35.650
Longitude	35.317	35.317	34.350	26.467	26.133	22.642	22.383	22.367	22.367	22.367	22.217
Depth(m)	1250	1250	2700	2867	2960	320	1070	1700	1700	230	202
F (ppm)	-	-	-	30000*	-	-	-	-	-	-	-
Ga	17	20	18	-	-	-	-	-	-	-	-
Sn	-	-	-	-	2	-	-	-	-	-	-
Tl	-	-	-	-	260	-	-	-	-	-	-
Zr	320	450	500	-	-	167*	236*	31*	137*	101*	26*
Reference	A388	A388	A388	A422	A200	A466	A466	A466	A466	A466	A466

Sequence#	2150054-04	2150058-02	2250007-01	2250007-05	2310055-01	2330065-01	2330069-03	2430025-01	2450016-03	2490034-01	2670023-00
Latitude	-34.600	-34.700	-25.517	-25.517	-20.390	-22.662	-22.667	-22.363	-23.267	-29.100	-17.600
Longitude	17.000	16.900	-85.233	-85.233	-148.020	-160.788	-160.822	91.633	74.983	36.733	-141.917
Depth(m)	2740	3200	920	920	4630	4830	4850	5280	4520	3880	2132
B (ppm)	-	-	230	-	-	-	-	-	-	-	400
Bi	-	-	-	-	50*	-	-	-	-	-	-
C	-	-	-	-	-	330	1000	2000	-	-	-
Cl	-	-	-	-	-	8700	9000	-	-	-	-
Ga	-	9	-	-	-	-	-	-	-	15	-
S	11000*	17000*	-	-	-	-	-	1900	-	-	-
Sc	-	-	10	2	-	-	-	-	8	-	14
Th	-	-	-	86	-	-	-	-	23	-	-
Tl	56	350	-	-	-	-	-	-	-	-	-
Yb	-	-	57	-	-	-	-	-	-	-	53
Zr	-	211	260	-	-	-	-	520	-	500	1000
Reference	A388	A388	A261	A323	A248	A390	A390	A220	A323	A388	A261

Sequence#	2670098-01	2670098-02	2670098-03	2670098-07	2670117-01	2670119-01	2670130-06	2670130-07	2670252-00	2690013-01	2690019-03
Latitude	-16.483	-16.483	-16.483	-16.483	-16.167	-17.000	-18.917	-18.917	-13.250	-12.700	-12.700
Longitude	-145.550	-145.550	-145.550	-145.550	-146.000	-146.000	-146.383	-146.383	-148.500	-160.617	-160.750
Depth(m)	1270	1270	1270	1270	1190	1700	4465	4465	4650	4753	3953
B (ppm)	400	300	300	-	500	600	-	-	124	-	-
Bi	27	-	36	-	-	-	1	8	-	-	-
Eu	-	-	-	-	-	-	-	-	2	-	-
Ga	-	-	-	-	-	-	-	-	7	-	-
Nd	-	-	-	-	-	-	-	-	22	-	-
Sc	-	-	-	-	13	10	-	-	-	-	-
Sm	-	-	-	-	-	-	-	-	5	-	-
Sn	-	-	-	-	-	-	-	4	-	-	-
Tb	-	-	-	-	-	-	-	-	1	-	-
Th	-	-	-	-	-	-	-	-	-	64	29
Tl	-	-	-	180	-	-	340	340	-	175	164
U	-	-	-	-	-	-	-	-	-	10	15
Yb	48	53	31	-	53	57	-	-	2*	-	-
Zr	800	720	620	-	-	650	-	-	-	-	-
Reference	A261	A261	A261	A201	A261	A261	A200	A200	A463	A303	A303

Sequence#	2690022-02	2690065-00	2710120-01	2770039-00	2770039-01	3040105-01	3050029-00	3050039-00	3050039-03	3050076-01	3050090-00
Latitude	-12.700	-18.597	-11.317	-10.850	-10.850	-4.982	-2.292	-9.805	-9.805	-4.233	-8.275
Longitude	-160.817	-161.527	178.200	113.017	113.017	-154.983	-163.958	-164.743	-164.743	-168.283	-168.508
Depth(m)	3587	4998	770	5150	5150	4990	5243	4199	4199	5230	4565
Ag(ppm)	-	-	-	-	-	11	-	-	-	-	-
Be	-	-	-	-	-	-	-	3	-	-	-
Bi	-	-	-	13	-	-	-	-	-	-	-
C	-	800	-	-	-	-	-	-	-	-	-
Hg (ppb)	-	-	-	-	-	93	-	-	2800	-	-
S	-	-	-	-	28000*	-	-	-	-	-	-
Sc	-	-	5	-	-	-	-	-	-	-	-
Se	-	-	-	-	-	57	-	-	50	-	-
Te	-	-	-	-	-	-	-	223	-	-	-
Th	28	-	-	-	-	-	-	-	-	80	-
Tl	121	-	-	68	68	-	158	-	-	171	164
U	10	-	-	-	-	-	-	14	-	13	-
Reference	A303	A343	A323	A200	A388	A475	A303	A301	A475	A303	A303

Table 10. Trace Analyses of crusts from Scripps Nodule Databank

Sequence#	3050091-00	3050092-00	3050095-03	3050095-06	3050095-07	3050095-08	3050100-00	3050129-02	3190028-00	3350075-03	3350075-04
Latitude	-8.283	-8.287	-8.817	-8.817	-8.817	-8.817	-7.517	-7.740	-2.133	9.138	9.138
Longitude	-168.520	-168.528	-168.550	-168.550	-168.550	-168.550	-168.817	-168.553	57.400	-105.450	-105.450
Depth(m)	4751	4758	4550	4550	4550	4550	5288	4700	4133	2651	2651
Be (ppm)	3	-	-	-	-	-	-	-	-	-	-
Te	210	-	-	-	-	-	-	-	-	-	-
Th	-	-	-	23	31	-	51	-	-	20	10
Tl	-	184	186	-	-	173	85	168	-	137	97
U	14	-	-	10	7	-	11	-	-	4	4
Zr	-	-	-	-	-	-	-	-	520	-	-
Reference	A301	A303	A303	A303	A303	A303	A303	A303	A203	A303	A303

Sequence#	3410013-01	3410021-02	3410021-03	3410170-02	3410170-03	3470359-02	3470359-03	3470363-01	3540066-00	3540066-01	3540066-02
Latitude	5.872	5.232	5.232	8.330	8.330	7.455	7.455	7.433	2.942	2.942	2.942
Longitude	-160.848	-161.497	-161.497	-164.362	-164.362	136.407	136.407	133.715	60.057	60.057	60.057
Depth(m)	1604	1307	1307	1519	1519	3555	3555	3869	4042	4042	4042
Th	7	11	6	7	10	39	31	32	-	-	-
Tl	193	250	280	340	300	148	86	74	-	-	-
U	17	17	15	15	15	8	7	48	-	-	-
Zr	-	-	-	-	-	-	-	-	620	280	540
Reference	A303	A303	A303	A303	A303	A303	A303	A303	A217	A217	A217

Sequence#	3540066-03	3540066-04	3540070-00	3540070-01	3540070-02	3540070-03	3540072-01	3550004-00	3550004-01	3550004-02	3550004-03
Latitude	2.942	2.942	2.967	2.967	2.967	2.967	2.790	2.755	2.755	2.755	2.755
Longitude	60.057	60.057	60.047	60.047	60.047	60.047	60.042	59.903	59.903	59.903	59.903
Depth(m)	4042	4042	4093	4093	4093	4093	3816	3975	3975	3975	3975
Zr (ppm)	620	209	250	260	350	520	410	380	740	300	310
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Sequence#	3550004-04	3550004-05	3550004-06	3550004-07	3550004-08	3550004-09	3550013-00	3550013-01	3550013-02	3550013-03	3550013-04
Latitude	2.755	2.755	2.755	2.755	2.755	2.755	2.823	2.823	2.823	2.823	2.823
Longitude	59.903	59.903	59.903	59.903	59.903	59.903	59.862	59.862	59.862	59.862	59.862
Depth(m)	3975	3975	3975	3975	3975	3975	3563	3563	3563	3563	3563
Zr (ppm)	720	550	580	99	800	580	1300	1000	480	260	1200
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Sequence#	3550013-05	3550013-06	3550013-07	3550013-08	3550013-09	3550014-00	3550014-01	3550014-02	3550015-00	3550015-01	3550015-02
Latitude	2.823	2.823	2.823	2.823	2.823	2.798	2.798	2.798	2.863	2.863	2.863
Longitude	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.862	59.855	59.855	59.855
Depth(m)	3563	3563	3563	3563	3563	3776	3776	3776	3617	3617	3617
Zr (ppm)	1400	360	380	630	880	580	450	460	164	540	790
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Sequence#	3550015-03	3550015-04	3550015-05	3550015-06	3550015-07	3550015-08	3550015-09	3550018-00	3550018-01	3550018-02	3550018-03
Latitude	2.863	2.863	2.863	2.863	2.863	2.863	2.863	2.803	2.803	2.803	2.803
Longitude	59.855	59.855	59.855	59.855	59.855	59.855	59.855	59.768	59.768	59.768	59.768
Depth(m)	3617	3617	3617	3617	3617	3617	3617	3432	3432	3432	3432
Zr (ppm)	830	151	980	249	1500	1000	670	640	480	620	510
Reference	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217	A217

Table 10. Trace Analyses of crusts from Scripps Nodule Databank

Sequence#	3550018-04	3550018-05	3550018-06	3730026-01	3750103-03	3750390-00	3760145-02	3760147-04	3760223-01	3770025-01	3770026-03
Latitude	2.803	2.803	2.803	13.052	11.100	13.567	19.100	18.350	18.717	19.383	19.367
Longitude	59.768	59.768	59.768	-125.480	-140.017	-140.633	-158.233	-158.450	-158.283	-162.167	-162.317
Depth(m)	3432	3432	3432	4400	4800	4721	3131	1317	475	4160	4868
B (ppm)	-	-	-	120	-	-	-	-	-	-	-
Ga	-	-	-	30	-	-	-	-	-	-	-
Hg (ppb)	-	-	-	-	204	-	-	-	-	-	-
S	-	-	-	-	-	3500	-	-	-	-	-
Se	-	-	-	-	41	-	-	-	-	-	-
Tl	-	-	-	-	-	-	86	88	290	100	139
Yb	-	-	-	18	-	-	-	-	-	-	-
Zr	470	420	570	240	-	-	-	-	-	-	-
Reference	A217	A217	A217	A261	A475	A392	A303	A303	A303	A303	A303

Sequence#	3770101-00	3770103-03	3770138-00	3780035-00	3780046-03	3780070-01	3790020-01	3800024-01	3800024-02	3800025-06	3800027-01
Latitude	19.117	19.117	18.300	17.900	17.800	17.067	19.313	12.050	12.050	11.950	12.050
Longitude	-169.733	-169.733	-161.767	-174.267	-174.367	-177.250	176.735	165.000	165.000	164.983	164.950
Depth(m)	1740	1740	3060	1749	2288	2013	1753	2090	2090	2105	2105
B (ppm)	300	150	-	300	150	-	-	190	-	500	400
Be	-	3	-	-	3	-	-	-	-	-	-
Bi	-	30	-	-	30	-	-	-	-	27	-
Hg (ppb)	-	-	-	-	-	-	82	-	-	-	-
Nd	-	300*	-	-	300*	-	-	-	-	-	-
Sc	11	-	-	11	-	-	-	20	-	10	-
Se	-	-	-	-	-	-	61	-	-	-	-
Th	-	-	35	-	-	-	-	-	-	-	-
Tl	-	300	-	-	150	-	-	-	-	-	-
U	-	-	9	-	-	-	-	-	-	-	-
Yb	66	30	-	53	30	-	-	66	-	53	40
Zr	800	700	-	900	700	56*	-	470	82*	800	670
Reference	A261	A262	A346	A261	A262	A165	A475	A261	A165	A261	A261

Sequence#	3800031-00	3830063-00	3920032-00	3990010-02	3990101-00	4080121-05	4080121-06	4080306-00	4080310-02	4080336-01	4090002-04
Latitude	12.150	18.953	12.728	25.750	26.067	21.800	21.800	27.717	25.250	20.883	21.450
Longitude	164.683	135.793	47.373	-20.233	-22.367	-113.050	-113.050	-119.283	-119.667	-114.083	-126.717
Depth(m)	1830	3195	1170	2791	2300	3450	3450	1310	64	2560	4300
Ag(ppm)	-	-	-	-	-	-	-	-	-	-	2
B	300	-	-	400	-	-	-	500	200	-	400
Ga	-	-	-	-	-	-	-	-	-	-	7
Sc	9	8	-	21	-	5	1	-	10	-	16
Sn	-	-	-	-	6	-	-	-	-	-	-
Th	-	31	-	-	-	10	20	-	-	35	-
Tl	-	-	-	-	-	-	-	-	-	113	-
U	-	-	-	-	-	-	-	-	-	15	-
Yb	44	-	-	66	-	-	-	48	57	-	44
Zr	1000	-	480	640	-	-	-	530	480	-	1000
Reference	A261	A323	A195	A261	A354	A323	A323	A261	A261	A303	A261

Sequence#	4090002-05	4100004-00	4150104-01	4160105-02	4160136-02	4180272-00	4360183-00	4360184-00	4360185-00	4360186-00	4360187-00
Latitude	21.450	20.067	20.752	21.145	21.160	20.912	36.943	36.968	36.950	36.945	36.953
Longitude	-126.717	-130.067	173.440	163.397	163.147	142.532	-33.065	-33.063	-33.058	-33.067	-33.078
Depth(m)	4300	4959	1623	1575	1437	2423	2670	2100	2680	2690	2560
B (ppm)	200	-	-	-	-	-	204*	400*	280*	170*	390*
Ga	7	-	-	-	-	-	5	20	20	9	27
Hg (ppb)	-	-	114	81	137	-	-	-	-	-	-
Sc	14	7	-	-	-	10	-	-	-	-	-
Se	-	-	46	44	47	-	-	-	-	-	-
Th	-	39	-	-	-	1	-	-	-	-	-
Yb	9	-	-	-	-	-	-	-	-	-	-
Zr	380	-	-	-	-	-	-	-	-	-	-
Reference	A261	A323	A475	A475	A475	A323	A464	A464	A464	A464	A464

Table 10. Trace Analyses of crusts from Scripps Nodule Databank

Sequence#	4360188-00	4360189-00	4360190-00	4370030-01	4390353-00	4390358-00	4390358-02	4390358-03	4390358-04	4400536-01	4400536-03
Latitude	36.950	36.833	36.937	31.817	39.000	39.000	39.000	39.000	39.000	30.850	30.850
Longitude	-33.070	-33.178	-33.167	-43.417	-61.000	-60.950	-60.950	-60.950	-60.950	-78.450	-78.450
Depth(m)	2700	-	-	3700	-	2000	2000	2000	2000	732	732
B (ppm)	400*	350*	330*	-	120	-	170	190	170	-	-
Ga	16	2	27	-	-	-	-	-	-	-	10
S	-	-	-	25000*	-	-	-	-	-	-	9000*
Sb	-	-	-	-	45	-	60	45	25	-	-
Sc	-	-	-	-	28*	-	28*	42*	39*	-	-
Sn	-	-	-	-	-	4	-	-	-	-	-
Ti	-	-	-	244	-	-	-	-	-	55	206
Yb	-	-	-	-	38	-	33	32	39	-	-
Zr	-	-	-	-	690	-	790	1100	890	-	450
Reference	A464	A464	A464	A388	A283	A354	A283	A283	A283	A201	A388

Sequence#	4670471-00	4670471-01	4670471-02	4670471-03	4670471-04	4670472-00	4670472-01	4670472-02	4810487-01	4810487-03	4810492-00
Latitude	38.563	38.563	38.563	38.563	38.563	38.640	38.640	38.640	40.383	40.383	42.750
Longitude	14.180	14.180	14.180	14.180	14.180	14.017	14.017	14.017	-127.983	-127.983	-128.050
Depth(m)	740	740	740	740	740	690	690	690	1260	1260	2520
B (ppm)	-	-	-	-	-	-	-	-	-	-	600
Bi	-	-	-	-	-	-	-	-	6	-	-
Eu	4	4	1	3	1	2	-	1	-	-	-
Lu	1	1	-	1	-	1	-	-	-	-	-
Nd	73	74	18	49	9	33	10	23	-	-	-
Sc	-	-	-	-	-	-	-	-	-	16	13
Sm	15	14	3	11	2	7	1	4	-	-	-
Sn	-	-	-	-	-	-	-	-	3	-	-
Tb	2	2	-	2	-	1	-	-	-	-	-
Th	-	-	-	-	-	-	-	-	-	34	-
Ti	-	-	-	-	-	-	-	-	102	-	-
Yb	8*	7*	1*	5*	2*	3*	1*	1*	-	-	35
Zr	-	-	-	-	-	-	-	-	-	-	560
Reference	A477	A477	A477	A477	A477	A477	A477	A477	A200	A323	A261

Sequence#	4840006-04	4840006-05	4870015-01	5200002-02
Latitude	40.235	40.235	40.267	52.783
Longitude	-155.917	-155.917	170.333	-150.083
Depth(m)	5033	5033	2037	-
Hg (ppb)	-	-	-	470
Sc	14	11	9	-
Th	138	131	-	-
Reference	A323	A323	A346	A255

Table 11. Composition of Mn oxide majors as reported by NGDC

MMBIB	APLIAC8501	BURNWC7705	CANNJR7701	CANNJR7701	CANNJR7701	CANNJR7701	CANNJR7701	CANNJR7701	CORLJB7801
Sample#	45	1052	6243-1	6243-2	6243-3	6243-4	6243-5	6243-6	A-1
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	8	8	8	8	8	8	8	19
Latitude	-8.550	2.286	12.550	12.550	12.550	12.550	12.550	12.550	.600
Longitude	-167.000	-101.018	47.651	47.651	47.651	47.651	47.651	47.651	-86.117
Depth	3940	3150	2550	2550	2550	2550	2550	2550	-
Al(wt.%)	1.80	-	1.11	1.11	.84	.06	.69	.34	.09
Ca	2.30	-	1.41	1.74	1.49	1.50	1.55	1.52	1.07
Co	.390	.051	.004	.007	.003	.001	-	.002	-
Cu	.140	.073	.008	.011	.020	.001	.001	.008	.004
Fe	17.8	21.8	6.39	1.31	1.53	4.52	.76	1.51	27.3
K	-	-	1.13	1.54	1.57	1.28	1.21	1.62	-
Mg	-	-	1.09	2.21	2.01	1.60	1.50	2.17	-
Mn	19.2	16.7	34.2	34.9	37.3	38.8	39.8	42.5	7.29
Na	-	-	3.53	2.57	2.75	3.04	2.90	3.07	-
Ni	.320	.195	.039	.090	.067	.001	.002	.038	.007
P	-	-	-	-	-	-	-	-	-
Si	-	-	4.79	5.38	4.04	2.32	3.38	1.97	15.10
Ti	1.15	-	.20	.16	.11	.02	.07	.08	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	60
Ba	-	-	1700	2000	1100	1000	530	660	320
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	10
Mo	-	-	-	-	-	-	-	-	-
Pb	790	-	-	-	-	-	-	-	-
Pt	-	-	380	350	320	340	220	340	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	10	10	10	-	-	10	-
Zn	510	540	220	450	780	20	20	380	150

MMBIB	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801
Sample#	A-2	DM-1	DM-2	N-1	N-2	N-3	N-4	N-5	TB-1
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	19	19	19	19	19	19	19	19	19
Latitude	.583	.417	.417	.600	.600	.583	.583	.600	.600
Longitude	-86.100	-86.100	-86.100	-86.117	-86.117	-86.100	-86.100	-86.117	-86.117
Depth	-	-	-	-	-	-	-	-	-
Al(wt.%)	.55	1.33	1.32	.01	.02	.26	1.12	.83	.20
Ca	1.70	2.46	2.10	.49	.08	1.02	6.70	17.2	1.19
Co	-	.050	.025	-	-	-	.001	.001	.001
Cu	.006	.040	.038	-	.001	-	.015	.009	.010
Fe	27.6	17.3	10.2	25.7	23.2	27.4	11.8	8.33	.31
K	-	-	.46	1.74	1.86	.83	.64	.50	.55
Mg	-	-	.88	1.44	1.71	1.27	1.01	1.01	1.97
Mn	8.41	22.6	15.1	.20	.18	.35	.34	1.14	51.1
Na	-	-	1.11	1.19	1.03	1.21	.09	.20	2.29
Ni	.005	.777	.454	-	.001	.003	.010	.006	.050
P	-	-	-	-	-	-	-	-	-
Si	11.40	5.17	17.50	22.40	24.80	18.80	20.80	13.40	.65
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	20	180	120	10	-	10	-	-	-
Ba	1100	1400	760	70	70	600	1900	2100	2500
Cd	-	-	-	-	-	-	-	-	-
Co	-	210	110	-	-	-	-	-	-
Cr	10	40	20	-	-	10	20	10	10
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	150	770	520	30	30	50	380	240	300

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CORLJB7801	CRAIJD8201	CRAIJD8201	CRAIJD8201
Sample#	TB-2	TB-3	TB-4	TB-5	TB-6	TB-7	-	1-32-C	3-1-1
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	19	19	19	19	19	19	8	0	8
Latitude	.600	.583	.617	.600	.617	.583	21.833	25.668	21.833
Longitude	-86.117	-86.100	-86.100	-86.117	-86.100	-86.100	-158.667	-168.686	-158.667
Depth	-	-	-	-	-	-	1295	1510	1295
Al(wt.%)	.27	.27	.01	.28	.15	.16	-	1.70	5.40
Ca	1.34	1.60	1.31	1.69	1.82	1.72	-	-	-
Co	.001	-	-	-	.001	-	.388	.666	.177
Cu	.019	.005	.003	.007	.026	.003	.038	.084	.025
Fe	.33	.19	.03	.26	.57	.14	15.8	15.7	11.6
K	.62	.32	.92	.36	1.17	.27	-	-	-
Mg	1.81	.85	1.42	.75	2.07	.67	-	-	-
Mn	50.1	50.2	50.8	50.3	46.7	51.0	13.0	19.8	4.70
Na	2.10	3.80	2.98	3.46	2.28	4.03	-	-	-
Ni	.085	.012	.008	.016	.148	.010	.282	.442	.144
P	-	-	-	-	-	-	-	-	-
Si	.92	1.20	.11	1.06	.91	.70	-	-	-
Ti	-	-	-	-	-	-	1.36	1.12	1.49
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	30	40	-	20	-	-	-	-
Ba	3200	1200	1200	1500	1300	1000	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	10	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	750	240	40	160	1100	70	-	-	-

MMBIB	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201
Sample#	3-1-2A	3-2-4A	3-2-5A	3-2-6	3-2-8A	5-10	5-11-A	5-12-A	5-5-A
Analysis#	1	9	1	1	1	1	1	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	21.833	21.833	21.833	21.833	21.833	38.617	40.218	37.752	28.785
Longitude	-158.667	-158.667	-158.667	-158.667	-158.667	171.034	170.367	170.285	-178.801
Depth	1295	1295	1295	1295	1295	1104	2030	1800	880
Al(wt.%)	-	-	-	-	-	.80	.40	.70	.30
Ca	-	-	-	-	-	-	-	-	-
Co	.798	.782	.668	.554	-	1.12	.411	.463	1.41
Cu	.024	.036	.027	.032	-	.055	.052	.047	.065
Fe	19.3	18.3	20.5	17.1	18.6	19.3	13.1	15.3	8.90
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	24.6	21.6	21.6	18.0	22.5	26.0	27.2	19.5	30.9
Na	-	-	-	-	-	-	-	-	-
Ni	.341	.317	.264	.282	-	.246	.680	.364	.982
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	1.04	1.25	1.20	1.31	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201
Sample#	5-5-B	5-7-C	5-7-E	5-8-B	1-20-A	1-24	1-32-A	1-32-B	1-32-D
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	28.785	27.751	27.751	26.451	28.817	27.700	25.668	25.668	25.668
Longitude	-178.801	-175.636	-175.636	-177.852	-178.950	-175.683	-168.686	-168.686	-168.686
Depth	-	850	850	930	980	1090	1510	1510	1510
Al(wt.%)	.30	.40	.40	.60	.30	1.80	.80	1.40	1.00
Ca	-	-	-	-	-	-	-	-	-
Co	1.16	.969	.939	.656	1.64	.597	.800	.741	.771
Cu	.057	.059	.050	.120	.053	.066	.070	.125	.068
Fe	7.80	11.6	13.6	6.20	11.7	7.10	16.9	15.9	17.5
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	33.0	25.8	27.4	19.6	31.8	28.6	23.5	21.6	22.0
Na	-	-	-	-	-	-	-	-	-
Ni	1.107	.689	.570	.609	.624	.488	.411	.592	.349
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	.67	.63	.93	.97	.89
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

MMBIB	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201
Sample#	1-33-A	1-33-B	1-43	1-47-A	1-49	2-1011A	2-101A	2-1214A	2-8-8A
Analysis#	1	1	1	1	1	1	3	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	25.484	25.484	24.285	23.817	23.367	21.953	21.953	21.769	21.850
Longitude	-168.651	-168.651	-166.719	-164.417	-163.567	-158.602	-158.602	-158.735	-158.684
Depth	1075	1075	1115	870	870	1985	1985	1120	1340
Al(wt.%)	1.20	1.20	.80	.90	.50	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.775	1.00	1.04	1.00	1.36	.740	-	.761	.867
Cu	.069	.068	.029	.035	.037	.038	.027	.069	.028
Fe	15.4	16.2	16.7	16.7	14.4	20.8	19.3	17.2	17.5
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	23.7	24.4	23.5	23.5	26.2	22.1	24.0	25.8	22.4
Na	-	-	-	-	-	-	-	-	-
Ni	.525	.492	.299	.299	.370	.362	.371	.692	.401
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	.73	.83	.89	.76	.83	1.83	-	-	1.17
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201
Sample#	2-9-9A	3-3-11	3-4-14	3-4-15A	3-4-17	3-5-22	3-8-21A	4-10	4-11
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	21.901	21.918	21.868	21.868	21.868	20.134	20.134	23.168	23.117
Longitude	-158.634	-158.785	-158.818	-158.818	-158.818	-156.253	-156.253	-162.433	-162.467
Depth	1840	1945	1150	1150	1150	1440	1440	2065	1865
Al(wt.%)	-	-	-	-	-	-	3.40	.60	.50
Ca	-	-	-	-	-	-	-	-	-
Co	.591	.062	.378	.538	.856	.021	.055	1.23	.722
Cu	.026	.053	.025	.020	.059	.012	.012	.036	.047
Fe	21.8	22.6	13.6	16.0	16.3	10.8	10.8	19.0	15.7
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	19.5	7.60	8.90	17.2	27.2	8.20	14.9	26.1	21.4
Na	-	-	-	-	-	-	-	-	-
Ni	.281	.375	.149	.304	.711	.034	.119	.476	.387
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	1.27	.25	1.35	1.04	1.00	1.51	1.23	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

MMBIB	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRAIJD8201	CRONDS8201
Sample#	4-3	4-5	4-7	4-8	4-9	2-4-2	2-5-3A	2-6-6	U23-1
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	25.650	25.500	25.683	24.235	23.702	21.718	21.718	21.685	-26.933
Longitude	-168.785	-168.235	-167.686	-166.068	-165.600	-158.285	-158.451	-158.485	-177.617
Depth	1860	1440	1340	1840	1330	795	920	985	1700
Al(wt.%)	1.60	.60	.90	.80	1.20	-	-	-	.25
Ca	-	-	-	-	-	-	-	-	2.10
Co	.774	1.09	.122	1.11	.776	1.10	.923	1.17	-
Cu	.061	.036	.024	.075	.040	.026	.015	.025	.010
Fe	16.3	17.8	13.5	16.3	13.8	20.3	22.4	19.5	.24
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	18.0	22.2	21.2	22.2	17.0	24.3	24.3	27.4	52.0
Na	-	-	-	-	-	-	-	-	-
Ni	.358	.343	.406	.368	.393	.337	.262	.443	.032
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	1.21	1.13	1.12	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	490

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	CRONDS8201	CRONDS8201	CRONDS8201	CRONDS8201	CRONDS8201	CRONDS8201	CRONDS8201	CRONDS8201	DILLJG8201
Sample#	U23-1	U23-1	U23-1	U23-1	U23-1	U23-1	U23-2	U23-2	1D
Analysis#	2	3	4	5	6	7	1	2	1
Sampletype	8	8	8	8	8	8	8	8	1
Latitude	-26.933	-26.933	-26.933	-26.933	-26.933	-26.933	-26.933	-26.933	-38.600
Longitude	-177.617	-177.617	-177.617	-177.617	-177.617	-177.617	-177.617	-177.617	-167.900
Depth	1700	1700	1700	1700	1700	1700	1700	1700	1420
Al(wt.%)	.03	.07	.02	.03	.08	.28	1.10	15.6	-
Ca	2.20	3.60	4.90	5.80	6.80	7.90	1.10	2.60	-
Co	.001	-	-	-	-	.001	.005	-	-
Cu	.002	.003	.003	.003	.003	.017	.020	.003	-
Fe	.05	.06	.01	.02	.08	.32	1.50	2.70	-
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	-	50.0	49.0	49.0	52.0	46.0	38.0	49.0	-
Na	-	-	-	-	-	-	-	-	-
Ni	.009	.015	.004	.004	.010	.048	.073	.002	-
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	30
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	110	170	30	50	150	710	760	90	-

MMBIB	DILLJG8201	DILLJG8201	EHRLAM6803	EHRLAM6803	EHRLAM6803	EHRLAM6803	EHRLAM6803	EHRLAM6803	EHRLAM6803
Sample#	143D-C	143D-E	113-10	2-9	11-1	2390-12	2390-12	2390-12	2390-12
Analysis#	1	1	1	1	1	1	2	3	4
Sampletype	1	1	7	1	1	8	8	8	8
Latitude	19.500	19.500	9.019	35.583	-1.617	31.202	31.202	31.202	31.202
Longitude	-168.900	-168.900	-42.669	-67.917	58.617	-78.483	-78.483	-78.483	-78.483
Depth	1805	1805	2300	3000	3940	648	648	648	648
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cu	-	-	-	-	-	-	-	-	-
Fe	-	-	-	-	-	-	-	-	-
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	-	-	-	-	-	-	-	-	-
Na	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	40	20	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	50	910	2800	630	470	530	780
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	20	80	170	80	70	60	160
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	EHRLAM6803	EHRLAM6803	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001
Sample#	5-12A	4	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1
Analysis#	1	1	1	10	11	12	13	14	15
Sampletype	1	1	8	8	8	8	8	8	8
Latitude	31.934	-25.517	9.300	9.300	9.300	9.300	9.300	9.300	9.300
Longitude	-77.250	-85.233	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050
Depth	787	920	4830	4830	4830	4830	4830	4830	4830
Al(wt.%)	-	-	1.20	.98	1.09	1.11	1.00	1.55	1.62
Ca	-	-	-	-	-	-	-	-	-
Co	-	-	.420	.130	.130	.110	.110	.100	.090
Cu	-	-	.180	.210	.200	.200	.230	.270	.290
Fe	-	-	17.6	28.8	27.8	28.0	26.7	28.0	29.0
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	-	-	26.2	18.3	19.0	19.0	20.2	17.8	17.2
Na	-	-	-	-	-	-	-	-	-
Ni	-	-	.430	.210	.230	.240	.300	.220	.240
P	-	-	-	-	-	-	-	-	-
Si	-	-	6.00	7.00	6.80	6.80	2.99	6.40	6.80
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	1400	2300	2600	2600	1400	3000	3000
Cd	-	-	-	-	-	-	-	-	-
Ce	970	60	1000	390	470	470	230	580	590
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	180	10	-	-	-	-	-	-	-
Zn	-	-	560	950	930	900	900	890	920

MMBIB	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001	FRIEGH8001
Sample#	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1	FMC-1
Analysis#	16	17	18	19	2	3	4	5	6
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	9.300	9.300	9.300	9.300	9.300	9.300	9.300	9.300	9.300
Longitude	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050	-146.050
Depth	4830	4830	4830	4830	4830	4830	4830	4830	4830
Al(wt.%)	1.88	2.58	3.47	4.25	.85	.86	.86	.43	.90
Ca	-	-	-	-	-	-	-	-	-
Co	.080	.080	.080	.090	.450	.350	.210	.150	.160
Cu	.290	.270	.270	.240	.230	.220	.200	.180	.180
Fe	26.7	28.6	28.3	27.1	16.0	17.1	20.5	26.0	26.5
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	18.4	15.7	14.5	14.2	28.0	27.5	24.8	20.5	20.3
Na	-	-	-	-	-	-	-	-	-
Ni	.270	.200	.180	.190	.530	.450	.360	.230	.240
P	-	-	-	-	-	-	-	-	-
Si	8.30	10.00	11.70	14.30	4.20	5.10	5.70	6.00	6.20
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	3100	3000	3200	3300	1100	800	1400	2100	2500
Cd	-	-	-	-	-	-	-	-	-
Ce	630	730	770	680	640	450	500	450	600
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	860	820	800	830	580	570	580	780	760

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	FRIEGH8001	FRIEGH8001	FRIEGH8001	GLASGP7202	GLASGP7202	GLASGP7202	GLASGP7202	GLASGP7402	GLASGP7402
Sample#	FMC-1	FMC-1	FMC-1	2139A	2139B	2139C	2139F	6249	6252
Analysis#	7	8	9	1	1	1	1	1	1
Sampletype	8	8	8	8	8	8	8	8	8
Latitude	9.300	9.300	9.300	-55.151	-55.151	-55.151	-55.151	2.718	2.752
Longitude	-146.050	-146.050	-146.050	150.050	150.050	150.050	150.050	59.902	59.852
Depth	4830	4830	4830	3865	3865	3865	3865	3998	3833
Al(wt.%)	.92	.92	.98	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.150	.150	.130	.449	.289	.317	.129	.333	.343
Cu	.220	.220	.210	.058	.038	.042	.060	.067	.062
Fe	26.6	26.7	28.2	12.4	10.9	13.5	11.5	14.3	13.6
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	20.1	20.0	18.9	13.2	18.6	12.6	11.9	14.8	16.2
Na	-	-	-	-	-	-	-	-	-
Ni	.240	.240	.220	.258	.194	.840	.356	.281	.315
P	-	-	-	-	-	-	-	-	-
Si	6.40	6.40	7.00	-	-	-	-	8.88	7.06
Ti	-	-	-	-	-	-	-	.74	.64
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	2000	2500	2700	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	480	570	460	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	20	20
Mo	-	-	-	-	-	-	-	350	410
Pb	-	-	-	-	-	-	-	730	610
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	680	720
Y	-	-	-	-	-	-	-	-	-
Zn	860	860	920	200	190	190	90	260	200

MMBIB	GLASGP7402	GLASGP7402	GLASGP7402	GLASGP7402	GLASGP7504	GLASGP7504	GLASGP7504	GLASGP8202	GLASGP8202
Sample#	6253	6256	6257	6273	37DT-20	38DT-22	52DT-31	137DK	137DK
Analysis#	1	1	1	1	1	1	1	1	2
Sampletype	8	8	8	8	15	7	8	8	8
Latitude	2.817	2.818	2.768	2.902	-21.684	-22.535	-32.668	-10.000	-10.000
Longitude	59.834	59.851	59.768	60.036	-159.950	-160.117	-160.002	-134.000	-134.000
Depth	3579	3472	3516	4189	3970	4817	5300	5000	5000
Al(wt.%)	-	-	-	-	7.18	7.43	-	-	-
Ca	-	-	-	-	6.68	1.77	3.12	-	-
Co	.371	.372	.372	.167	.581	.270	.794	.460	.420
Cu	.078	.072	.046	.233	.116	.364	-	.500	.150
Fe	16.0	15.0	17.2	13.8	39.1	19.0	44.0	23.2	24.7
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	15.8	14.4	16.4	18.1	17.2	17.4	27.6	24.5	19.5
Na	-	-	-	-	-	-	-	-	-
Ni	.384	.372	.261	.711	.252	.864	.378	.120	.290
P	-	-	-	-	-	-	-	-	-
Si	9.19	9.32	8.04	9.94	22.67	17.17	13.96	-	-
Ti	.70	.72	.63	.45	-	-	-	-	-
H2O-	-	-	-	-	48.4	25.9	47.1	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	20	30	20	1800	-	-	-	-	-
Mo	510	480	610	420	190	400	-	-	-
Pb	920	1000	760	670	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	910	910	830	730	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	380	360	270	400	970	1100	1500	800	600

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8202	GLASGP8202	GLASGP8202	GLASGP8202	GLASGP8202	GLASGP8202	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	137DK	137DK	151-GB	211-GB	218-GB	94-GB	153-GB	153-GB	154-GB
Analysis#	3	4	2	1	1	1	1	2	6
Sampletype	8	8	1	8	8	8	1	1	1
Latitude	-10.000	-10.000	-17.717	-22.000	-22.017	-7.000	-17.417	-17.417	-17.400
Longitude	-134.000	-134.000	-159.967	-161.900	-161.967	-132.000	-159.600	-159.600	-159.617
Depth	5000	5000	5186	4433	4473	5000	5027	5027	5112
Al(wt.%)	-	-	-	-	-	-	4.92	4.50	3.76
Ca	-	-	-	-	-	-	-	-	-
Co	.180	.210	.510	.120	.270	.130	.510	.530	.500
Cu	.510	.310	.170	.080	.070	.730	.110	.090	.130
Fe	22.3	25.5	26.1	25.6	31.6	22.6	11.4	14.9	19.2
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	23.9	20.0	18.9	6.11	7.94	15.9	16.8	16.0	16.2
Na	-	-	-	-	-	-	-	-	-
Ni	.730	.450	.300	.150	.120	.750	.260	.230	.300
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	9.77	9.02	7.76
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	1300	1400	1800
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	1100	1100	700	800	700	1200	600	600	700

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	157GB	165GB	165GB	165GB	165GB	165GB	165GB	165GB	165GB
Analysis#	7	1	2	3	4	5	6	7	8
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-17.383	-19.017	-19.017	-19.017	-19.017	-19.017	-19.017	-19.017	-19.017
Longitude	-159.617	-161.667	-161.667	-161.667	-161.667	-161.667	-161.667	-161.667	-161.667
Depth	5148	4990	4990	4990	4990	4990	4990	4990	4990
Al(wt.%)	3.39	4.45	4.07	4.07	3.86	3.86	6.56	4.23	4.29
Ca	-	-	-	-	-	-	-	-	-
Co	.590	.550	.550	.520	.550	.550	.550	.540	.500
Cu	.170	.150	.120	.100	.100	.100	.090	.110	.100
Fe	20.1	17.8	19.1	19.5	19.7	19.3	19.1	18.1	18.1
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	18.1	17.9	16.5	15.0	16.0	15.2	15.9	14.4	14.1
Na	-	-	-	-	-	-	-	-	-
Ni	.410	.340	.270	.230	.230	.230	.230	.220	.210
P	-	-	-	-	-	-	-	-	-
Si	6.73	7.76	7.99	8.42	7.90	7.90	13.46	9.07	9.32
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1500	1300	1400	1500	1500	1500	1600	1500	1400
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	700	600	600	600	600	600	600	600	600

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	165GB	167GB	167GB	167GB	167GB	167GB	167GB	167GB	167GB
Analysis#	9	1	2	3	4	5	6	7	8
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-19.017	-19.000	-19.000	-19.000	-19.000	-19.000	-19.000	-19.000	-19.000
Longitude	-161.667	-161.650	-161.650	-161.650	-161.650	-161.650	-161.650	-161.650	-161.650
Depth	4990	4925	4925	4925	4925	4925	4925	4925	4925
Al(wt.%)	4.45	4.60	4.07	3.70	3.55	3.65	3.65	4.71	4.13
Ca	-	-	-	-	-	-	-	-	-
Co	.540	.530	.570	.570	.590	.580	.570	.510	.510
Cu	.110	.150	.140	.130	.110	.110	.110	.110	.120
Fe	18.8	18.8	19.0	20.0	20.4	19.7	20.2	17.4	18.9
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	15.6	16.3	16.9	17.2	16.9	16.2	16.4	14.3	15.1
Na	-	-	-	-	-	-	-	-	-
Ni	.250	.300	.300	.290	.270	.250	.250	.230	.240
P	-	-	-	-	-	-	-	-	-
Si	8.93	8.51	7.34	7.48	7.25	7.34	7.48	9.68	8.51
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1500	1400	1500	1500	1600	1600	1600	1600	1500
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	600	600	600	600	600	600	600	500	600

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	167GB	168GB	168GB	168GB	168GB	168GB	168GB	170GB	170GB
Analysis#	9	10	2	3	4	5	9	1	2
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-19.000	-18.983	-18.983	-18.983	-18.983	-18.983	-18.983	-18.983	-18.983
Longitude	-161.650	-161.650	-161.650	-161.650	-161.650	-161.650	-161.650	-161.633	-161.633
Depth	4925	4936	4936	4936	4936	4936	4936	4897	4897
Al(wt.%)	4.02	3.23	4.39	4.02	4.02	3.86	4.02	4.29	3.92
Ca	-	-	-	-	-	-	-	-	-
Co	.550	.600	.520	.500	.510	.520	.530	.530	.550
Cu	.150	.130	.190	.160	.130	.120	.140	.130	.110
Fe	19.4	21.7	19.6	20.2	20.2	19.2	19.3	17.9	18.8
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	16.2	15.2	16.4	15.6	14.7	14.5	16.1	17.1	16.6
Na	-	-	-	-	-	-	-	-	-
Ni	.270	.300	.370	.320	.300	.290	.300	.300	.260
P	-	-	-	-	-	-	-	-	-
Si	7.95	7.20	7.85	7.48	7.99	7.90	7.76	8.04	7.76
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1500	1600	1400	1500	1500	1700	1900	1400	1500
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	600	700	700	700	600	600	600	600	600

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	170GB	170GB	170GB	170GB	170GB	171GB	171GB	172KG	172KG
Analysis#	3	4	5	6	8	3	6	1	2
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-18.983	-18.983	-18.983	-18.983	-18.983	-18.967	-18.967	-18.983	-18.983
Longitude	-161.633	-161.633	-161.633	-161.633	-161.633	-161.633	-161.633	-161.683	-161.683
Depth	4897	4897	4897	4897	4897	4955	4955	4944	4944
Al(wt.%)	4.02	4.02	3.86	4.18	4.07	4.18	4.18	4.07	4.02
Ca	-	-	-	-	-	-	-	-	-
Co	.550	.550	.580	.520	.540	.500	.510	.560	.550
Cu	.100	.110	.110	.130	.110	.140	.110	.130	.110
Fe	19.0	19.4	19.1	18.4	18.7	18.7	18.7	19.7	19.6
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	15.8	15.1	16.7	15.4	15.9	15.4	14.5	17.2	16.1
Na	-	-	-	-	-	-	-	-	-
Ni	.240	.230	.260	.250	.250	.330	.230	.290	.270
P	-	-	-	-	-	-	-	-	-
Si	8.04	8.32	7.62	8.70	8.18	8.04	8.79	7.62	8.04
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1500	1600	1500	1700	1500	1600	1500	1400	1600
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	600	600	600	600	600	700	600	600	600

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	172KG	172KG	174KG	174KG	174KG	174KG	174KG	174KG	179KG
Analysis#	4	6	1	2	3	4	6	8	1
Sampletype	1	6	1	1	1	1	1	1	1
Latitude	-18.983	-18.983	-19.033	-19.033	-19.033	-19.033	-19.033	-19.033	-19.350
Longitude	-161.683	-161.683	-161.667	-161.667	-161.667	-161.667	-161.667	-161.667	-162.267
Depth	4944	4944	5088	5088	5088	5088	5088	5088	4616
Al(wt.%)	4.45	3.86	4.18	4.66	7.90	4.66	4.55	3.23	4.23
Ca	-	-	-	-	-	-	-	-	-
Co	.520	.580	.540	.520	.470	.540	.510	.630	.610
Cu	.130	.100	.130	.150	.170	.110	.140	.120	.090
Fe	18.8	19.0	19.6	18.8	19.3	18.3	18.5	20.2	18.1
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	15.4	17.6	15.8	16.9	16.3	15.0	15.5	17.7	17.6
Na	-	-	-	-	-	-	-	-	-
Ni	.290	.270	.320	.320	.390	.290	.320	.310	.250
P	-	-	-	-	-	-	-	-	-
Si	8.98	8.37	8.42	8.18	8.65	9.63	9.07	6.92	9.07
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1400	1400	1500	1400	1400	1300	1400	1500	1100
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	600	600	600	600	700	600	600	600	600

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	179KG	179KG	179KG	179KG	191GB	191GB	192GB	192GB	192GB
Analysis#	2	3	4	6	3	5	2	3	4
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-19.350	-19.350	-19.350	-19.350	-19.933	-19.933	-19.933	-19.933	-19.933
Longitude	-162.267	-162.267	-162.267	-162.267	-162.000	-162.000	-162.000	-162.000	-162.000
Depth	4616	4616	4616	4616	4958	4958	4900	4900	4900
Al(wt.%)	4.29	3.92	4.13	3.49	3.70	3.33	4.02	3.97	3.92
Ca	-	-	-	-	-	-	-	-	-
Co	.550	.530	.560	.520	.550	.560	.510	.510	.510
Cu	.080	.080	.080	.130	.180	.200	.230	.180	.150
Fe	18.2	18.9	18.4	19.8	18.2	18.6	17.8	18.9	18.7
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	16.3	16.8	16.9	16.4	17.2	18.6	18.6	17.0	15.9
Na	-	-	-	-	-	-	-	-	-
Ni	.250	.240	.250	.230	.360	.410	.480	.380	.330
P	-	-	-	-	-	-	-	-	-
Si	9.35	8.65	9.02	7.62	7.71	6.83	6.78	7.43	7.76
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1200	1500	1300	1700	1700	1800	1500	1500	1600
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	600	600	600	600	700	700	700	700	700

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	192GB	193GB	194GB	194GB	196GB	196GB	196GB	196GB	197GB
Analysis#	6	4	3	4	2	3	4	5	2
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-19.933	-19.917	-19.917	-19.917	-20.483	-20.483	-20.483	-20.483	-20.467
Longitude	-162.000	-162.000	-162.000	-162.000	-161.233	-161.233	-161.233	-161.233	-161.233
Depth	4900	4857	4938	4938	4907	4907	4907	4907	4913
Al(wt.%)	3.76	3.92	4.29	4.29	4.13	3.76	4.07	4.02	4.23
Ca	-	-	-	-	-	-	-	-	-
Co	.500	.520	.500	.520	.510	.470	.540	.500	.510
Cu	.120	.120	.130	.100	.240	.180	.160	.220	.220
Fe	19.2	19.2	19.0	18.2	16.8	17.6	17.2	16.9	16.8
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	14.2	15.5	14.3	14.4	19.6	18.0	17.4	19.0	18.4
Na	-	-	-	-	-	-	-	-	-
Ni	.300	.300	.290	.270	.530	.410	.400	.500	.480
P	-	-	-	-	-	-	-	-	-
Si	7.90	7.90	8.51	8.74	7.15	7.43	8.37	7.43	7.29
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1600	1500	1400	1300	1500	1500	1500	1500	1600
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	700	600	600	600	700	600	600	700	700

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	197GB	197GB	197GB	197GB	197GB	198KG	211GB	218KAL	220GB
Analysis#	3	4	5	6	7	1	1	1	1
Sampletype	1	1	1	1	1	1	6	1	1
Latitude	-20.467	-20.467	-20.467	-20.467	-20.467	-20.483	-21.600	-21.617	-21.500
Longitude	-161.233	-161.233	-161.233	-161.233	-161.233	-161.217	-161.533	-161.583	-162.417
Depth	4913	4913	4913	4913	4913	4995	4433	4473	4913
Al(wt.%)	4.23	3.86	4.18	4.82	3.81	4.07	5.40	4.50	3.60
Ca	-	-	-	-	-	-	-	-	-
Co	.520	.550	.510	.520	.550	.530	.070	.180	.540
Cu	.180	.160	.220	.160	.190	.170	.090	.080	.300
Fe	17.4	17.4	16.9	15.5	18.8	18.0	12.3	18.2	16.0
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	17.8	17.3	18.5	18.3	16.5	18.0	3.40	6.30	23.3
Na	-	-	-	-	-	-	-	-	-
Ni	.420	.380	.480	.360	.420	.420	.240	.210	.680
P	-	-	-	-	-	-	-	-	-
Si	7.62	7.76	7.39	8.84	7.20	7.76	15.10	12.15	5.70
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1600	1600	1600	1500	1600	1500	1000	1400	1700
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	700	600	700	500	700	600	500	600	800

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302
Sample#	225GB	225GB	225GB	226GB	226GB	226GB	226GB	227GB	227GB
Analysis#	2	3	4	2	3	4	6	1	2
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-21.350	-21.350	-21.350	-21.350	-21.350	-21.350	-21.350	-21.367	-21.367
Longitude	-162.967	-162.967	-162.967	-162.967	-162.967	-162.967	-162.967	-162.933	-162.933
Depth	4964	4964	4964	4944	4944	4944	4944	4861	4861
Al(wt.%)	4.13	4.34	4.18	4.02	4.07	4.23	4.34	4.13	4.87
Ca	-	-	-	-	-	-	-	-	-
Co	.520	.500	.500	.510	.530	.510	.500	.510	.640
Cu	.220	.210	.240	.260	.220	.220	.250	.160	.240
Fe	16.8	16.7	16.3	16.5	17.1	17.1	16.3	17.9	17.2
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	20.4	19.1	20.6	20.5	19.7	17.2	19.1	19.7	18.3
Na	-	-	-	-	-	-	-	-	-
Ni	.530	.450	.550	.590	.180	.430	.460	.510	.510
P	-	-	-	-	-	-	-	-	-
Si	7.34	7.76	7.25	6.83	7.29	8.23	7.76	7.29	9.72
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1600	1600	1600	1600	1700	1600	1600	1600	1500
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	700	700	700	800	700	700	700	700	900

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	GLASGP8302	HALBPA8301
Sample#	227GB	229GB	229GB	229GB	229GB	240GB	241KL	LOC-26	111DK2
Analysis#	3	1	2	3	5	9	3	1	1
Sampletype	1	1	1	1	1	8	1	1	8
Latitude	-21.367	-21.367	-21.367	-21.367	-21.367	-22.317	-22.033	-19.350	20.069
Longitude	-162.933	-162.917	-162.917	-162.917	-162.917	-164.250	-164.283	-162.267	-170.635
Depth	4861	4861	4861	4861	4861	5216	5211	4616	1240
Al(wt.%)	4.50	4.02	4.13	3.86	4.23	6.03	3.76	4.13	-
Ca	-	-	-	-	-	-	-	-	-
Co	.580	.520	.540	.560	.520	.270	.580	.560	1.30
Cu	.200	.280	.230	.200	.230	.190	.110	.080	.020
Fe	17.6	17.0	17.0	17.7	17.0	16.3	18.7	18.4	14.6
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	19.0	21.8	20.7	19.5	19.7	11.5	16.4	16.9	26.7
Na	-	-	-	-	-	-	-	-	-
Ni	.510	.630	.560	.450	.510	.370	.270	.250	.480
P	-	-	-	-	-	-	-	-	-
Si	8.51	6.36	6.50	7.06	7.29	12.15	8.56	9.02	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	1600	1700	1600	1700	1700	1100	1300	1300	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	800	800	800	700	700	500	500	600	-

MMBIB	HALBPA8301	HALBPA8301	HALBPA8301	HALBPA8301	HALBPA8301	HANAKN8001	HANAKN8001	ISKOJM8201	ISKOJM8201
Sample#	31DK5	32DK2	57DK2	73DK7	76DK	2P-50	DWHD-16	MDH-20	RC12-D4
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	8	8	8	8	8	1	1	1	1
Latitude	9.136	9.400	13.150	19.400	19.350	-13.883	-16.483	28.817	-37.050
Longitude	-164.801	-164.783	-165.484	-171.168	-170.983	-150.583	-145.550	-178.950	-7.183
Depth	2100	1120	3280	2860	1190	3620	1270	1090	3100
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.780	2.00	.620	.570	.910	.600	1.40	.690	.420
Cu	.050	.050	.100	.120	.040	.200	.300	.040	.190
Fe	14.5	9.50	19.0	17.5	16.7	20.1	13.6	15.8	20.1
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	23.7	31.4	21.4	19.9	25.7	22.5	29.5	12.7	18.6
Na	-	-	-	-	-	-	-	-	-
Ni	.380	.620	.270	.250	.470	.500	.800	.280	.540
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	ISKOJM8201	ISKOJM8201	ISKOJM8201	ISKOJM8201	ISKOJM8201	ISKOJM8201	JONEHA8001	JONEHA8001	JONEHA8001
Sample#	RC14-D3	RC15-D5	V16SBT3	V18-D32	V25-D14	V27-256	PC34-13	PC34-21	PC36-15
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-36.750	-48.467	-13.067	-14.300	24.950	26.417	-45.200	-52.083	-56.583
Longitude	44.767	-55.233	-24.683	-149.533	-51.750	-29.983	145.067	135.100	150.283
Depth	2220	2650	440	2000	5960	5080	3968	3367	3516
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.380	.310	.430	.690	.580	.600	.070	.050	.120
Cu	.150	.090	.270	.190	.180	.180	.140	.180	.120
Fe	16.2	26.3	19.8	23.3	19.6	21.3	19.0	20.0	14.0
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	17.6	19.8	20.4	25.3	20.2	18.8	7.00	8.50	1.00
Na	-	-	-	-	-	-	-	-	-
Ni	.560	.290	.660	.570	.540	.310	.120	.190	.230
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

MMBIB	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001	JONEHA8001
Sample#	PC36-18	PC36-37	PC38-10	PC44-09	PC44-28	RD38-02	RD38-03	KD13	KD3
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-53.017	-58.667	-57.467	-53.500	-51.983	-61.883	-57.000	-12.900	-13.100
Longitude	150.000	159.517	150.467	163.517	119.633	149.283	150.000	119.867	120.083
Depth	3878	3876	3255	2689	3905	3657	3291	2100	2300
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.160	.010	.290	.160	.110	.210	.150	.350	.260
Cu	.070	.040	.180	.060	.070	.350	.130	.060	.040
Fe	17.0	7.50	15.0	17.9	20.0	9.40	12.0	18.3	19.4
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	9.50	1.50	14.0	10.5	10.7	16.0	13.5	17.5	17.5
Na	-	-	-	-	-	-	-	-	-
Ni	.130	.040	.390	.090	.080	.790	.430	.380	.300
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	JONEHA8001	KOBAKA8401	KOBAKA8401	KOBAKA8401	KOBAKA8401	KOBAKA8401	KOBAKA8401	KOBAKA8401	KOBAKA8401
Sample#	KD4	2-124	2-306	27-017	27-017	3-606	3-606	3-607	5-33
Analysis#	1	1	1	1	3	1	2	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-13.150	26.267	26.267	26.200	26.200	26.117	26.117	26.083	26.217
Longitude	120.083	142.967	142.967	144.183	144.183	144.317	144.317	144.317	144.083
Depth	2100	1430	1430	890	890	1050	1050	1050	2430
Al(wt.%)	-	-	-	.33	-	1.06	-	-	-
Ca	-	1.42	1.45	1.01	2.27	2.59	2.59	1.31	1.75
Co	.320	.180	.280	.576	.580	.473	.480	.430	.220
Cu	.030	.078	.071	.046	.046	.091	.091	.080	.043
Fe	18.1	16.3	16.9	17.9	17.9	7.83	7.83	9.34	18.1
K	-	.31	.29	.23	.29	.84	.84	.37	.31
Mg	-	.90	.88	.10	1.01	1.01	1.01	.90	.85
Mn	21.2	14.3	14.4	23.7	23.7	25.0	25.0	20.1	13.4
Na	-	.85	.81	.29	.95	1.37	1.37	1.06	1.03
Ni	.470	.200	.200	.360	.360	.634	.630	.310	.170
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	1.22	-	.68	-	-	-
Ti	-	.63	.79	.95	.71	.60	.60	.68	.65
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	180	150	-	380	-	150	180	200
Ba	-	2200	1800	130	3100	2000	2500	3600	2300
Cd	-	-	-	-	-	-	-	-	-
Co	-	870	940	-	1800	-	1800	2100	920
Cr	-	-	-	-	-	-	-	-	-
Mo	-	290	270	-	750	-	820	770	180
Pb	-	-	-	-	-	-	-	-	-
Pt	-	1100	1200	1800	1800	1200	1200	1900	1200
V	-	510	560	810	810	650	650	700	450
Y	-	130	140	190	190	80	80	270	170
Zn	-	530	470	510	510	80	820	540	490

MMBIB	KOBAKA8401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401
Sample#	8-51	E15-13	E15-13	E15-13	E15-13	E21-4	E21-4	E21-4	E21-4
Analysis#	1	1	2	3	4	1	2	3	4
Sampletype	1	8	8	8	8	8	8	8	8
Latitude	25.500	-55.383	-55.383	-55.383	-55.383	-33.050	-33.050	-33.050	-33.050
Longitude	142.533	-145.033	-145.033	-145.033	-145.033	-82.050	-82.050	-82.050	-82.050
Depth	2010	-	-	-	-	-	-	-	-
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	3.07	-	-	-	-	-	-	-	-
Co	.500	.090	.090	.084	.084	.128	.126	.140	.130
Cu	.017	.022	.022	.022	.020	.078	.048	.054	.062
Fe	14.9	15.2	14.7	15.2	13.5	15.6	15.5	16.4	17.4
K	.20	-	-	-	-	-	-	-	-
Mg	.90	-	-	-	-	-	-	-	-
Mn	18.4	7.50	7.80	7.40	6.60	13.2	13.1	13.2	13.7
Na	1.18	-	-	-	-	-	-	-	-
Ni	.310	.028	.040	.038	.056	.264	.262	.272	.248
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	.56	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	330	-	-	-	-	-	-	-	-
Ba	3200	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	1200	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	470	-	-	-	-	-	-	-	-
Pb	-	720	720	700	620	820	760	740	760
Pt	1400	-	-	-	-	-	-	-	-
V	650	-	-	-	-	-	-	-	-
Y	190	-	-	-	-	-	-	-	-
Zn	490	300	360	380	360	600	580	600	620

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRAETA7401	KRISSA7201	KRISSA7201	KRISSA7201	KRISSA7201
Sample#	E21-4	E21-4	E24-15C	E24-15C	E24-15C	2P-50	TF-2	TRPD-2D	ZETES3D
Analysis#	5	6	1	2	3	1	1	1	1
Sampletype	8	8	8	8	8	1	1	1	1
Latitude	-33.050	-33.050	-35.967	-35.967	-35.967	-13.883	-13.867	20.750	40.267
Longitude	-82.050	-82.050	-134.833	-134.833	-134.833	-150.583	-150.583	-112.783	170.333
Depth	-	-	-	-	-	3695	3623	3000	3000
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.136	.102	.356	.310	.270	.390	.420	.367	.545
Cu	.048	.256	.036	.042	.048	.145	.194	.021	.045
Fe	16.5	10.0	12.8	12.2	12.4	20.5	20.0	8.60	17.4
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	13.5	13.3	13.7	14.0	13.8	18.0	18.6	18.9	26.5
Na	-	-	-	-	-	-	-	-	-
Ni	.234	.662	.332	.312	.288	.314	.302	.253	.480
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	1.34	1.14	.65	.65
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	30	-	20
Mo	-	-	-	-	-	760	-	590	2800
Pb	760	440	940	940	1000	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	540	450	450	420	400	-	-	-	-

MMBIB	KRISSA7201	LAVRVM7301	LAVRVM7301	LONSPF8007	LONSPF8007	LONSPF8007	LONSPF8007	LONSPF8007	LONSPF8007
Sample#	ZETES3D	STN363	STN363	B-CRUST	DPSD3-C	DPSD3-N	DPSD4-N	DPSD5-C	NOD-B
Analysis#	2	1	2	1	1	1	1	1	2
Sampletype	1	1	1	7	7	1	1	7	1
Latitude	40.267	33.500	33.500	8.701	8.701	8.701	8.701	8.701	8.701
Longitude	170.333	-29.933	-29.933	-103.886	-103.886	-103.886	-103.886	-103.886	-103.886
Depth	3000	2370	2370	1875	1875	1875	1875	1875	1875
Al(wt.%)	-	5.94	5.00	-	-	-	-	-	-
Ca	-	1.69	2.14	-	-	-	-	-	-
Co	.490	-	-	.710	.120	.100	.120	.130	.410
Cu	.041	-	-	.010	.440	.140	.270	.290	.090
Fe	18.0	17.1	18.6	17.0	14.0	20.3	21.2	20.2	16.7
K	-	.58	.30	-	-	-	-	-	-
Mg	-	1.74	1.92	-	-	-	-	-	-
Mn	26.6	11.8	13.3	21.3	21.4	11.4	19.6	19.4	25.2
Na	-	1.19	.89	-	-	-	-	-	-
Ni	.464	-	-	.400	.630	.220	.630	.660	.570
P	-	.22	.22	-	-	-	-	-	-
Si	-	4.90	2.63	-	-	-	-	-	-
Ti	.70	1.60	1.53	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	1200	200	300	400	400	1000
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	500	900	800	900	1000	1000

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	LONSPF8007	MCGOPJ7901	MCGOPJ7901	MCGOPJ7901	MCGOPJ7901	MCGOPJ7901	MCGOPJ7901	MEYLMA7801	MEYLMA7801
Sample#	SIQD4-C	2A3-30	2A3-31	2A3-32	2A4-30	2B2	2B8	G-1001	G-1002
Analysis#	1	1	1	1	1	1	1	1	2
Sampletype	7	8	8	8	8	8	8	18	7
Latitude	8.701	26.152	26.152	26.152	26.152	26.117	26.117	-21.684	-22.535
Longitude	-103.886	-44.784	-44.784	-44.784	-44.784	-25.350	-25.350	-159.950	-160.117
Depth	1875	3148	3148	3148	3148	2600	2600	3970	4817
Al(wt.%)	-	.07	.07	.25	.27	3.11	2.17	3.70	5.50
Ca	-	-	-	-	-	-	-	3.45	1.32
Co	1.15	-	.001	-	.002	.605	.245	.300	.200
Cu	.240	-	-	-	-	-	-	.060	.270
Fe	22.4	.04	.10	.48	.34	20.5	20.1	20.2	14.1
K	-	.87	.87	.87	.77	.42	.48	-	-
Mg	-	1.35	1.32	1.35	1.18	1.02	.98	-	-
Mn	16.6	34.4	38.3	34.0	36.4	12.0	11.7	8.90	12.9
Na	-	-	-	-	-	-	-	-	-
Ni	.380	-	-	-	-	-	-	.130	.640
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	11.70	12.72
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	50	-	30	30	50	50	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	400	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	700	-	-	-	-	-	-	-	-

MMBIB	MEYLMA7801	MEYLMA7801	MEYLMA7801	MEYLMA7801	MEYLMA7801	MEYLMA7801	MIZUAA7501	MIZUAA7501	MIZUAA8101
Sample#	G-1007	G-993E	G-993E	G-994	G-996B	I-166	111	113	D315
Analysis#	2	4	5	2	1	3	1	1	1
Sampletype	1	16	1	16	16	6	8	8	1
Latitude	-27.650	-23.534	-23.534	-22.934	-21.886	-15.134	10.052	8.335	10.555
Longitude	-160.003	-162.900	-162.900	-162.069	-160.902	-166.900	-165.319	-164.385	-168.003
Depth	4982	4993	4993	4848	4817	5348	1340	1660	1609
Al(wt.%)	-	2.80	3.80	2.90	3.20	-	.76	.47	-
Ca	1.79	1.88	2.33	1.68	2.14	-	10.5	2.06	-
Co	.570	.540	-	.580	.520	.166	.800	1.02	1.87
Cu	.110	.120	-	.250	.230	.053	.060	.080	.040
Fe	26.4	26.9	24.6	23.5	20.0	22.7	8.69	9.88	13.2
K	-	-	.76	-	-	-	-	-	-
Mg	-	-	1.44	-	-	-	1.24	1.28	-
Mn	16.0	15.9	16.1	17.8	19.6	7.02	15.3	21.5	36.2
Na	-	-	1.45	-	-	-	-	-	-
Ni	.260	.230	-	.440	.470	.035	.610	.790	.929
P	-	-	.12	-	-	-	3.67	.27	-
Si	6.86	6.76	9.52	5.85	6.39	-	1.39	.75	-
Ti	-	-	1.93	-	-	-	.58	.89	-
H2O-	-	-	-	-	-	-	-	-	25.7
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	2200
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	800	800	890

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	MIZUAA8201	MIZUAA8201	MIZUAA8201	MIZUAA8201	MIZUAA8201	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS7601
Sample#	B15	B15	FG219-2	FG251-2	P171	D-9	D-9	D-9	D-9
Analysis#	4	5	2	1	9	1	2	3	4
Sampletype	1	1	1	1	11	8	8	8	8
Latitude	-13.794	-13.794	-13.788	16.169	-1.513	2.953	2.953	2.953	2.953
Longitude	-159.476	-159.476	-159.474	-179.339	-165.881	-95.167	-95.167	-95.167	-95.167
Depth	5162	5162	5147	5291	5537	-	-	-	-
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.563	.568	.592	.579	.895	.157	.091	.005	.017
Cu	.203	.170	.201	.284	.028	.050	.094	.007	.174
Fe	19.2	24.5	19.8	18.4	4.96	-	-	-	-
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	21.0	17.7	22.0	22.7	.70	27.2	25.5	36.4	44.8
Na	-	-	-	-	-	-	-	-	-
Ni	.371	.227	.402	.500	.013	.490	.630	.054	2.300
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	11.2	12.0	15.5	12.0	14.0	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	1500	2100	1300	1500	40	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	620	570	630	650	140	1000	1800	580	4500

MMBIB	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS7601	MOORWS8101	MOORWS8101
Sample#	D6	D6	D6	D6	D6	D6	D6	20-2	20-2
Analysis#	1	2	3	4	5	6	7	11	12
Sampletype	8	8	8	8	8	8	8	1	1
Latitude	2.685	2.685	2.685	2.685	2.685	2.685	2.685	11.117	11.117
Longitude	-95.235	-95.235	-95.235	-95.235	-95.235	-95.235	-95.235	-140.083	-140.083
Depth	-	-	-	-	-	-	-	4722	4722
Al(wt.%)	-	-	-	-	-	-	-	1.17	1.08
Ca	-	-	-	-	-	-	-	1.64	1.63
Co	-	.002	.002	.002	.004	.004	.002	.485	.521
Cu	.005	.004	.001	.001	.002	.002	.020	.799	.911
Fe	-	-	-	-	-	-	-	9.46	13.2
K	-	-	-	-	-	-	-	.51	.35
Mg	-	-	-	-	-	-	-	.85	1.28
Mn	49.1	52.7	65.2	49.6	60.7	58.2	46.8	26.1	27.5
Na	-	-	-	-	-	-	-	1.31	.90
Ni	-	.010	.006	.007	-	-	.050	1.037	1.430
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	3.01	2.94
Ti	-	-	-	-	-	-	-	.74	.75
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	4300	3900
Cd	-	-	-	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	280	100	90	140	4600	4100	4900	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101
Sample#	20-2	20-2	20-2	20-2	20-2	20-2	20-2	20-2	20-2
Analysis#	13	14	15	16	18	22	24	25	26
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	11.117	11.117	11.117	11.117	11.117	11.117	11.117	11.117	11.117
Longitude	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083
Depth	4722	4722	4722	4722	4722	4722	4722	4722	4722
Al(wt.%)	1.18	1.49	1.16	1.76	1.86	1.65	2.83	.76	1.14
Ca	2.13	1.91	1.89	1.66	1.18	2.04	1.29	2.64	1.54
Co	.470	.712	.433	.521	.529	.595	.397	.367	.800
Cu	.351	.615	-	.895	.655	.320	1.486	.120	.375
Fe	18.5	17.8	13.9	13.0	7.40	10.7	5.36	8.21	12.1
K	.26	.34	.32	.30	.68	.47	.58	.52	.47
Mg	.65	1.02	.75	1.15	2.63	1.80	3.40	.84	1.37
Mn	13.1	34.5	19.2	21.9	31.2	25.7	30.9	14.8	20.4
Na	.90	1.08	.79	1.08	1.97	1.72	1.28	1.21	1.42
Ni	.330	.605	.550	1.147	1.878	1.045	2.774	.338	.754
P	-	-	-	-	-	-	-	-	-
Si	5.41	5.45	3.26	4.90	3.38	3.47	2.84	2.30	3.21
Ti	1.82	1.49	1.02	1.09	.71	.95	.45	.59	.83
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	4300	5600	3600	3100	3100	2800	1800	2500	4400
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

MMBIB	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101	MOORWS8101
Sample#	20-2	20-2	20-2	20-2	20-2	20-2	20-2	20-2	20-2
Analysis#	27	28	29	30	31	32	5	6	7
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	11.117	11.117	11.117	11.117	11.117	11.117	11.117	11.117	11.117
Longitude	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083	-140.083
Depth	4722	4722	4722	4722	4722	4722	4722	4722	4722
Al(wt.%)	1.05	.81	.72	2.61	2.72	2.64	1.01	1.34	1.54
Ca	2.16	1.87	2.11	1.13	1.29	1.30	1.84	1.77	1.37
Co	.698	.485	.470	.463	.411	.433	.617	.866	.529
Cu	.471	.599	.511	1.070	.256	1.789	.304	.343	.503
Fe	14.2	12.8	9.01	4.08	8.40	2.31	14.7	16.0	7.13
K	.47	.38	.43	.73	.35	.71	.55	.37	.71
Mg	1.19	1.70	1.52	2.76	.80	3.82	1.10	1.12	1.87
Mn	25.9	23.1	26.2	24.3	13.4	34.9	28.7	27.3	27.9
Na	2.11	2.13	2.03	1.52	2.93	2.19	1.10	1.64	.96
Ni	.762	1.352	1.147	1.902	.346	3.151	.652	.542	1.163
P	-	-	-	-	-	-	-	-	-
Si	2.96	2.31	2.72	8.03	7.78	2.27	3.21	3.46	3.20
Ti	1.29	.67	.58	.41	.78	.26	1.09	1.19	.33
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	5700	4100	4700	2900	3100	3800	4900	4700	1500
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	MOORWS8101	MOORWS8401	MORITA8105	MORITA8105	MORITA8105	NOAKLC7501	NOAKLC7501	NOAKLC7501	NOAKLC7501
Sample#	20-2	91	FG91-2	G622	G622	ELTAN08	ELTAN13	ELTAN14	ELTAN15
Analysis#	8	3	1	3	3	1	1	1	1
Sampletype	1	8	1	1	1	1	1	1	1
Latitude	11.117	11.000	12.986	12.985	12.985	-45.184	-51.969	-52.069	-53.017
Longitude	-140.083	-140.000	179.986	179.983	179.983	145.052	119.619	135.100	150.000
Depth	4722	-	4762	5053	5053	3969	3905	3367	3878
Al(wt.%)	.94	-	-	-	-	-	-	-	-
Ca	1.81	-	-	-	-	-	-	-	-
Co	.587	-	.691	.652	.699	.070	.110	.050	.160
Cu	.288	.653	.243	.268	.246	.140	.070	.180	.070
Fe	11.7	6.26	19.2	19.4	20.6	19.0	20.0	20.0	17.0
K	.34	-	-	-	-	-	-	-	-
Mg	1.43	-	-	-	-	-	-	-	-
Mn	27.0	22.9	24.7	25.0	25.5	7.00	10.7	8.50	9.50
Na	1.51	-	-	-	-	-	-	-	-
Ni	.629	.655	.576	.550	.505	.120	.080	.190	.130
P	-	-	-	-	-	-	-	-	-
Si	2.53	-	-	-	-	-	-	-	-
Ti	.99	-	-	-	-	-	-	-	-
H2O-	-	-	21.8	21.8	22.7	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	3700	2700	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	1300	1300	1300	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	750	690	670	670	-	-	-	-

MMBIB	NOAKLC7501	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601
Sample#	ELTAN16	03	04	05	06	07	08	10	11
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	8	8	8	8	8	8	8	8
Latitude	-53.500	44.617	44.617	44.550	44.500	37.117	-38.000	38.983	36.067
Longitude	163.517	170.333	170.300	170.283	170.417	162.650	-169.967	146.000	143.533
Depth	2689	1385	1365	1232	1290	2920	5070	3450	3350
Al(wt.%)	-	.11	.13	.15	.11	.93	1.25	.64	1.38
Ca	-	-	-	-	-	-	-	-	-
Co	.160	.538	.559	.527	.619	.186	.213	.195	.243
Cu	.060	.047	.064	.050	.059	.066	.088	.110	.237
Fe	17.0	17.2	15.2	16.3	17.5	17.2	20.3	18.5	17.3
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	10.5	27.5	25.9	26.0	28.3	10.2	17.3	16.5	12.3
Na	-	-	-	-	-	-	-	-	-
Ni	.090	.609	.585	.578	.624	.222	.262	.411	.341
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	.71	.68	.69	.85	1.24	.93	.94	1.43
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	1900	1800	2000	2200	1600	1100	1200	1400
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	710	640	650	650	500	550	690	700

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	NOHAMA7601	NOHAMA7601	NOHAMA7601	NOHAMA7601	RONAPA8403	RONAPA8403	RONAPA8403	RONAPA8403	ROONGS8001
Sample#	12	13	15	17	1243-1	1244-1	1247-1	1247-2	109
Analysis#	1	1	1	1	1	1	1	1	23
Sampletype	8	8	1	1	19	19	19	19	8
Latitude	37.117	23.817	-20.383	28.083	28.134	26.134	26.134	26.134	11.017
Longitude	145.300	148.767	-148.017	131.633	-44.769	-26.768	-44.769	-44.769	-147.635
Depth	2630	1250	4618	1260	2944	2896	2958	2951	5308
Al(wt.%)	.82	.59	1.07	1.64	.05	.03	.09	.05	4.60
Ca	-	-	-	-	.17	1.56	1.39	.92	.98
Co	.198	.791	.532	.230	.010	.020	.010	.010	.290
Cu	.056	.062	.169	.089	.010	.010	.010	.010	.280
Fe	20.7	12.8	19.7	20.7	32.4	.10	9.57	41.5	11.8
K	-	-	-	-	1.34	.43	.51	.90	1.20
Mg	-	-	-	-	1.86	.92	1.05	.62	.51
Mn	17.2	23.8	19.8	16.1	.67	52.3	41.5	2.43	18.6
Na	-	-	-	-	-	-	-	-	5.80
Ni	.293	.564	.415	.529	.010	.010	.030	.010	.600
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	12.15	.06	1.24	5.88	7.60
Ti	.75	.76	2.16	.60	.94	.31	.37	.65	1.20
H2O-	-	-	-	-	6.9	17.5	19.2	13.6	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	4800
Cd	-	-	-	-	-	-	-	-	10.0
Cs	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	590
Pb	1500	2800	870	2100	-	-	-	-	580
Pt	-	-	-	-	-	-	-	-	70
V	-	-	-	-	-	-	-	-	400
Y	-	-	-	-	-	-	-	-	-
Zn	620	710	550	780	100	100	100	100	520

MMBIB	ROONGS8001	ROONGS8001	ROONGS8001	SCOTMR7401	SCOTMR7401	SCOTMR7401	SCOTMR7401	SCOTMR7401	SCOTMR7401
Sample#	109	109	109	148-2B	160-10G	253-13	253-13	253-13	253-13
Analysis#	24	25	26	1	1	1	2	3	4
Sampletype	8	8	8	6	6	6	6	6	6
Latitude	11.017	11.017	11.017	26.117	30.133	26.133	26.133	26.133	26.133
Longitude	-147.635	-147.635	-147.635	-25.350	-42.483	-44.750	-44.750	-44.750	-44.750
Depth	5308	5308	5308	-	-	-	-	-	-
Al(wt.%)	3.90	5.20	6.30	-	-	-	-	-	-
Ca	.88	.14	.98	-	-	-	-	-	-
Co	.270	.130	.180	.720	.272	.002	.002	.002	.002
Cu	.360	.310	.320	.075	.088	.001	.012	.009	-
Fe	8.50	5.30	5.70	16.1	18.1	.01	.08	.11	.07
K	1.78	2.12	2.20	-	-	-	-	-	-
Mg	.56	1.14	.89	-	-	-	-	-	-
Mn	15.3	8.40	10.7	14.1	9.80	39.2	38.5	38.6	39.4
Na	-	5.58	6.08	-	-	-	-	-	-
Ni	1.020	.720	.760	.220	.128	.010	.079	.066	.020
P	-	-	-	-	-	-	-	-	-
Si	10.00	10.30	14.60	-	-	-	-	-	-
Ti	.88	.88	.84	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	5300	4200	4200	-	-	-	-	-	-
Cd	20.0	20.0	10.0	-	-	-	-	-	-
Cs	-	-	-	-	-	-	-	-	-
Cr	10	10	10	-	-	-	-	-	-
Mo	400	390	300	-	-	-	-	-	-
Pb	480	480	340	-	-	-	-	-	-
Pt	40	250	160	-	-	-	-	-	-
V	340	240	200	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	640	500	600	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	SCOTMR7401	SCOTMR7401	SCOTMR7401	SCOTMR7401	SCOTMR7401	SIEGMD8101	SKORNS7501	SKORNS7501	SKORNS7501
Sample#	253-13	253-13	253-13	254-15	255-19	019-1	6298-13	6298-53	6298-9
Analysis#	5	6	7	1	1	5	1	1	1
Sampletype	6	6	6	6	6	1	1	1	1
Latitude	26.133	26.133	26.133	26.553	26.269	10.950	-22.733	-22.733	-22.733
Longitude	-44.750	-44.750	-44.750	-44.500	-45.101	-140.163	-160.817	-160.817	-160.817
Depth	-	-	-	-	-	4223	4530	4530	3180
Al(wt.%)	-	-	-	-	-	1.49	-	-	-
Ca	-	-	-	-	-	1.26	-	-	-
Co	.002	.002	.001	.948	.495	.551	.920	.570	.565
Cu	.002	.002	.001	.030	.041	.415	.080	.091	.104
Fe	.07	.04	.04	16.4	18.6	10.7	16.7	19.0	17.9
K	-	-	-	-	-	.42	-	-	-
Mg	-	-	-	-	-	.71	-	-	-
Mn	39.2	39.1	39.3	11.2	11.0	22.4	22.6	15.4	16.6
Na	-	-	-	-	-	.43	-	-	-
Ni	.040	.027	.005	.090	.111	.597	.420	.180	.450
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	4.60	-	-	-
Ti	-	-	-	-	-	.57	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	1800	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	2600	700	440	660

MMBIB	STOFPA8101	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701
Sample#	215KG	1	1	1	1	1	1	1	1
Analysis#	1	1	10	11	12	13	14	2	3
Sampletype	3	1	1	1	1	1	1	1	1
Latitude	-21.983	54.767	54.767	54.767	54.767	54.767	54.767	54.767	54.767
Longitude	-161.900	10.083	10.083	10.083	10.083	10.083	10.083	10.083	10.083
Depth	447	25	25	25	25	25	25	25	25
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	.032	-	-	-	-	-	-	-	-
Cu	.050	.019	.004	.003	.004	.004	.003	.027	.026
Fe	16.3	6.61	11.8	9.61	7.73	6.71	4.30	17.9	14.4
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	3.81	34.6	30.6	30.8	32.6	34.4	38.7	11.0	16.6
Na	-	-	-	-	-	-	-	-	-
Ni	.090	-	-	-	-	-	-	-	-
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	700	-	-	-	-	-	-	-	-
Cd	-	10.0	-	-	-	-	-	10.0	10.0
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	160	60	40	30	30	20	120	140
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	740	1500	240	170	190	200	120	1500	1700

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	SUESEA7701	TAKENA7901	TAKENA7901	TAKENA7901
Sample#	1	1	1	1	1	1	01-K1	06-N4	12
Analysis#	4	5	6	7	8	9	1	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	54.767	54.767	54.767	54.767	54.767	54.767	44.500	17.269	50.101
Longitude	10.083	10.083	10.083	10.083	10.083	10.083	170.417	-176.301	-123.785
Depth	25	25	25	25	25	25	1280	4400	350
Al(wt.%)	-	-	-	-	-	-	-	-	-
Ca	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	.371	.507	.022
Cu	.009	.010	.007	.008	.007	.007	.047	.180	.008
Fe	25.1	22.3	9.92	9.84	16.1	14.4	1.10	12.4	8.89
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	-	-	-	-	-	-
Mn	11.5	10.5	28.4	24.3	22.8	22.7	22.7	15.2	22.4
Na	-	-	-	-	-	-	-	-	-
Ni	-	-	-	-	-	-	.375	.349	.025
P	-	-	-	-	-	-	-	-	-
Si	-	-	-	-	-	-	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	120	140	60	90	50	50	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	1000	980	1000	1500	420	380	480	550	190

MMBIB	TAKENA7901	THIJAA8101	THIJAA8101	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601
Sample#	13	137-DK	226-GB	9-7	9-7	9-7	9-7	9-7	9-7
Analysis#	1	1	1	10	11	12	13	14	15
Sampletype	1	8	1	1	1	1	1	1	1
Latitude	50.101	-10.149	-21.300	44.617	44.617	44.617	44.617	44.617	44.617
Longitude	-123.785	-134.000	-162.951	170.300	170.300	170.300	170.300	170.300	170.300
Depth	350	4453	4944	1365	1365	1365	1365	1365	1365
Al(wt.%)	-	-	8.00	.75	.32	.22	.20	.22	.24
Ca	-	-	-	1.38	1.72	1.77	1.64	1.80	1.72
Co	.020	.050	.510	.350	.800	.620	.670	.710	.640
Cu	.009	.270	.220	.114	.056	.060	.046	.046	.040
Fe	9.32	14.2	17.1	10.0	13.5	12.8	13.4	13.8	14.5
K	-	-	-	-	-	-	-	-	-
Mg	-	-	-	1.36	.95	.95	.91	.92	.87
Mn	22.3	6.45	17.2	29.8	25.4	27.1	26.1	25.6	23.7
Na	-	-	-	-	-	-	-	-	-
Ni	.038	.440	.430	1.000	.440	.560	.460	.440	.360
P	-	-	-	-	-	-	-	-	-
Si	-	-	17.60	2.47	1.81	1.61	1.71	1.50	2.05
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	1600	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Co	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	840	1100	840	1100	1100	840
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	230	700	700	-	-	-	-	-	-

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	UCHITA7601	VANDCH7602
Sample#	9-7	9-7	9-7	9-7	9-7	9-7	9-7	9-7	01
Analysis#	17	3	4	5	6	7	8	9	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	44.617	44.617	44.617	44.617	44.617	44.617	44.617	44.617	-16.483
Longitude	170.300	170.300	170.300	170.300	170.300	170.300	170.300	170.300	-145.550
Depth	1365	1365	1365	1365	1365	1365	1365	1365	1270
Al(wt.%)	1.50	-	1.24	1.50	1.37	-	.59	.26	-
Ca	1.29	11.8	2.37	1.17	1.41	2.02	1.69	1.75	-
Co	.190	.250	.190	.440	.360	.430	.330	.700	1.03
Cu	.168	.120	.098	.160	.136	.098	.092	.052	.120
Fe	5.11	3.94	6.42	8.59	9.89	10.9	11.1	13.5	13.0
K	-	-	-	-	-	-	-	-	-
Mg	1.96	5.32	1.09	1.90	1.47	1.42	1.04	1.03	-
Mn	33.6	19.2	28.0	28.8	28.6	29.8	27.1	27.4	21.5
Na	-	-	-	-	-	-	-	-	-
Ni	1.440	.880	1.400	1.320	.960	.960	.480	.520	.560
P	-	-	-	-	-	-	-	-	-
Si	3.94	.62	2.59	3.98	3.89	1.96	2.74	1.74	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	340	-	840	1000	1100	1100	840	790	1700
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	-	-	-	-	-	-	-	-	800

MMBIB	VANDCH7602	VANDCH7602	VONSUA7801	VONSUA7801	VONSUA7801	VONSUA7801	VONSUA8401	VONSUA8401	VONSUA8401
Sample#	04	04	KD13-1	KD13-1	KD13-1	KD13-1	237KD	237KD	237KD
Analysis#	1	2	1	2	3	4	0	1	2
Sampletype	1	1	8	8	8	8	8	8	8
Latitude	38.067	38.067	-12.910	-12.910	-12.910	-12.910	9.300	9.300	9.300
Longitude	-60.217	-60.217	119.882	119.882	119.882	119.882	-146.050	-146.050	-146.050
Depth	3200	3200	2100	2100	2100	2100	4830	4830	4830
Al(wt.%)	-	-	.07	.08	.08	.07	-	.79	.53
Ca	-	-	3.19	2.43	2.49	25.3	1.25	1.18	2.50
Co	.360	.360	.240	.310	.330	.083	.470	.330	.390
Cu	.140	.160	.052	.042	.067	.047	.150	.170	.250
Fe	18.3	19.5	16.6	18.8	18.4	10.8	12.6	15.9	16.6
K	-	-	-	-	-	-	-	-	-
Mg	-	-	.98	.90	.99	.49	1.11	.93	.86
Mn	11.3	12.0	18.6	17.0	17.3	3.66	20.1	18.8	19.8
Na	-	-	-	-	-	-	1.11	2.13	.60
Ni	.230	.230	.420	.310	.320	.120	.490	.350	.500
P	-	-	-	-	-	-	-	-	-
Si	-	-	4.27	3.96	4.82	2.51	-	-	-
Ti	-	-	-	-	-	-	-	-	-
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	280	230	90
Ba	-	-	-	-	-	-	-	-	-
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	800	1100	540
Cr	-	-	60	70	70	90	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	1000	1000	1800	2400	1600	720	850	720	690
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	800	800	760	720	810	460	670	980	620

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	VONSUA8401	VONSUA8401	VONSUA8401	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201
Sample#	237KD	237KD	237KD	D41	D42-1	D42-1-1	D42F	D43B	D46-1
Analysis#	21	22	3	1	1	1	1	1	1
Sampletype	8	8	8	1	1	1	1	1	1
Latitude	9.300	9.300	9.300	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000
Longitude	-146.050	-146.050	-146.050	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000
Depth	4830	4830	4830	-	-	-	-	-	-
Al(wt.%)	.70	.53	-	1.13	1.22	1.12	1.93	4.38	1.90
Ca	2.41	2.50	1.38	2.83	6.73	1.25	4.99	1.48	1.42
Co	.320	.390	.320	.120	.430	.460	.190	.190	.230
Cu	.160	.250	.250	.013	.038	.021	.025	.034	.037
Fe	15.0	12.6	14.0	30.6	19.6	26.4	17.1	13.4	23.5
K	-	-	-	.67	.66	.68	2.04	2.49	2.40
Mg	.78	.86	.94	-	-	-	-	-	-
Mn	18.3	21.0	20.9	10.9	16.8	12.5	9.93	6.81	11.7
Na	-	-	1.67	-	-	-	-	-	-
Ni	.400	.500	.400	.260	1.020	.270	.370	.670	.360
P	-	-	-	.59	.52	.51	2.98	.53	.32
Si	-	-	-	2.26	1.61	3.13	5.12	11.57	4.73
Ti	-	-	-	.10	.28	.32	.21	1.17	.27
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	190	-	-	-	-	-	-
Ba	-	-	-	1500	3500	2400	-	-	4000
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	1300	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	790	690	490	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	-	-	-	1100	800	1100	280	280	900
Y	-	-	-	-	-	-	-	-	-
Zn	560	620	540	900	1400	1000	730	530	1000

MMBIB	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201
Sample#	D46-1-1	D48-1-1	D48A	D49A	D4B1	D53	D53-1	D53-1-1	D53B
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000
Longitude	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000
Depth	-	-	-	-	-	-	-	-	-
Al(wt.%)	1.43	1.68	1.55	1.37	2.92	.77	.68	1.13	.90
Ca	5.91	.99	1.23	.94	1.52	1.60	1.51	1.91	1.23
Co	.340	.270	.260	.310	.160	.340	.320	.600	.290
Cu	.068	.050	.019	.033	.022	.015	.022	.022	.013
Fe	21.2	18.9	18.5	23.3	13.0	24.7	23.2	29.2	21.3
K	.65	.70	.62	1.90	1.51	.87	.64	.64	1.08
Mg	-	-	-	-	-	-	-	-	-
Mn	15.2	11.0	10.9	10.5	5.47	20.8	17.8	13.5	16.3
Na	-	-	-	-	-	-	-	-	-
Ni	1.160	.190	.160	.150	.120	.280	.230	.150	.220
P	2.20	.27	.43	.47	.39	.40	.40	.64	.36
Si	2.14	4.98	5.52	4.72	7.42	1.68	1.31	2.84	2.03
Ti	.24	.46	.40	.46	.70	.30	.29	.50	.19
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	2400	1900	-	900	-	4700	5900	1600	3700
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	900	600	170	880	350	1200	1200	1300	1600
Y	-	-	-	-	-	-	-	-	-
Zn	1300	700	360	480	330	960	800	800	840

Table 11. Composition of Mn oxide majors as reported by NGDC (cont'd).

MMBIB	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201	XAVIAA8201
Sample#	D7-1	D7-1-1	D7B-1-1	D7B1	D7C	D7CPL-2	D7CPL1	D7D	P81
Analysis#	1	1	1	1	1	1	1	1	1
Sampletype	1	1	1	1	1	1	1	1	1
Latitude	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000	-8.000
Longitude	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-34.000	-37.000
Depth	-	-	-	-	-	-	-	-	260
Al(wt.%)	.76	1.25	-	1.65	2.39	1.63	1.36	1.62	.51
Ca	1.56	1.84	7.11	6.33	6.54	.79	1.36	1.17	2.04
Co	.770	.670	.170	.120	.160	.350	1.02	.540	.170
Cu	.021	.020	.065	.063	.074	.025	.018	.018	.018
Fe	25.1	27.8	10.4	8.05	10.1	18.4	21.8	24.7	26.8
K	.59	.65	1.40	.96	1.36	1.06	.76	1.22	.51
Mg	-	-	-	-	-	-	-	-	-
Mn	17.5	14.9	13.3	9.19	10.5	8.77	16.3	12.5	14.3
Na	-	-	-	-	-	-	-	-	-
Ni	.240	.180	1.390	.940	1.280	.180	.340	.220	.570
P	.51	.54	2.76	1.44	2.88	.40	.51	.50	.69
Si	1.10	1.79	4.28	3.30	4.28	2.86	1.83	2.85	.86
Ti	.45	.51	.58	.51	.60	.33	.64	.42	.09
H2O-	-	-	-	-	-	-	-	-	-
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	2800	2600	-	1400	1200	1000	-	-	2400
Cd	-	-	-	-	-	-	-	-	-
Ce	-	-	-	-	-	-	-	-	-
Cr	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	-	-	-	-	-	-	-	-	-
Pt	-	-	-	-	-	-	-	-	-
V	1100	1200	330	340	470	430	590	960	1400
Y	-	-	-	-	-	-	-	-	-
Zn	950	750	1200	710	810	560	430	570	800

MMBIB	XAVIAA8201
Sample#	P90A
Analysis#	1
Sampletype	1
Latitude	-8.000
Longitude	-37.000
Depth	260
Al(wt.%)	1.25
Ca	1.23
Co	.270
Cu	.022
Fe	19.6
K	.68
Mg	-
Mn	8.94
Na	-
Ni	.150
P	.36
Si	4.02
Ti	.44
H2O-	-
As(ppm)	-
Ba	-
Cd	-
Ce	-
Cr	-
Mo	-
Pb	-
Pt	-
V	720
Y	-
Zn	560

Table 12. Chemical composition of ferromanganese crusts as reported in Glasby (written communication), Dillard and Crowther (1984) and Exon (1982).

Sequence#	316004	351016	352001	352002	352003	352004	352005	352006	387001
Latitude	-9.997	-19.920	-12.752	-10.033	-10.097	-11.138	-11.555	-19.225	-21.303
Longitude	-161.033	-157.655	-160.713	-161.150	-161.090	-165.567	-165.445	-169.913	-159.738
Depth	1843	1744	4469	1863	2600	1913	1297	2520	1272
Lab#	U-314	U-367	U-299B	U-315	U-316B	U-333B	U-336B	U-358	U-375
Fe(wt.%)	19.9	20.5	21.6	19.5	14.8	20.0	23.0	23.5	4.50
Mn	23.5	20.1	14.8	27.1	16.1	27.0	21.5	17.6	41.3
Cu	.050	.070	.160	.080	.120	.080	.050	.050	.250
Ni	.430	.310	.300	.530	.510	.480	.320	.180	.380
Co	.960	.640	.350	.850	.480	.930	.650	.340	.230
Si	10.2	9.89	19.6	7.02	23.3	6.90	9.25	12.3	4.21
Al	2.36	2.47	6.18	1.48	6.08	1.43	2.32	2.82	3.37
Ti	1.85	1.81	1.90	1.56	2.65	1.78	1.62	1.29	1.01
Ca	5.44	8.30	4.04	5.00	5.54	4.45	5.92	8.05	6.97
K	.35	.39	1.45	.36	1.80	.35	.51	.31	.16
P	1.03	1.17	1.72	1.14	1.41	1.06	1.37	1.14	.44
As(ppm)	-	-	-	-	-	-	-	-	-
Ba	-	-	-	-	-	-	-	-	-
Mo	-	-	-	-	-	-	-	-	-
Pb	61	440	118	410	164	440	380	176	215
Sr	-	-	-	-	-	-	-	-	-
Y	-	-	-	-	-	-	-	-	-
Zn	740	690	740	740	810	740	710	640	3300
Zr	-	-	-	-	-	-	-	-	-

Sequence#	053164	350006	351017	387002	353007	389002	389003	389004	389005
Latitude	12.050	-16.483	-13.883	-22.583	-14.137	-22.766	-22.768	-23.025	-21.850
Longitude	165.000	-145.550	-150.583	-150.800	-171.120	-175.804	-175.628	-175.957	-175.077
Depth	2090	1270	3695	807	3100	800	700	650	750
Lab#	MP43	DWHD16	M2P50	AMPH9D	WS-79(1)-10	3-9	5-10	8-5	1-2
Fe(wt.%)	11.1	13.5	15.8	12.4	15.9	22.0	25.1	21.6	25.1
Mn	22.6	22.6	17.0	24.2	10.3	18.8	18.0	16.1	18.0
Cu	.197	.186	.214	.160	.290	.053	.042	.042	.039
Ni	.700	.359	.294	.414	.130	.310	.270	.250	.280
Co	.805	1.18	.483	1.99	.160	.570	.560	.440	.510
Si	.81	.93	4.91	<.40	-	-	-	-	-
Al	.48	.44	1.32	.10	-	-	-	-	-
Ti	.80	1.02	1.08	1.17	-	-	-	-	-
Ca	3.14	2.28	1.77	.29	-	-	-	-	-
K	.26	.36	.55	2.37	-	-	-	-	-
P	.75	.40	.37	.37	-	-	-	-	-
As(ppm)	190	230	180	310	-	-	-	-	-
Ba	2500	2100	1800	2200	-	-	-	-	-
Mo	810	520	0	560	-	-	-	-	-
Pb	1900	2400	1100	2900	-	-	-	-	-
Sr	1600	1600	1400	1700	-	-	-	-	-
Y	140	155	200	120	-	-	-	-	-
Zn	1100	910	700	650	-	-	-	-	-
Zr	570	525	620	410	-	-	-	-	-

Table 13. Chemical composition of ferromanganese crusts as reported in Volkov (1976) and Dymond and others (1984)

Sequence#	055012
Latitude	17.000
Longitude	170.500
Depth	4090
Lab#	611
Fe(wt.%)	16.7
Mn	14.7
Ti	1.28
P	.40
Ba(ppm)	900
Cu	.090
Ni	.279
Co	.319
V(ppm)	470
Zr(ppm)	600
W(ppm)	88
Mo(ppm)	176
As(ppm)	115

Sequence#	010012	010013	010014
Latitude	6.658	6.658	6.658
Longitude	-92.842	-92.842	-92.842
Depth	3450	3450	3450
Lab#	MP9842	MP9843	MP9844
Na(wt.%)	1.91	1.78	1.83
Mg	1.18	1.16	1.12
Al	1.12	1.17	1.21
Si	4.91	4.78	5.10
K	.51	.51	.51
Ca	2.63	2.46	2.42
Ti	.45	.49	.52
Mn	22.3	21.7	21.2
Fe	15.8	18.1	18.4
Co	.114	.117	.132
Ni	.583	.521	.527
Cu	.070	.065	.061
Zn(ppm)	970	750	770
Ba(ppm)	1700	1400	1400

Sequence#	010013	010014
Latitude	6.658	6.658
Longitude	-92.842	-92.842
Depth	3450	3450
Lab#	MP9843	MP9844
Fe(wt.%)	14.0	14.5
Ba	1800	1300
Sc(ppm)	7.6	8.1
Cr	19.2	11.6
Co	999.9	1155.
Sb	16	16
La	136	131
Hf	11.	11.
Th	12.	13.
U	7.5	8.3

Table 14. Chemical composition of ferromanganese crusts as reported in Goddard and others (1987).

Sequence#	002003	002004	003002	003003	003004	003005	003006	003007	003008	003009
Latitude	8.917	8.917	9.017	9.017	9.017	9.017	4.283	4.217	7.917	7.917
Longitude	-19.767	-19.767	-21.033	-21.033	-21.033	-21.033	-20.867	-21.017	-20.983	-20.983
Depth	1611	1611	834	834	834	834	2934	3350	1621	1621
Sample#	S-1224-2	S-1224-5	S-1225-4	S-1225-6	S-1225-7	S-1225-10	S1233-1	S1234-1	S1240-1	S1240-2
Fe	25.2	23.5	17.9	18.3	17.1	17.7	21.8	20.4	21.7	19.6
Mn	15.7	16.1	21.3	10.8	22.2	21.5	17.9	17.2	19.1	19.6
Na	.79	.75	1.26	3.17	1.19	2.04	.83	1.00	.70	.67
K	.15	.14	.20	.15	.22	.23	.19	.21	.16	.11
Ca	1.97	2.11	3.41	4.78	2.33	2.30	1.92	1.53	1.89	1.47
Mg	1.20	1.32	1.38	2.29	1.52	1.65	1.29	1.50	1.55	1.86
Ca	.029	.037	.032	.029	.027	.030	.066	.067	.770	.044
Zn	.069	.068	.049	.048	.046	.059	.071	.063	.089	.064
Ni	.177	.237	.243	.215	.271	.262	.247	.252	.373	.379
Co	.435	.552	.921	.693	1.000	1.01	.355	.692	.477	.412
Ti	-	-	-	-	-	-	-	-	.880	1.16
Thickness(mm.)	39	39	5	2	5	2	15	13	20	20
Substrate	Basalt	Basalt	Phosphorite	Phosphorite	Phosphorite	Phosphorite				Sediment

Sequence#	115016	115017	114007	114008	114009	114010	115018	003010	003011	003012
Latitude	39.867	38.833	36.850	36.850	36.867	36.517	38.300	1.483	1.483	1.483
Longitude	-67.367	-64.067	-58.817	-58.817	-58.800	-59.383	-62.933	-24.833	-24.833	-24.833
Depth	3423	3793	3660	3660	2550	3175	3660	2210	2210	2210
Sample#	AII85-2-2	AII85-11-24	AII85-16-10	AII85-16-17	AII85-17-11	AII85-18-1	KNR61-28-15	S-1197B-1	S-1197B-2	S-1197B-3
Fe	16.7	11.0	15.0	13.9	21.6	16.8	10.1	19.5	21.6	15.5
Mn	15.4	13.8	16.8	16.4	18.5	17.3	13.7	19.4	16.9	11.1
Na	.54	.56	.45	.48	.76	.61	.53	.93	.93	1.26
K	.20	.23	.15	.14	.12	.14	.18	.24	.22	.85
Ca	.61	1.03	1.09	1.39	2.63	1.39	2.00	2.03	1.54	5.20
Mg	1.87	1.44	1.54	1.01	1.03	1.08	1.16	1.32	1.26	1.82
Cu	.032	.083	.050	.038	.035	.031	.060	.089	.078	.098
Zn	.043	.038	.039	.038	.059	.037	.047	.074	.061	.076
Ni	.337	.240	.117	.143	.150	.112	.225	.348	.188	.478
Co	.090	.048	.062	.066	.135	.112	.063	.533	.649	.151
Ti	.447	.245	.745	.718	1.39	1.14	.348	-	1.07	-
Thickness(mm.)	70	25	12	8	10	4	3	72	22	26
Substrate	Basalt	Limestone	Basalt	Montmorillonite clay	Phillipsite clay	Basalt	Glacial erratic	Basalt	Basalt breccia	Basalt

Table 14. Chemical composition of ferromanganese crusts as reported in Goddard and others (1987).

Sequence#	003013	003014	301002	301003	303001	004001	004002	304001	002005	002006
Latitude	1.483	1.483	-4.117	-3.800	-.900	.600	.933	-.167	.400	.233
Longitude	-24.833	-24.833	-12.133	-11.083	-30.133	-32.933	-32.933	-43.367	-18.483	-16.933
Depth	2210	2210	3371	3440	3941	3652	2643	4240	6470	3108
Sample#	S-1197B-4	S-1197B-6	AII42-1-8	AII42-2-6	CH35-4-1	CH35-2-1B	AII20-34-13	AII20-9-2	AII20-11-16	AII20-14-2
Fe	18.6	19.5	19.1	8.23	15.6	27.7	19.6	9.10	13.8	24.5
Mn	17.3	18.7	14.4	9.15	13.6	12.4	10.4	15.5	7.50	18.9
Na	.96	.96	.89	.67	1.00	1.14	.90	.80	.91	.66
K	.30	.29	.18	.14	.21	.16	.15	.21	.52	.14
Ca	2.76	2.12	1.89	6.75	2.30	1.86	3.08	.77	1.13	1.58
Mg	1.39	1.58	1.38	3.62	.96	1.12	.83	2.81	1.87	1.16
Cu	.083	.088	.123	.020	.042	.069	.041	.196	.069	.037
Zn	.072	.065	.065	.020	.037	.048	.041	.071	.037	.057
Ni	.249	.331	.361	.226	.239	.128	.128	.450	.113	.120
Co	.584	.641	.119	.271	.420	.202	.225	.030	.065	.125
Ti	-	-	.479	.615	1.57	1.01	.987	.275	.544	1.05
Thickness(mm.)	38	38	13	1	1	2	2	4	1	40
Substrate	Basalt	Basalt	Metabasalt	Metagabbro	Basalt	Basalt	Basalt	Serpentinite	Basalt	

Sequence#	002007	003015	002008	301004	301005	002009
Latitude	.733	.100	.067	-.133	-.133	.317
Longitude	-17.167	-20.433	-18.300	-18.317	-18.383	-17.317
Depth	4523	3329	1425	2135	3200	2950
Sample#	AII20-16-93	AII20-23-61	AII60-14-2	AII60-15-7	AII60-17-14	AII60-19-2
Fe	7.32	16.2	26.4	17.5	14.4	15.0
Mn	4.47	13.9	8.78	12.5	10.4	13.7
Na	.31	.75	.74	.68	.56	.98
K	.18	.19	.11	.12	.15	.21
Ca	1.02	1.58	1.37	1.87	1.36	1.23
Mg	2.17	.89	1.17	.91	2.01	1.13
Cu	.048	.076	.147	.055	.061	.107
Zn	.026	.051	.062	.041	.027	.038
Ni	.064	.247	.142	.100	.088	.182
Co	.029	.179	.234	.118	.074	.069
Ti	.364	.940	1.25	.755	.547	.532
Thickness(mm.)	1	5	8	6	1	14
Substrate	Metagabbro	Gabbro	Metagabbro	Metagabbro	Amphibolite	Metagabbro
	-	-	Basalt	-	-	-

Table 15. Chemical composition of ferromanganese crust layers as reported in Goddard and others (1987).

Sequence#	003010	003010	003010	003011	003011	003012	003012	003012	003013	003013	003013
Latitude	1.483	1.483	1.483	1.483	1.483	1.483	1.483	1.483	1.483	1.483	1.483
Longitude	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833	-24.833
Depth	2210	2210	2210	2210	2210	2210	2210	2210	2210	2210	2210
Sub-sample#	S-1197B-1a	S-1197B-1b	S-1197B-1c	S-1197B-2a	S-1197B-2b	S-1197B-3a	S-1197B-3b	S-1197B-3c	S-1197B-4a	S-1197B-4b	S-1197B-4c
Position from Surface(mm)	0-3	3-27	27-49	0-6	6-22	0-7	7-14	14-26	0-6	6-23	23-38
Fe	18.7	19.4	19.9	20.4	21.8	20.4	10.1	16.5	18.1	18.5	19.2
Mn	17.7	20.8	19.9	12.3	16.8	15.3	5.77	13.0	13.2	19.6	19.2
Na	1.04	1.03	.71	.84	1.10	1.06	1.35	1.31	.79	1.11	.99
K	.26	.27	.19	.24	.22	.43	1.24	.78	.33	.29	.28
Ca	2.86	1.54	1.69	5.75	1.51	1.59	9.09	4.11	5.33	1.43	1.47
Mg	1.48	1.38	1.11	1.58	1.31	2.07	1.79	1.59	1.33	1.43	1.44
Cu	.089	.118	.064	.087	.084	.108	.072	.117	.072	.093	.085
Ni	.369	.377	.298	.245	.196	.449	.299	.684	.221	.258	.270
Co	.454	.649	.495	.405	.749	.175	.080	.201	.352	.755	.651
Zn	.081	.067	.075	.063	.062	.106	.049	.077	.068	.067	.082

Sequence#	003014	003014	003014	002003	002003	002003	002004	002004	002004	003006	003006
Latitude	1.483	1.483	1.483	8.917	8.917	8.917	8.917	8.917	8.917	4.283	4.283
Longitude	-24.833	-24.833	-24.833	-19.767	-19.767	-19.767	-19.767	-19.767	-19.767	-20.867	-20.867
Depth	2210	2210	2210	1611	1611	1611	1611	1611	1611	2934	2934
Sub-sample#	S-1197B-6a	S-1197B-6b	S-1197B-6c	S-1224-2a	S-1224-2b	S-1224-2c	S-1224-5a	S-1224-5b	S-1224-5c	S1233-1a	S1233-1b
Position from Surface(mm)	0-5	5-26	26-38	0-7	7-24	24-39	0-7	7-22	22-39	0-7	7-15
Fe	17.9	20.5	20.2	25.6	25.6	24.6	22.0	24.8	23.5	22.1	21.6
Mn	19.3	17.2	19.5	16.2	15.4	15.6	15.6	17.2	16.7	17.5	18.2
Na	.79	1.02	1.09	.83	.83	.71	.88	.61	.91	.85	.82
K	.37	.24	.27	.17	.16	.14	.16	.14	.18	.17	.21
Ca	3.56	1.43	1.61	2.26	11.9	1.75	2.66	1.87	1.82	1.96	1.88
Mg	2.06	1.34	1.34	1.23	1.20	1.20	1.17	1.51	1.28	1.21	1.37
Cu	.085	.090	.092	.027	.034	.027	.017	.053	.044	.061	.072
Ni	.533	.202	.254	.170	.194	.170	.279	.232	.203	.219	.377
Co	.533	.732	.659	.398	.465	.443	.478	.599	.583	.276	.333
Zn	.059	.070	.066	.069	.063	.076	.062	.065	.077	.070	.071

Table 16. Chemical composition of ferromanganese crusts as reported in DeCarlo and others (1987).

Sequence#	089101	089102	089103	089104	089105	089106	090050	090051	090052	090053
Latitude	25.926	25.929	25.929	25.783	25.489	25.489	28.904	28.904	28.895	28.895
Longitude	-167.710	-167.755	-167.755	-167.733	-168.672	-168.672	-178.957	-178.957	-178.868	-178.868
Depth	3250	2500	2500	1600	1200	1200	1500	1500	1280	1280
Lab#	67-39-2	67-40-1	67-40-2	69-10-3	71-11-2	71-11-7	59-29-1	59-29-2	59-30-7	59-30-8
Al(wt%)	3.20	.62	.70	1.40	.66	1.10	.65	.51	.53	.25
Ca	2.64	2.45	2.40	1.17	1.57	2.36	2.48	2.50	2.62	2.72
Co	.540	.750	.960	.090	1.39	1.31	1.28	1.10	1.35	1.32
Cu	.195	.056	.047	.107	.044	.056	.037	.041	.043	.034
Fe	17.0	20.3	19.4	1.80	18.2	17.1	17.4	16.1	13.8	12.5
K	.65	.45	.38	.51	.32	.41	.56	.37	.60	.53
Mg	1.50	1.11	1.03	2.10	1.20	2.35	1.06	1.03	1.32	1.17
Mn	17.0	21.2	23.2	41.8	25.3	23.7	22.7	26.3	29.1	30.3
Na	1.40	1.70	1.20	1.04	1.04	1.20	1.78	.89	1.95	1.96
Ni	.330	.380	.410	.370	.400	.410	.300	.460	.590	.630
Si	7.80	3.55	4.07	2.30	2.60	4.25	3.50	2.20	2.10	1.30
Ti	1.14	1.20	1.26	.55	.84	.66	1.00	.84	.70	.60
Ag(ppm)	2.4	.3	3.6	3.7	.6	.5	2.5	.5	3.6	1.0
Ba	1200	1400	1400	9800	1000	1100	2200	1100	1200	1100
Cd	6.4	7.2	5.9	58.0	8.4	7.5	6.2	7.5	11.1	10.6
Pb	1900	2300	2000	200	2800	2400	3000	2400	2700	2800
V	570	690	620	246	820	790	810	680	760	850
Zn	670	660	650	2000	540	580	580	550	560	640
LOI(wt%)	12.9	15.2	15.6	16.4	16.2	15.4	15.8	16.2	18.0	17.8

Sequence#	090054	090055	090056	090057	090058	090059	090060	090061	090062	090063
Latitude	28.895	28.895	28.739	29.106	29.106	29.167	29.167	29.167	29.167	29.167
Longitude	-178.868	-178.868	-178.783	-173.948	-173.948	-174.067	-174.067	-174.067	-174.067	-174.067
Depth	1280	1280	3000	1850	1850	1425	1425	1425	1425	1425
Lab#	59-30-12	59-30-15	60-33-2	61-34-5	61-34-6	62-6-5	62-6-6	62-6-7	62-6-9	62-6-10
Al(wt%)	.58	5.00	.90	.70	.75	.55	1.03	.80	1.54	1.38
Ca	2.64	1.60	2.30	2.55	2.57	2.82	2.64	2.77	2.00	2.38
Co	1.47	.570	.600	.840	.800	.870	.780	.840	.710	.720
Cu	.045	.031	.044	.054	.067	.046	.042	.062	.064	.055
Fe	13.1	6.20	19.1	17.0	17.0	16.4	16.3	15.6	18.4	16.2
K	.54	1.46	.60	.56	.55	.53	.60	.62	.61	.63
Mg	.96	2.22	.95	.96	1.00	1.03	1.17	1.15	1.10	1.22
Mn	30.5	18.7	19.6	25.1	24.6	25.3	24.4	26.0	19.1	23.0
Na	1.70	2.93	1.65	1.73	1.72	1.73	1.77	1.95	1.80	1.80
Ni	.650	.270	.310	.440	.460	.490	.450	.640	.330	.500
Si	1.70	12.5	5.75	3.94	3.53	2.55	4.40	3.30	7.60	4.90
Ti	.78	.88	1.00	.97	1.10	1.14	.90	1.05	1.18	1.00
Ag(ppm)	.8	.2	3.3	3.6	3.2	.5	.3	.9	.4	.4
Ba	1100	600	1400	1700	1700	1600	1500	1400	2600	1400
Cd	13.4	31.2	4.6	6.5	6.6	7.0	13.6	10.8	6.0	7.7
Pb	2100	140	2200	2500	2600	2400	2400	2400	2200	2100
V	760	260	670	780	780	810	750	720	660	760
Zn	590	1100	670	680	760	720	630	880	610	650
LOI(wt%)	17.2	13.3	14.8	16.2	15.6	16.2	15.1	17.5	13.5	15.0

Table 16. Chemical composition of ferromanganese crusts as reported in DeCarlo and others (1987).

Sequence#	090064	090065	090066	090067	090068	090069	091024	091025	091026	091027
Latitude	29.167	29.167	29.208	29.208	29.185	29.185	29.866	29.839	29.820	29.643
Longitude	-174.067	-174.067	-174.112	-174.112	-174.010	-174.010	179.083	179.065	179.103	179.282
Depth	1425	1425	2200	2200	985	985	2250	2100	1700	1300
Lab#	62-6-11	62-6-12	62-35-10	62-35-11	63-7-1	63-7-3	55-23-4	55-24-4	56-25-7	57-28-5
Al(wt%)	1.04	1.30	.77	1.80	.55	.65	1.70	1.80	1.70	.42
Ca	2.63	2.44	2.00	2.30	2.64	2.80	2.57	1.72	2.57	2.72
Co	.930	.670	.730	.500	1.23	1.18	.720	.630	.750	1.28
Cu	.042	.069	.101	.113	.054	.057	.050	.078	.041	.040
Fe	14.8	15.4	15.7	15.7	16.5	16.1	17.3	18.5	15.4	13.2
K	.68	.63	.62	.83	.54	.56	.88	.70	.83	.57
Mg	1.08	1.02	.78	.90	1.17	1.15	1.10	1.33	1.15	1.16
Mn	24.5	22.9	21.6	18.8	26.9	25.8	20.0	19.9	22.2	29.6
Na	1.79	1.88	.96	1.41	1.92	1.74	1.56	1.48	1.56	1.91
Ni	.500	.530	.410	.340	.460	.470	.360	.410	.450	.590
Si	4.20	5.50	4.60	7.30	1.13	1.50	6.40	6.02	6.08	1.53
Ti	.90	.93	1.20	1.14	1.06	1.07	1.00	1.02	.84	.66
Ag(ppm)	3.0	.7	.3	.2	.8	1.4	.3	.3	1.1	3.1
Ba	2000	2700	1700	2400	1800	1600	1000	2800	1000	1200
Cd	7.8	7.1	6.4	6.9	9.2	8.0	7.2	8.3	8.8	10.8
Pb	2400	2200	2100	1600	3000	2900	2200	2200	2300	2800
V	740	680	620	560	870	920	610	590	660	860
Zn	690	660	660	610	760	800	580	760	580	640
LOI(wt%)	16.9	15.9	15.2	14.2	12.2	15.9	14.5	14.7	15.3	16.2

Table 17. Chemical composition of ferromanganese crusts as reported in DeCarlo and others (1987).

Sequence#	317015	317016	317017	317018	317019	317020	317021	317022	317023	317024
Latitude	-3.837	-3.837	-3.837	-3.837	-3.837	-3.837	-3.837	-3.837	-3.804	-3.804
Longitude	-173.329	-173.329	-173.329	-173.329	-173.329	-173.329	-173.329	-173.329	-173.490	-173.490
Depth	2265	2265	2265	2265	2265	2265	2265	2265	4800	4800
Lab#	6RD-008-01	6RD-008-02	6RD-008-03	6RD-008-04	6RD-008-05	6RD-008-06	6RD-008-08	6RD-008-S8	6RD-009-01A	6RD-009-1AF
Al(wt%)	.95	.86	.66	.69	.55	.44	.51	.46	1.25	.85
Ca	2.63	3.21	2.58	2.75	2.88	3.40	5.77	5.34	2.29	2.24
Co	.742	.820	.855	.871	.783	.818	.770	.723	.495	.504
Cu	.098	.092	.120	.113	.097	.096	.122	.103	.128	.086
Fe	18.0	17.0	15.9	16.7	15.6	15.3	14.1	14.0	16.6	20.9
Mg	1.04	1.20	1.21	1.19	1.09	1.13	1.23	1.10	1.05	1.05
Mn	23.5	23.1	26.3	25.5	24.8	26.7	25.4	24.5	23.5	21.9
Ni	.586	.596	.672	.648	.586	.646	.651	.620	.382	.251
P	.577	.730	.508	.563	.622	.778	1.59	1.51	.404	.524
Si	4.07	3.65	2.74	2.97	2.36	2.29	2.14	2.25	4.96	3.48
Ti	1.11	1.12	1.16	1.20	1.22	1.15	1.27	1.16	1.09	1.25
V	.074	.068	.077	.076	.075	.080	.073	.076	.074	.091
Thickness(mm.)	20.0	40.0	60.0	50.0	45.0	60.0	60.0	60.0	85.0	85.0

Sequence#	317025	317026	317027	317028	317029	317030	317031	317032	317033	317034
Latitude	-3.804	-3.804	-3.804	-3.804	-3.804	-2.992	-2.992	-2.992	-2.992	-2.992
Longitude	-173.490	-173.490	-173.490	-173.490	-173.490	-171.380	-171.380	-171.380	-171.380	-171.380
Depth	4800	4800	4800	4800	4800	1465	1465	1465	1465	1465
Lab#	6RD-009-02	6RD-009-03	6RD-009-04	6RD-009-05	6RD-009-06	7RD-011-X	7RD-011-01	7RD-011-02	7RD-011-03	7RD-011-04
Al(wt%)	1.06	1.40	.94	.60	.91	.22	.60	.20	.69	.29
Ca	2.20	2.15	2.25	2.15	1.86	2.77	2.95	2.88	19.1	4.82
Co	.514	.556	.599	.728	.711	1.37	1.70	1.63	.427	1.18
Cu	.153	.116	.094	.085	.115	.057	.112	.042	.127	.098
Fe	19.9	19.2	18.7	17.2	18.2	12.9	12.7	14.6	3.92	8.95
Mg	1.04	1.02	1.08	1.26	1.08	1.30	1.62	1.32	1.72	1.44
Mn	23.5	22.0	23.1	23.8	22.8	31.7	30.9	29.5	15.7	29.3
Ni	.350	.298	.321	.377	.338	.855	.682	.660	1.127	1.035
P	.530	.425	.512	.408	.365	.553	.753	.629	6.57	1.32
Si	3.85	4.44	3.04	2.02	2.99	1.13	1.56	1.11	.68	.68
Ti	1.26	1.25	1.34	1.33	1.42	.90	1.02	.79	.22	.68
V	.089	.079	.084	.078	.077	.087	.093	.083	.032	.064
Thickness(mm.)	60.0	70.0	30.0	70.0	60.0	20.0	35.0	8.0	20.0	10.0

Sequence#	317035	317036	317037	317038	317039	317040	317041	317042	317043	317044
Latitude	-2.992	-2.992	-2.992	-2.992	-2.992	-2.992	-2.992	-2.992	-2.992	-2.992
Longitude	-171.380	-171.380	-171.380	-171.380	-171.380	-171.380	-171.380	-171.380	-171.380	-171.380
Depth	1465	1465	1465	1465	1465	1465	1465	1465	1465	1465
Lab#	7RD-011-05	7RD-011-06	7RD-011-07	7RD-011-08	7RD-011-10	7RD-011-11	7RD-011-12	7RD-011-13	7RD-011-14	7RD-011-15
Al(wt%)	.27	.23	.20	.36	.46	.22	.47	.29	.36	.36
Ca	2.60	2.75	3.51	5.49	3.41	2.38	3.10	8.73	6.92	3.65
Co	1.26	1.48	1.30	1.29	1.24	1.48	1.62	.987	1.22	1.32
Cu	.053	.035	.057	.082	.089	.058	.116	.083	.049	.067
Fe	12.5	14.4	12.7	9.98	10.1	10.6	8.14	10.1	10.0	12.4
Mg	1.37	1.26	1.33	1.56	1.41	1.43	1.84	1.15	1.24	1.31
Mn	28.1	28.7	31.4	29.3	30.7	30.7	33.8	25.9	27.3	27.0
Ni	.790	.694	.828	1.134	.890	.915	1.263	.688	.733	.784
P	.523	.612	.750	1.64	.752	.440	.689	2.82	2.05	.892
Si	1.07	1.27	1.09	.78	.92	.83	.64	.91	1.26	1.20
Ti	.83	.90	.87	.68	.85	.84	.53	.85	.90	.87
V	.081	.092	.084	.065	.100	.072	.094	.085	.084	.073
Thickness(mm.)	10.0	7.0	25.0	7.0	7.0	10.0	7.0	18.0	13.0	10.0

Table 17. Chemical composition of ferromanganese crusts as reported in DeCarlo and others (1987).

Sequence#	317045	317046	318001	318002	318003	318004	318005	318006	318007	318008
Latitude	-3.016	-3.016	-7.451	-7.451	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408
Longitude	-171.446	-171.446	179.024	179.024	179.046	179.046	179.046	179.046	179.046	179.046
Depth	3130	3130	1230	1230	1690	1690	1690	1690	1690	1690
Lab#	7RD-012-1A	7RD-012-1B	4MD-001-SO1	4MD-001-SO2	4RD-007-01	4RD-007-02	4RD-007-03	4RD-007-04	4RD-007-05	4RD-007-07
Al(wt%)	.43	.58	.26	.22	.94	1.08	.56	.52	1.28	.99
Ca	2.51	2.45	2.54	3.34	2.53	3.14	5.22	3.47	2.75	3.60
Co	.664	.691	1.92	1.52	.709	.683	.856	.857	.624	.780
Cu	.125	.146	.067	.063	.069	.100	.126	.100	.109	.130
Fe	17.4	17.7	11.3	11.6	17.4	17.4	15.5	16.1	16.8	16.0
Mg	1.11	1.03	1.56	1.38	1.12	1.17	1.12	1.18	1.22	1.26
Mn	26.2	26.6	32.0	33.0	22.7	22.0	24.6	25.6	21.6	24.2
Ni	.515	.558	.885	.892	.517	.525	.543	.558	.523	.675
P	.474	.448	.411	.565	.528	.764	1.35	.766	.637	.965
Si	2.46	2.86	.98	.88	3.21	3.77	2.08	2.20	3.88	3.10
Ti	1.21	1.20	1.14	.96	1.11	1.20	1.35	1.27	1.41	1.16
V	.090	.088	.072	.081	.074	.077	.082	.088	.076	.085
Thickness(mm.)	50.0	54.0	10.0	15.0	10.0	23.0	40.0	40.0	50.0	50.0

Sequence#	318009	318010	318011	318012	318013	318014	318015	318016	318017	318018
Latitude	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408	-7.408
Longitude	179.046	179.046	179.046	179.046	179.046	179.046	179.046	179.046	179.046	179.046
Depth	1690	1690	1690	1690	1690	1690	1690	1690	1690	1690
Lab#	4RD-007-09	4RD-007-10	4RD-007-11	4RD-007-12	4RD-007-13	4RD-007-14	4RD-007-15	4RD-007-16	4RD-007-17	4RD-007-18
Al(wt%)	.58	.77	1.12	.67	.82	1.21	.74	.41	.70	.69
Ca	3.16	3.38	3.77	2.71	2.44	2.48	3.42	6.58	2.36	2.29
Co	.854	.812	.579	.822	.751	.691	.934	.868	.804	.875
Cu	.107	.121	.115	.096	.068	.093	.087	.106	.087	.075
Fe	15.1	16.7	16.0	16.6	16.9	17.8	15.8	11.4	16.0	15.6
Mg	1.13	1.16	1.23	1.22	1.10	1.23	1.17	1.08	1.11	1.17
Mn	23.9	24.8	21.6	25.5	22.9	21.9	23.6	23.7	23.6	24.5
Ni	.571	.547	.632	.606	.553	.562	.586	.659	.588	.601
P	.748	.784	1.08	.579	.507	.618	.852	1.98	.537	.475
Si	2.05	2.72	3.50	2.43	2.94	3.81	2.40	1.20	2.56	2.37
Ti	1.26	1.30	1.04	1.26	1.10	1.25	1.27	1.28	1.09	1.12
V	.074	.081	.070	.085	.074	.074	.069	.068	.073	.077
Thickness(mm.)	40.0	40.0	40.0	35.0	40.0	40.0	45.0	40.0	40.0	60.0

Table 18. Chemical composition of ferromanganese crusts as reported in OF87-281 (Hein and others, 1987).

Sequence#	058008	058009	058010	058010	058010	058011	058012	058013	094023	094024	094025
Latitude	17.936	19.149	19.149	19.149	19.149	19.149	19.455	17.148	20.025	20.112	20.396
Longitude	145.503	145.498	145.498	145.498	145.498	145.498	145.491	145.657	145.223	145.046	144.977
Depth	1940	2880	2880	2880	2880	2880	1380	2975	172	1650	1930
Lab#	D6-1	D8-5A	D8-12A	D8-12B	D8-12C	D8-20	D11-1A	D3-3	D12-2	D13-1-A	D15-1-A
Si(wt.%)	17.6	10.4	14.0	19.6	15.2	17.7	2.00	.57	10.1	18.4	15.3
Al	.40	3.60	4.10	7.90	5.30	6.50	.83	.29	4.00	6.90	4.90
Fe	8.10	16.8	12.3	5.70	14.8	4.70	1.56	.23	2.75	4.70	15.9
Mg	6.60	1.61	2.00	1.80	1.48	2.68	1.76	.68	2.25	2.22	1.79
Ca	6.20	3.30	2.70	8.50	3.40	6.60	1.07	2.13	3.60	6.30	3.20
Na	1.28	1.65	1.62	2.11	1.63	2.17	1.54	3.50	2.21	2.45	1.46
K	.41	.63	1.14	.56	1.01	.85	1.55	.40	.78	.36	.93
Ti	.41	.81	.29	.44	.88	.32	.10	.02	.19	.35	.27
P	.04	.30	.14	.06	.27	.07	.06	.03	.04	.03	.16
Mn	9.80	12.3	13.6	4.40	7.10	11.9	44.3	48.0	28.9	12.2	9.10
H_2O^-	1.5	4.7	2.6	2.3	4.0	1.2	3.9	4.6	3.0	1.2	3.6
H_2O^+	1.8	6.3	5.4	1.9	6.1	2.2	7.4	6.9	5.3	2.4	5.3
CO_2	.01	.18	.05	3.14	.19	.83	.06	.04	.06	.43	.08
As(ppm)	10	180	90	13	120	12	110	140	37	<1	180
Ba	250	1100	2800	260	880	290	5000	500	1500	230	850
Cd	8.40	5.80	6.20	1.70	1.90	.65	16.00	1.40	18.00	.35	1.85
Co	50	930	740	18	530	140	85	25	12	27	180
Cr	140	20	35	21	24	71	6	4	15	39	26
Cu	210	580	4000	120	400	900	400	28	130	220	130
Mo	73	140	230	3	19	56	840	1300	240	38	190
Ni	320	1200	1400	130	730	120	840	82	150	38	260
Pb	<49	650	300	25	330	25	100	10	25	<49	<49
Sr	210	1000	540	410	800	400	1100	400	530	300	360
V	460	580	310	260	340	220	410	<4	620	250	230
Zn	310	560	480	140	370	83	840	110	160	85	220
Thickness(mm.)	-	-	-	-	8.0	-	-	-	2.0	-	8.0
Y (ppm)	17	130	39	38	110	96	38	3	12	17	20
La	5	-	-	-	-	121	-	2	-	-	-
Ce	9	310	53	<10	210	220	22	2	<10	<10	17
Pr	1	-	-	-	-	27	-	<1	-	-	-
Nd	7	-	-	-	-	118	-	<2	-	-	-
Sm	2	-	-	-	-	26	-	<1	-	-	-
Eu	.66	-	-	-	-	6.8	-	.13	-	-	-
Gd	3	-	-	-	-	29	-	1	-	-	-
Tb	<1	-	-	-	-	5	-	<1	-	-	-
Dy	3	-	-	-	-	-	-	<1	-	-	-
Ho	.64	-	-	-	-	5.2	-	.12	-	-	-
Er	2.2	-	-	-	-	14	-	<.5	-	-	-
Tm	.3	-	-	-	-	2.2	-	<.2	-	-	-
Yb	1.9	-	-	-	-	14	-	<.5	-	-	-
Lu	.30	-	-	-	-	2.1	-	<.05	-	-	-
Pt	.005	.084	.026	.007	.039	.006	.054	<.005	.010	<.005	.017
Pd	.002	.0022	.0024	.0026	.0022	.004	.015	<.010	.002	.0056	.0026
Rh	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001

Table 18. Chemical composition of ferromanganese crusts as reported in OF87-281 (Hein and others, 1987).

Sequence#	094026	094027	094028	094029	094030	094031	094032	094033	094033	094034	094035
Latitude	20.612	21.052	21.141	21.141	21.141	21.141	21.765	22.082	22.082	22.082	22.293
Longitude	144.653	143.832	143.904	143.904	143.904	143.904	143.720	143.400	143.400	143.400	143.226
Depth	1640	2290	1715	1715	1715	1715	1170	1950	1950	1950	1572
Lab#	D20-1-A	D27-1-A	D28-3-A	D28-4-A	D28-6-A	D28-7-A	D33-2-3-A	D36-2-A	D36-2-B	D36-4	D37-1
Si(wt.%)	1.60	2.52	20.8	15.7	15.4	8.30	-	13.0	12.4	12.3	7.60
Al	.57	.84	7.60	5.80	5.70	2.70	3.10	4.70	4.30	4.30	2.63
Fe	.51	5.30	6.60	4.80	5.60	17.4	8.80	14.6	14.7	15.2	18.0
Mg	.82	1.59	3.40	2.49	2.41	1.08	1.29	1.36	1.28	1.38	.99
Ca	2.36	1.45	6.20	5.00	5.20	2.59	2.00	2.90	2.37	2.69	2.30
Na	3.26	1.70	2.00	2.12	2.11	1.69	-	1.82	1.49	1.43	1.55
K	.51	1.33	.48	.57	.72	.58	.84	1.03	1.08	1.00	.61
Ti	.04	.19	.38	.34	.41	.67	.14	.87	.80	.86	.70
P	<.03	.18	.06	.04	.05	.38	.10	.23	.23	.25	.43
Mn	46.3	36.8	5.60	15.9	15.6	13.1	14.5	4.90	5.90	6.10	12.1
H_2O^-	3.0	6.2	1.5	2.6	2.0	10.3	-	14.8	16.7	15.8	14.4
H_2O^+	7.6	7.4	1.6	3.7	3.8	7.0	-	4.4	4.0	5.2	5.5
CO_2	.04	.14	.02	.75	.93	.31	-	.14	.15	.18	.28
As(ppm)	110	160	12	14	19	230	-	110	110	120	270
Ba	450	9800	310	620	890	1100	510	760	720	760	910
Cd	2.75	27.00	.45	7.40	16.00	2.30	.30	1.10	1.40	1.25	1.55
Co	9	1000	42	33	51	1400	<4	470	560	580	1700
Cr	<1	6	85	8	9	12	7	32	35	35	15
Cu	39	1700	140	96	190	420	45	330	440	380	340
Mo	980	1000	<4	67	70	170	220	<4	<4	18	250
Ni	120	2400	54	57	300	1700	69	380	580	530	1500
Pb	70	460	<49	<49	<49	1100	<49	400	460	440	1200
Sr	360	1100	290	360	420	1200	410	670	680	730	1100
V	30	530	260	320	460	640	320	270	280	290	520
Zn	720	940	110	110	390	470	320	360	360	390	430
Thickness(mm.)	-	12.0	12.0	-	-	30.0	-	13.0	7.0	25.0	20.0
Y (ppm)	-5	125	17	45	34	150	35	86	97	99	191
La	-	157	-	32	-	-	-	-	-	-	253
Ce	<10	303	<10	51	<10	430	17	250	250	260	550
Pr	-	34	-	6	-	-	-	-	-	-	53
Nd	-	148	-	29	-	-	-	-	-	-	230
Sm	-	33	-	6	-	-	-	-	-	-	50
Eu	-	8.4	-	1.6	-	-	-	-	-	-	12.6
Gd	-	37	-	7	-	-	-	-	-	-	56
Tb	-	6	-	2	-	-	-	-	-	-	8
Dy	-	27	-	-	-	-	-	-	-	-	40
Ho	-	6.5	-	1.6	-	-	-	-	-	-	9.9
Er	-	18	-	5	-	-	-	-	-	-	28
Tm	-	2.7	-	.7	-	-	-	-	-	-	4
Yb	-	18	-	4.3	-	-	-	-	-	-	26
Lu	-	2.8	-	.73	-	-	-	-	-	-	4
Pt	<.005	.064	.007	.011	.008	.069	-	-	-	-	.090
Pd	.001	.0012	.0046	.0046	.0046	.0066	-	-	-	-	.002
Rh	<.001	<.001	<.001	<.001	<.001	.0023	-	-	-	-	.0046

Table 18. Chemical composition of ferromanganese crusts as reported in OF87-281 (Hein and others, 1987).

Sequence#	094036	094037	094038	094039	094040	094041	094042	094042	094042	094043	094044
Latitude	22.293	22.293	22.462	22.829	22.922	23.587	23.618	23.618	23.618	23.618	23.618
Longitude	143.226	143.226	142.999	142.585	142.526	141.825	141.819	141.819	141.819	141.819	141.819
Depth	1572	1572	1230	2450	2000	1400	1105	1105	1105	1105	1105
Lab#	D37-4	D37-5	D41-2B-A	D42-1	D44-1	D51-1	D52-4-A	D52-4-B	D52-4-C	D52-5	D52-9
Si(wt.%)	9.60	9.30	1.05	4.20	7.10	5.90	8.00	.18	9.90	5.30	6.40
Al	3.30	3.20	.57	1.10	.82	2.70	2.54	.11	4.20	.10	2.28
Fe	18.7	19.5	1.09	18.5	5.40	1.90	6.50	.17	3.40	6.30	3.60
Mg	1.03	1.07	2.16	.98	1.14	2.32	2.02	1.98	2.33	1.44	2.20
Ca	2.50	2.62	1.38	2.19	1.26	2.76	1.98	1.48	3.10	1.54	1.96
Na	1.80	1.67	1.69	1.74	3.10	2.70	1.78	2.40	2.30	2.01	1.90
K	.67	.65	1.55	.42	.91	1.30	1.61	1.04	1.89	1.40	1.63
Ti	.86	.78	.04	.83	.04	.14	.14	.01	.23	.07	.13
P	.42	.44	.03	.47	<.03	.06	.11	<.03	.09	.16	.08
Mn	10.1	11.5	44.3	15.8	34.7	33.4	29.6	47.2	27.1	35.0	33.7
H_2O^-	9.7	7.3	6.2	16.2	6.2	5.1	4.4	4.2	2.7	6.5	4.7
H_2O^+	7.3	7.5	7.3	7.0	5.7	5.5	6.5	8.6	5.9	6.5	6.9
CO_2	.25	.28	.03	.46	.01	1.50	.04	.02	.03	.03	.02
As(ppm)	250	280	78	280	50	34	57	28	21	98	50
Ba	980	980	2100	920	1700	870	2200	530	580	1300	1300
Cd	1.65	1.60	23.00	2.15	<.20	10.00	9.80	.50	5.90	<.20	6.90
Co	1400	1600	31	2600	170	44	87	190	35	230	100
Cr	21	17	3	5	2	2	3	0	12	7	5
Cu	360	310	120	200	300	60	67	18	100	62	62
Mo	160	210	1200	180	670	250	230	610	490	530	420
Ni	1200	1400	360	2200	130	150	210	30	190	280	270
Pb	1100	1300	30	1400	15	18	28	<9	43	38	43
Sr	1000	1200	680	1300	280	580	700	450	500	520	550
V	500	530	130	540	<4	160	130	<4	58	<4	59
Zn	460	460	440	530	35	190	180	18	210	140	200
Thickness(mm.)	25.0	20.0	-	2.0	-	-	-	-	-	-	-
Y (ppm)	150	170	60	201	8	9	13	-5	16	10	12
La	-	-	13	313	5	7	-	-	-	12	-
Ce	520	540	18	790	14	9	18	<10	18	21	27
Pr	-	-	2	70	1	1	-	-	-	2	-
Nd	-	-	11	290	5	5	-	-	-	9	-
Sm	-	-	2	64	1	1	-	-	-	2	-
Eu	-	-	.68	16.2	.39	.26	-	-	-	.51	-
Gd	-	-	3	68	1	1	-	-	-	2	-
Tb	-	-	1	10	<1	<1	-	-	-	<1	-
Dy	-	-	3	51	1	<1	-	-	-	<1	-
Ho	-	-	.96	11.3	.4	.24	-	-	-	.37	-
Er	-	-	3.1	31	1.4	.8	-	-	-	1.2	-
Tm	-	-	.3	4.6	<.2	<.2	-	-	-	<.2	-
Yb	-	-	2.2	29	1.5	.8	-	-	-	1	-
Lu	-	-	.4	4.5	.21	.14	-	-	-	.17	-
Pt	-	-	.008	.130	.013	<.005	-	-	-	<.005	-
Pd	-	-	.001	.0028	.0028	.0012	-	-	-	.0012	-
Rh	-	-	<.001	<.001	<.001	<.001	-	-	-	<.001	-

Table 18. Chemical composition of ferromanganese crusts as reported in OF87-281 (Hein and others, 1987).

Sequence#	094045	094046	094047	094048	094049	094050	094051	094052	094053	094054	094055
Latitude	23.817	24.028	24.028	24.075	24.075	24.043	24.043	23.193	23.193	23.193	23.193
Longitude	141.727	141.588	141.588	141.553	141.553	141.670	141.670	141.395	141.395	141.395	141.395
Depth	1640	1780	1780	1500	1500	1730	1730	1080	1080	1080	1080
Lab#	D54-2	D55-3	D55-4	D56-1-B	D56-2	D57-2	D57-4	D58-3	D58-4	D58-7	D58-11
Si(wt.%)	14.8	16.5	.19	14.7	6.90	12.0	17.4	3.80	2.60	4.50	5.60
Al	6.10	5.90	.14	6.10	2.65	3.40	7.30	1.41	.91	1.23	1.54
Fe	6.50	4.40	.11	5.30	1.61	9.10	5.60	20.4	20.0	20.0	19.9
Mg	3.20	1.99	2.41	2.43	1.89	2.11	3.50	1.02	1.03	.99	1.00
Ca	5.10	3.70	1.69	4.60	7.70	2.37	6.60	2.22	2.19	2.14	2.11
Na	1.96	2.40	2.07	2.20	2.40	1.94	1.68	1.44	1.39	1.32	1.37
K	1.49	2.03	1.65	1.65	1.09	1.60	1.02	.42	.34	.38	.42
Ti	.43	.30	.01	.35	.13	.16	.30	.56	.53	.56	.57
P	.10	.09	.03	.12	.05	.13	.07	.62	.64	.61	.58
Mn	14.5	15.5	44.2	15.7	27.4	19.9	10.5	16.9	17.7	16.8	15.3
H_2O^-	2.9	2.8	5.9	2.7	3.4	4.8	1.7	11.1	13.7	14.9	15.8
H_2O^+	3.9	3.5	6.7	6.0	5.4	5.5	2.8	8.1	8.3	7.8	7.4
CO_2	.03	.02	.04	.59	5.90	.02	.01	.31	.34	.36	.33
As(ppm)	14	18	48	24	20	62	22	410	430	410	380
Ba	1000	1100	900	660	910	1000	790	970	930	950	900
Cd	9.60	22.00	13.00	14.00	4.20	12.00	2.10	2.45	2.65	2.42	2.35
Co	33	20	40	61	40	220	220	3000	3300	3000	2600
Cr	14	17	0	11	4	17	77	13	12	13	17
Cu	200	130	120	210	44	77	310	290	200	220	210
Mo	83	55	520	64	100	240	140	530	570	510	450
Ni	170	240	340	340	73	300	110	2000	2100	2000	1800
Pb	23	28	10	55	20	20	5	2100	240	2100	2000
Sr	800	630	590	680	620	480	620	1500	1500	1500	1300
V	310	190	150	240	81	170	210	730	800	730	680
Zn	220	350	260	400	85	210	110	490	550	510	480
Thickness(mm.)	-	-	-	-	-	-	-	18.0	8.0	15.0	30.0
Y (ppm)	19	22	6.9	25	13	14	13	240	240	257	247
La	-	13	-	-	-	-	-	-	-	354	320
Ce	39	63	<10	73	14	31	15	580	570	600	590
Pr	-	7	-	-	-	-	-	-	-	73	67
Nd	-	27	-	-	-	-	-	-	-	310	290
Sm	-	5	-	-	-	-	-	-	-	67	62
Eu	-	1.31	-	-	-	-	-	-	-	16.9	15.7
Gd	-	5	-	-	-	-	-	-	-	75	70
Tb	-	<1	-	-	-	-	-	-	-	11	10
Dy	-	<1	-	-	-	-	-	-	-	58	54
Ho	-	.76	-	-	-	-	-	-	-	12.9	12.3
Er	-	2.2	-	-	-	-	-	-	-	36	34
Tm	-	.3	-	-	-	-	-	-	-	5.2	5
Yb	-	2.3	-	-	-	-	-	-	-	33	32
Lu	-	.37	-	-	-	-	-	-	-	5.1	5
Pt	-	.005	-	-	-	-	-	-	-	.140	.190
Pd	-	.0022	-	-	-	-	-	-	-	.0014	.0014
Rh	-	<.001	-	-	-	-	-	-	-	.002	.0018

Table 18. Chemical composition of ferromanganese crusts as reported in OF87-281 (Hein and others, 1987).

Sequence#	094056	094057	094058	094059	094060	094061	094062	094063
Latitude	23.095	22.447	22.447	22.447	25.122	25.122	20.648	25.122
Longitude	141.388	141.928	141.928	141.928	141.273	141.273	144.449	141.273
Depth	1470	1660	1660	1660	1620	1620	2200	1620
Lab#	D59-4	D71-1	D71-2	D71-4	D73-1A	D73-1F	D21-1-A	D73-2
Si(wt.%)	5.70	10.7	11.3	10.3	16.9	.55	12.8	5.40
Al	1.91	3.80	2.96	3.80	5.70	.51	4.60	1.64
Fe	21.1	17.5	18.0	17.0	6.40	.34	14.7	19.5
Mg	.92	1.02	1.01	1.15	2.25	2.05	1.44	1.02
Ca	2.07	2.42	2.28	2.63	4.00	1.61	3.30	2.21
Na	1.47	1.74	1.58	1.68	2.40	2.05	1.65	1.60
K	.46	.85	.69	.83	.95	1.05	.86	.49
Ti	.69	.76	.66	.72	.42	.02	.75	.80
P	.58	.37	.40	.38	.08	.01	.32	.56
Mn	13.6	9.80	11.8	10.7	12.7	45.2	9.50	15.2
H_2O^-	10.1	8.6	13.6	8.1	2.6	6.0	6.9	11.0
H_2O^+	6.2	6.7	6.1	6.6	3.5	7.7	4.7	8.4
CO_2	.28	.14	.25	.21	.14	.30	.24	.25
As(ppm)	380	220	250	220	20	52	150	320
Ba	1100	910	910	910	460	5000	970	940
Cd	1.88	1.40	1.70	1.80	8.00	2.85	2.20	2.35
Co	2100	900	1100	970	31	6	790	2700
Cr	15	15	16	16	6	3	330	15
Cu	220	470	430	440	160	43	510	180
Mo	350	160	250	210	85	290	100	260
Ni	1500	1100	1400	1300	170	54	1500	1900
Pb	1800	860	1100	870	20	5	890	1600
Sr	1400	1000	1100	1100	430	570	930	1300
V	700	440	490	470	310	770	390	640
Zn	520	440	430	420	290	50	400	500
Thickness(mm.)	25.0	40.0	35.0	32.0	-	-	12.0	5.0
Y (ppm)	220	150	195	150	25	22	104	200
La	-	-	246	-	-	11	119	-
Ce	610	380	440	360	<10	4	215	830
Pr	-	-	50	-	-	2	27	-
Nd	-	-	220	-	-	11	118	-
Sm	-	-	47	-	-	2	26	-
Eu	-	-	12.2	-	-	.83	6.9	-
Gd	-	-	55	-	-	3	30	-
Tb	-	-	9	-	-	1	5	-
Dy	-	-	39	-	-	3	-	-
Ho	-	-	9.8	-	-	.73	5.5	-
Er	-	-	28	-	-	2.3	15	-
Tm	-	-	4.1	-	-	.3	2.3	-
Yb	-	-	26	-	-	2.1	15	-
Lu	-	-	4.1	-	-	.37	2.3	-
Pt	-	-	.110	-	-	.015	.075	-
Pd	-	-	.002	-	-	.0066	.0032	-
Rh	-	-	.0018	-	-	<.001	<.001	-