DEPARTMENT OF THE INTERIOR
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Reconnaissance Geochemical Exploration for Gold in the Ad Darb Area, Kingdom of Saudi Arabia

by

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ABSTRACT

Geochemical data were analyzed for 244 wadi-sediment samples in an attempt to locate gold exploration targets in late Proterozoic metasedimentary and metavolcanic rocks in the Ad Darb area of the southern Arabian Shield. The target was gold mineralization in high-alumina alteration zones of the type that occurs in the Carolina Slate Belt, eastern United States. Such a target was sought in the Ad Darb area because of the known presence of kyanite in schist of the Sabya formation, which was interpreted to be a possible indicator of late Proterozoic high-alumina hydrothermal activity in the region.

Overall, metal values in the wadi-sediment samples are low. The known kyanite mineral occurrence is marked by anomalous gold and tin in three minus-80-mesh samples. The low values of the metals do not justify further exploration for the sought deposit type in the immediate vicinity, although the signature of anomalous elements in the wider region is comparable to the signature known in the Carolina Slate Belt, and is permissive of the interpretation that a diffuse hydrothermal system operated in the region during the late Proterozoic. A large concentration of polymetallic anomalies (gold, arsenic, copper, antimony, tin, tungsten, and lead) is outlined in the northeastern part of the survey area on the basis of panned-concentrate samples. The source of the concentration is unknown, and further investigations are recommended. Recommended low-priority investigation of the source of lead and zinc anomalies in the western part of the survey area would be justified as part of a larger program designed to evaluate the mineral potential of the entire belt of Sabya formation rock.

INTRODUCTION

EXPLORATION CONCEPT

This report presents the results of a wadi-sediment geochemical survey that was part of a reconnaissance exploration program for gold in the Sabya formation of southern Saudi Arabia. The project developed from a proposal by R.G. Schmidt and W.C. Overstreet of the U.S. Geological Survey, Reston, Virginia (written commun. 1983), to investigate the Wadi Marbat (MODS 3179) kyanite-topaz-lazulite occurrence as a possible indicator of high-alumina alteration by a type of hydrothermal system that elsewhere is known to be gold and copper bearing (Schmidt, 1985; Klein and Criss, 1988).

Such systems are characterized by:

1. An abundance of high-alumina minerals including alunite, kaolinite, pyrophyllite, andalusite, kyanite, and topaz;
2. their large size, on the order of kilometers in each direction;
3. evidence of very intense alteration by strong acids acting through large volumes of rock; and
4. profound changes in bulk composition and the common destruction of primary textures.

At many locations the altered zones are associated with a widespread dissemination of pyrite; and, locally, with economic concentrations of gold, silver, copper, molybdenum, tin, and other metals. Fluorine is commonly, but not always, more abundant than boron, and is usually present as topaz. Primary rock ilmenite tends to be altered to rutile. The alteration commonly grades from high-alumina minerals in the core, through intermediate quartz-sericite or quartz-paragonite zones, to a peripheral propylitic zone. Some systems appear to grade to potassic alteration at depth, where they are akin to porphyry-copper types of systems. Most known instances of high-alumina alteration occur in metavolcanic rocks and may have originated from the action of large subvolcanic to solfataric hydrothermal systems.

High-alumina alteration zones are gold-exploration targets in the Carolina Slate Belt of the eastern United States (Allard and Carpenter, 1982), and were sites for historic gold mining at the Brewer mine, Chesterfield County, S.C., Pilot Mountain, Randolf County, N.C., and elsewhere (Bell, 1982).

Kyanite-topaz-lazulite at Wadi Marbat was first reported by L.F. Rooney of the U.S. Geological Survey in 1977. He recommended that "the deposit be studied in detail even though it appeared to be too small to have any economic potential" (cited by Fairer, 1985, pg. 21). Fairer (1982b) subsequently mapped the occurrence and reported "kyanite, topaz, and quartz, and thin beds of natroalunite" in metasedimentary rocks of the Sabya formation. Optical and X-ray examination detected "trace amounts of muscovite, barite, chlorite, rutile, calcite, and pyrophyllite scattered throughout the rock," and Fairer concluded that "this occurrence of aluminum silicates and hydrated aluminum silicates is indicative of the relatively high-pressure hydrothermal alteration of pelitic sediments." Fairer (1985) later described the occurrence as containing lazulite rather than natroalunite, and referred to the presence of kyanite-topaz-lazulite gneiss as a lithologic component of the Sabya formation.

The exploration reported in the present report was instituted to test for the presence of low-grade gold in the high-alumina metavolcanic rocks of the region.

Location and Topography

The survey area is centered on lat 17° 40'N. and long 42° 30'E., about 15 km east of Ad Darb and about 70 km north of Jizan, in the Southern Province of Saudi Arabia (fig 1). It is relatively well populated. The area is accessible 2 km east from the point where the Jiddah-Ad Darb-Jizan paved highway crosses Wadi Bayd, 15 km south-southeast of Ad Darb.

The survey area lies at the transition between the Tihamat Asir (Red Sea coastal plain) and the foothills of the Red Sea escarpment, and rises from the gently undulating low-lying eastern margin of the coastal plain in the west, to rugged terrain in the east. Numerous wadis cross the area and drain to the southwest. They, and their tributaries, form a dendritic drainage pattern, except in restricted eastern parts of the survey area where the drainage has a trellised pattern.

Previous Work

In the 1950s, the Ad Darb area was mapped at 1:500,000 scale as part of the geologic map of the Asir quadrangle (Brown and Jackson, 1959). Later, in 1979 and 1980, it was mapped at 1:100,000 scale as part of the Ad Darb (17/42A) and Wadi Baysh (17/42B) quadrangles (Fairer, 1982a; 1982b). In 1981 and 1982, the results of the 1:100,000-scale quadrangle mapping were compiled at 1:250,000 scale as part of the Wadi Baysh 1° by 1.5° geologic map (sheet 17F) (Fairer, 1985).

With the exception of the kyanite occurrence studied here, no mineral occurrences of economic potential or ancient mine sites are reported in the region. The industrial-mineral potential of the occurrence was judged by Cartier and Laurent (1987) to be nonexistent.

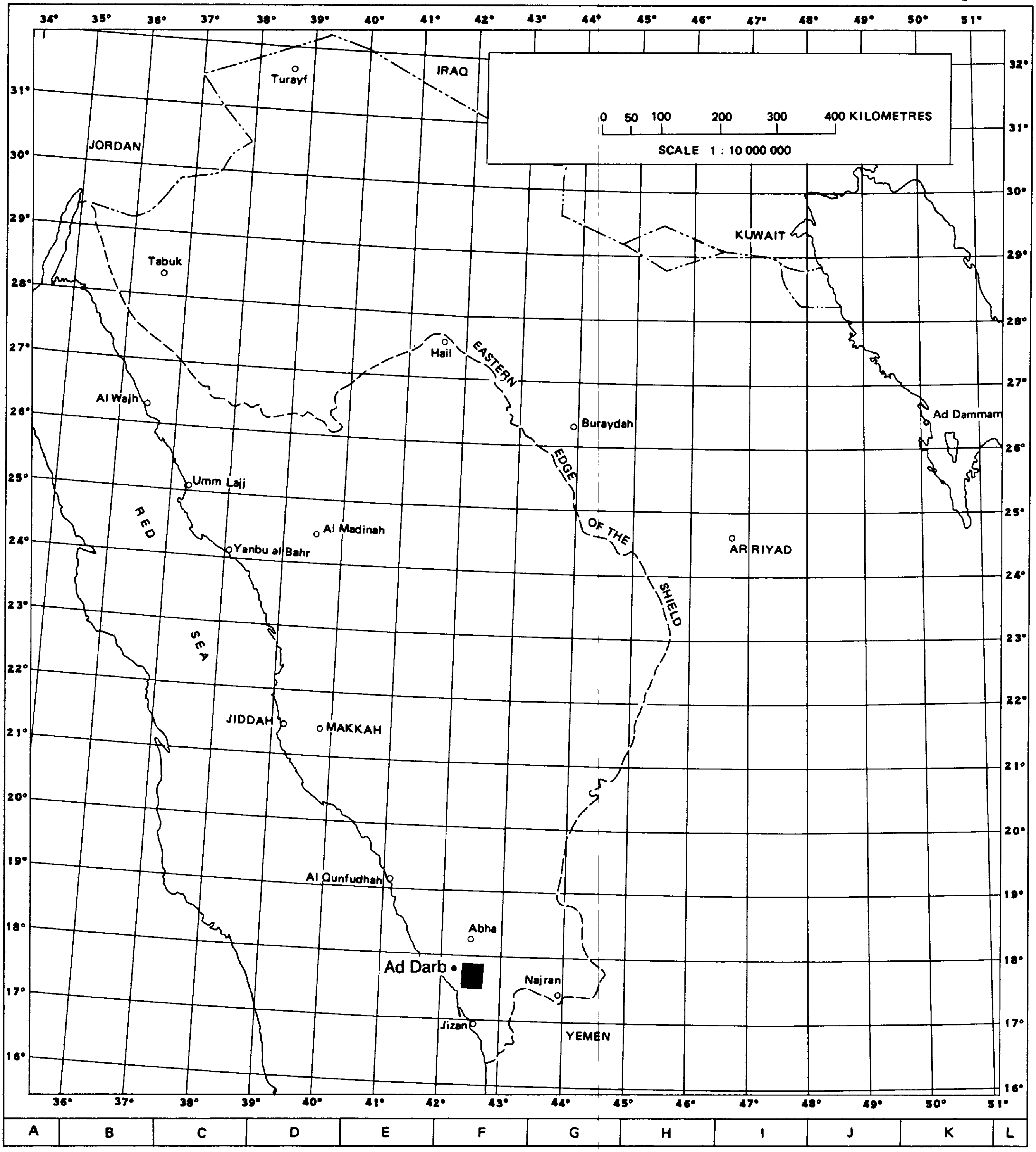

Figure 1.–Index map of western Saudi Arabia, showing the location of the Ad Darb area.

PRESENT INVESTIGATION

The purpose of the Ad Darb reconnaissance geochemical survey was to acquire and interpret wadi-sediment geochemical data that would narrow the search for potential gold in the area. The study was supervised by R.M. Samater and was undertaken in Safar 1409 (October 1988).

Geologic reconnaissance of the Wadi Marbat occurrence by A.A. Bookstrom in September 1988, prior to the geochemical survey, revealed the presence of stratabound lenses of layered quartz-kyanite rock in white mica schist. The schist protolith was probably lapilli tuff. Minor limonite, possibly after pyrite, is associated with the occurrence. A minor amount of quartz veining is present but indications of ancient prospecting in the area were not observed. Constrained by the low gold-detection limit of the atomic absorption spectroscopy analytical method employed at the DGMR/USGS Laboratory, Jiddah, no gold was detected in rock chip samples. Nevertheless, following discussion with T. Klein (USGS, Reston, Virginia), who pointed out that gold may occur anywhere in hydrothermal systems of the type considered in this project, it was decided to continue exploration: (1) by utilizing enhanced Landsat imagery to define possible alteration zones, and (2) by conducting a wadi-sediment geochemical survey.

Landsat Thematic Mapper data for the area were digitally enhanced at the DGMR Computer Center, using DIPIX equipment under the supervision of J.O. Morgan (USGS). Four images were produced, depicting an area of about 25x25 km centered about 85 km north of Jizan. The images were captured on Polaroid film at a print scale of approximately 1:135,000. The enhancements entailed high-pass filtering, piecewise-contrast stretching, and printing in different orders of spectral bands 2, 4, and 7. An objective of the image processing was to obtain information about the lithology and structure of the bedrock, and to delineate limonitic alteration zones. Contrasts in texture and hue across the images clearly differentiate five stratigraphic units, but the enhancements failed to allow detection of alteration zones. The results of image processing aided compilation of the geologic map shown in figure 2, but provided no evidence concerning the location of exploration targets.

The geochemical survey entailed collection of bulk wadi-sediment samples from 244 sites. The samples were collected by helicopter in 7 days, utilizing Jizan airport as an operational base, 30- to 45-minutes' flying time south of the survey area. Sample preparation and panning was done in the field, and samples were analysed by Skyline Labs, Inc., Denver, Colorado. The analytical results were entered into the DGMR Rock Analysis Storage System (RASS). Computer plots of the geochemical data were generated by R.P. Christian at the USGS computer section, Jeddah using U.S. Geological Survey computer programs GSDRAW and GSMAP (Selner and Taylor, 1988). The report was compiled by P. R. Johnson.

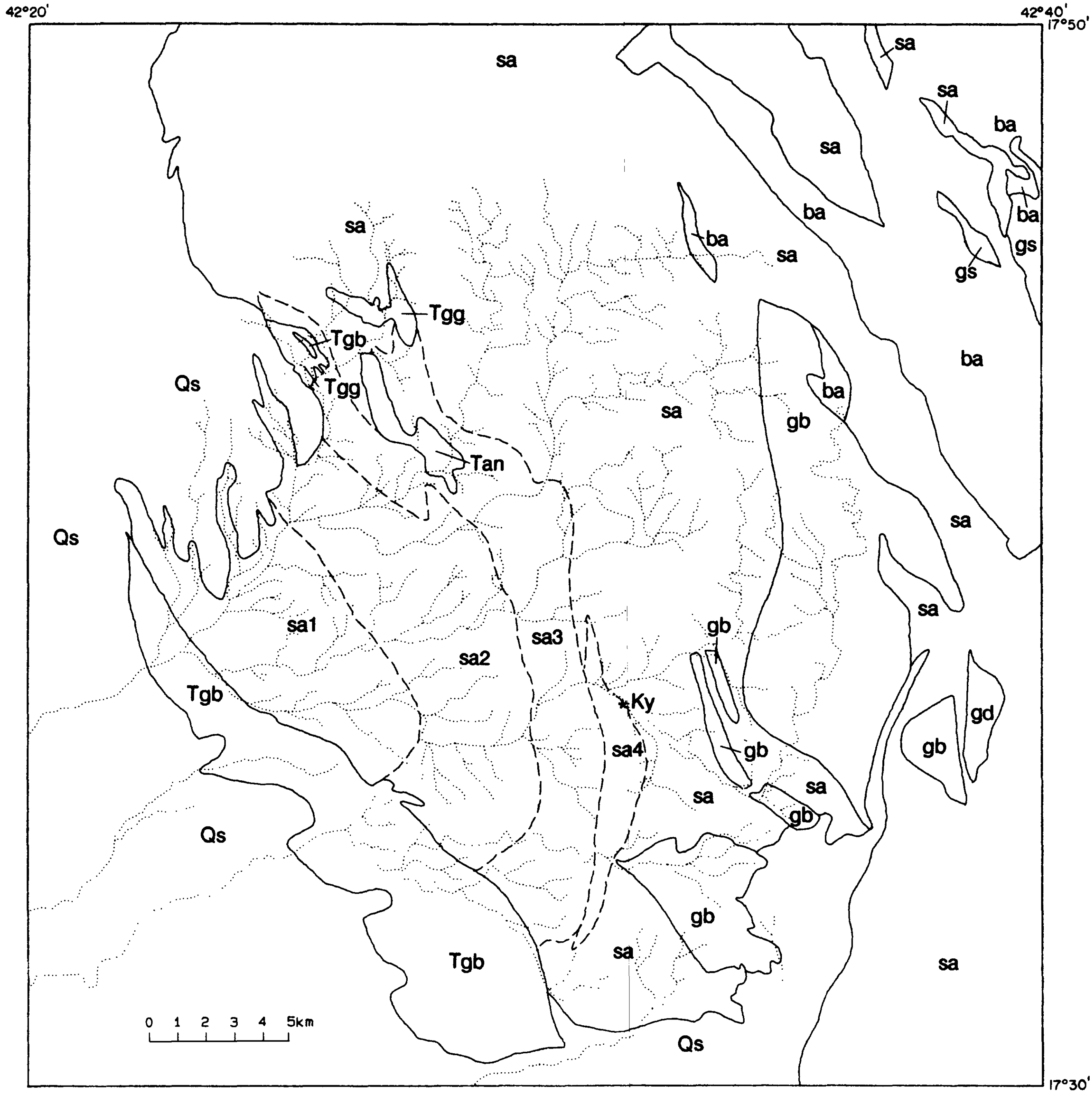

Figure 2.--Geologic map of the Ad Darb geochemical survey area (compiled from Fairer, 1982a; 1982b; 1985; and Landsat imagery). *Ky = Wadi Marbat (MODS 3179) kyanite occurrence. Geologic units: Sabya formation quartz-sericite schist (sa1), quartz-biotite-sericite schist (sa2), quartz-sericite schist (sa3), quartz-sericite schist and quartz-kyanite lenses (sa4), undivided (sa); Baish group (ba); gabbro (gb); granodiorite (gd); granite (gs); Tertiary andesite (Tan); Tertiary granophyre (Tgg); Tertiary gabbro-diabase dike complex (Tgb); Quaternary surficial cover (Qs).

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GEOLOGIC SETTING

The survey area is underlain by folded and metamorphosed late Proterozoic rocks of the Sabya formation and Baish group, late Proterozoic intrusive rocks, and Tertiary igneous rocks of the Tihamat Asir Complex. Quaternary alluvium extensively covers the bedrock in the western and southern parts of the survey area, but is confined to wadi channels in the east (fig. 2).

The Sabya formation crops out in the eastern two thirds of the study area in an antiform that plunges gently to the southeast. The eastern limb of the antiform is intruded by sills and dikes of gabbro and granodiorite and the western limb is truncated by a Tertiary gabbro-diabase dike swarm. In the type area, southeast of the Ad Darb geochemical survey area, the Sabya formation consists of quartzite, quartz-pebble conglomerate, argillite, limestone, dolomite, and sparse basalt regionally metamorphosed to greenschist facies and locally amphibolite and granulite facies (Fairer, 1983). The most common rock type is quartz-sericite schist; other rock types include quartz-biotite-sericite schist, quartz-siderite-sericite schist, quartz-calcite-sericite schist, black slate, and red slate. Pyrite is a common component of the schistose rocks, and chlorite is ubiquitous, imparting a characteristic green hue to the unit.

Reconnaissance geologic mapping during the early stage of the Ad Darb exploration program suggested a four-fold division of the stratigraphy in the western part of the study area (fig. 2). The reconnaissance also suggested that the protoliths of the Sabya formation schist, at least in the vicinity of the Wadi Marbat kyanite occurrence, included lapilli tuff rather than exclusively epiclastic sedimentary rocks as inferred by Fairer (1982b). The four divisions comprise quartz-sericite schist (sa1), overlain by quartz-biotite-sericite schist, marble, black slate, and argillite (sa2), quartz-sericite schist (sa3), and quartz-sericite schist and quartz-kyanite lenses (sa4). The units are well displayed by distinctive textures and pale hues on Landsat imagery. The eastern part of the study area is underlain by undivided units of the Sabya formation (sa), which is differentiated from the four divided units farther west by distinctive dark hues on the Landsat images. The undivided Sabya formation (sa) shown in figure 2 correlates with the upper Sabya formation of Fairer (1982b) and consists of "broad outcropping bands of quartz-siderite-sericite schist alternating with quartz-sericite schist, quartz-calcite schist, graywacke, and marble, intruded by sparse basaltic and gabbroic sills" (Fairer, 1982b).

The Wadi Marbat kyanite occurrence is in the upper part of the quartz-sericite schist unit (sa4). Fairer (1985) describes blue-bladed kyanite crystals as long as 15 cm and brown topaz crystals as long as 4 cm associated with cryptocrystalline quartz, plagioclase, and lazulite. The quartz-sericite schist unit is lenticular and pinches out approximately 3 km north of and 8 km south of the Wadi Marbat occurrence.

Metavolcanic rocks of the Baish group (ba) (fig. 2) overlie the Sabya formation in the northeast corner of the survey area. The rocks consist of medium to thick flows of tholeiitic basalt and spilitic basalt interbedded with metagraywacke, metachert, schist, and marble. According to Fairer (1982b), the contact of the Baish group and Sabya formation is generally sheared, but at one locality north of the study area basaltic lapilli tuff of the Baish group rests conformably on quartz-sericite schist of the Sabya formation.

A small tongue of Ablah group marble in the northwest of the study area is depicted on the 1:250,000-scale geologic compilation of the Wadi Baysh quadrangle (Fairer, 1985), but is not differentiated in figure 2.

Gabbro sills (gb) and minor bodies of granodiorite (gd) intrude the Sabya formation in the eastern third of the study area. The intrusive rocks probably represent hypabyssal sills coeval with the Baish-group basalt (Fairer, 1985). Foliated granite (gs) intrudes the Baish group at the eastern margin of the study area. The presence of additional small bodies of intrusive rock, particularly in a zone that extends northeast from the kyanite occurrence in Wadi Marbat to the upper reaches of Wadi Juwan, is suggested by clusters of short-wavelength anomalies shown on the aeromagnetic maps for the region (Consortium Members, 1966-67). The steep gradients of the anomalies imply shallow magnetic sources, and the paired, high-low character of at least one of the anomalies is typical of magnetic fields caused by induction in small intrusions.

Tertiary rock units in the survey area comprise a small irregular plug of andesite north of Wadi Bayd (Tan), granophyric rock (Tgg), and a gabbro-diabase sheeted dike complex (Tgb). The granophyre and sheeted dike complex are part of the Tihamat Asir complex, and represent ocean-crust material intruded into the Precambrian crust of the Arabian Shield early in the development of the Red Sea rift (Coleman and others, 1979).

Quaternary surficial deposits in the survey area (Qs) largely consist of accumulations of inactive gravel, sand, and silt capped by veneers of lag gravel. Such deposits are present as old terrace deposits between Wadi Samra and Wadi Marbat, and as extensive sheets of alluvium northwest of Wadi Bayd. Wadi Samra and its tributaries appear to incise the old terrace material, probably as a result of capture by Wadi Samra of a wadi that formerly trended to the northwest and deposited the terrace formation that is conspicuously shown on Landsat images of the region. Reworked alluvium composed of sand and silt occurs adjacent to parts of Wadi Marbat and Wadi Juwan; and gravel, sand, and silt fill the modern wadi channels.

DATA ACQUISITION AND PRESENTATION

FIELD AND LABORATORY PROCEDURES

Because of the preliminary reconnaissance character of the gold exploration program reported here, an orientation survey was not deemed necessary to precede the wadi-sediment sampling program. Instead, the specifications of the Ad Darb geochemical program were based on practices adopted by earlier workers in the region, on experience gained by R.M. Samater elsewhere in the Arabian Shield, and on the general approach of the USGS Saudi Arabian Mission to geochemical sampling. Particular background information that contributed to the design of the survey was provided by Parker (1982), Samater (1982), Samater and others (1989), Sanderson (1984), Gaukroger and Sale (1985), Overstreet and Day (1985), and Saleh (1985). The absence of active dune-fields in the survey region, although close to the coastal plain, meant that no special precautions were required to screen out very fine grained, wind-borne material (Barbier, 1987).

A total of 244 wadi-sediment samples were collected over an area of approximately 930 km^2 from sites preselected on aerial photographs, at a sample density of just under one sample per 4 km^2. About 5 kg of unconsolidated wadi alluvium was collected from the bottom of a shallow excavation approximately 20 cm deep at each sample site. The samples were sieved on site to -10 mesh (2mm) to remove the coarse material, and split mechanically at the field camp to provide two fractions for further preparation. One fraction was sieved to obtain a minus-80-mesh sample (-180 micron); the second fraction was hand-panned to obtain a heavy-mineral concentrate. The panned concentrates were dried, and the magnetic material (chiefly magnetite) removed with a hand magnet. The minus-80-mesh and panned-concentrate samples were analyzed by Skyline Labs, Inc., Denver, Colorado for gold (AA graphite furnace), and for silver, arsenic, tellurium, copper, lead, zinc, tin, tungsten, antimony, and bismuth (atomic-absorption spectroscopy). Both the panned-concentrate and minus-80-mesh fractions were analyzed in order to obtain the maximum amount of geochemical information for the area. Investigations elsewhere in the Arabian Shield (Gaukroger and Sale, 1985) indicated that ultrafine gold, which might be washed off in suspension and lost during panning, is likely to be detected in the very fine fraction. Conversely, panning yields greater contrast between background and anomaly because of enhanced element concentrations in heavy minerals, and outlines longer dispersion trains than bulk or sieved samples (Samater, 1982; Samater and others, 1989).

Data Interpretation

The analytical data were statistically treated using routines developed for the U.S. Geological Survey (Sower and others, 1971). The geometric mean and standard deviation were calculated for the sample population by element (table 1) using Cohen's method (Miesch, 1967), which provides an estimate of the geometric mean for censored or qualified distributions (in this case for sample sets in which values -- particularly for gold and tin -- are below the lower limit of detection). Following USGS practice, frequency-versus-element-concentration histograms, based on a logarithmic scale, were plotted (fig. 3). The thresholds between background and anomalous concentrations for each element (table 1) were selected by inspection of the frequency-versus-concentration histograms and are reported as the mid-point value of the histogram class that marks each threshold. In this report, "background" refers to element values at or below threshold; "anomalous" refers to element values above threshold. The locations of panned-concentrate samples containing anomalous concentrations of elements are shown in figure 4, and the locations of anomalous concentrations from minus-80-mesh samples are shown in figure 5. In these figures, which are to the same scale and of the same region as the geologic map, the letters and(or) thin solid lines identify the areas having particular concentrations of anomalous samples referred to in the text, and the numbers and thick dashed lines serve to indicate areas that contain the majority of anomalous samples. The Appendix contains a map of the sample locations (fig. A-1), and tables of analytical results for panned-concentrate samples (table A-1) and for minus-80-mesh samples (table A-2).

DISCUSSION OF RESULTS

Geochemical Anomalies

Anomalies from Panned-Concentrate Samples

Gold:--The contents of gold in wadi-sediment samples from the Ad Darb area are comparable to those in the range of normal crustal abundances (100 ppb in ultramafic rocks; 35 ppb in mafic rocks; 10 ppb in felsic rocks: Hawkes and Webb, 1962) and overall do not highlight concentrations of major exploration significance. Sites of samples containing anomalous concentrations of gold occur throughout the survey area (fig. 4a), but they are more numerous in the northeastern half of the area, particularly in the upper reaches of Wadi Bayd (area A).

The anomalous gold samples in area A range in value between 25 and 130 ppb Au. The cluster is underlain by undifferentiated rocks of the Sabya formation, and the source of the anomalous gold is unknown. Elsewhere, high values of gold occur at isolated sites in a tributary to Wadi Bayd (25-40 ppb; area D); in a small tributary

Table 1.--Geometric means and threshold values for elements obtained from 244 wadi-sediment geochemical samples in the Ad Darb area.

[N= Number of samples with concentrations greater than the lower detection limit. Geometric mean calculated by methods of Sower and others (1971), assigning values to samples below the detection limits according to Cohen's method for estimating means of censored distributions (Miesch, 1967)].

Element	N	Lower limit of detection (in ppm)	Geometric mean (in ppm)	Selected histogram threshold values (mid-point of class interval) (in ppm)
Panned-concentrate samples				
Gold	130	0.002	0.002	0.02
Silver	3	0.2	-	-
Arsenic	217	5.0	19.9	50
Copper	244	5.0	66.3	100
Lead	58	5.0	0.7	10
Zinc	244	5.0	69.5	150
Tellurium	4	1.0	-	-
Antimony	74	2.0	2.5	2
Tin	65	2.0	0.96	3
Tungsten	178	2.0	2.5	4
Bismuth	8	1.0	-	1
Minus-80-mesh samples				
Gold	72	0.002	0.003	0.002
Silver	7	0.2	-	-
Arsenic	187	5.0	7.3	20
Copper	242	5.0	36.0	50
Lead	24	5.0	0.7	5
Zinc	244	5.0	69.5	100
Tellurium	nd	1.0	-	-
Antimony	11	2.0	1.0	1
Tin	73	2.0	1.0	2
Tungsten	165	2.0	2.4	-
Bismuth	nd	1.0	-	-

Notes: - = not determined due to insufficient number of samples above detection limit
nd = not detected

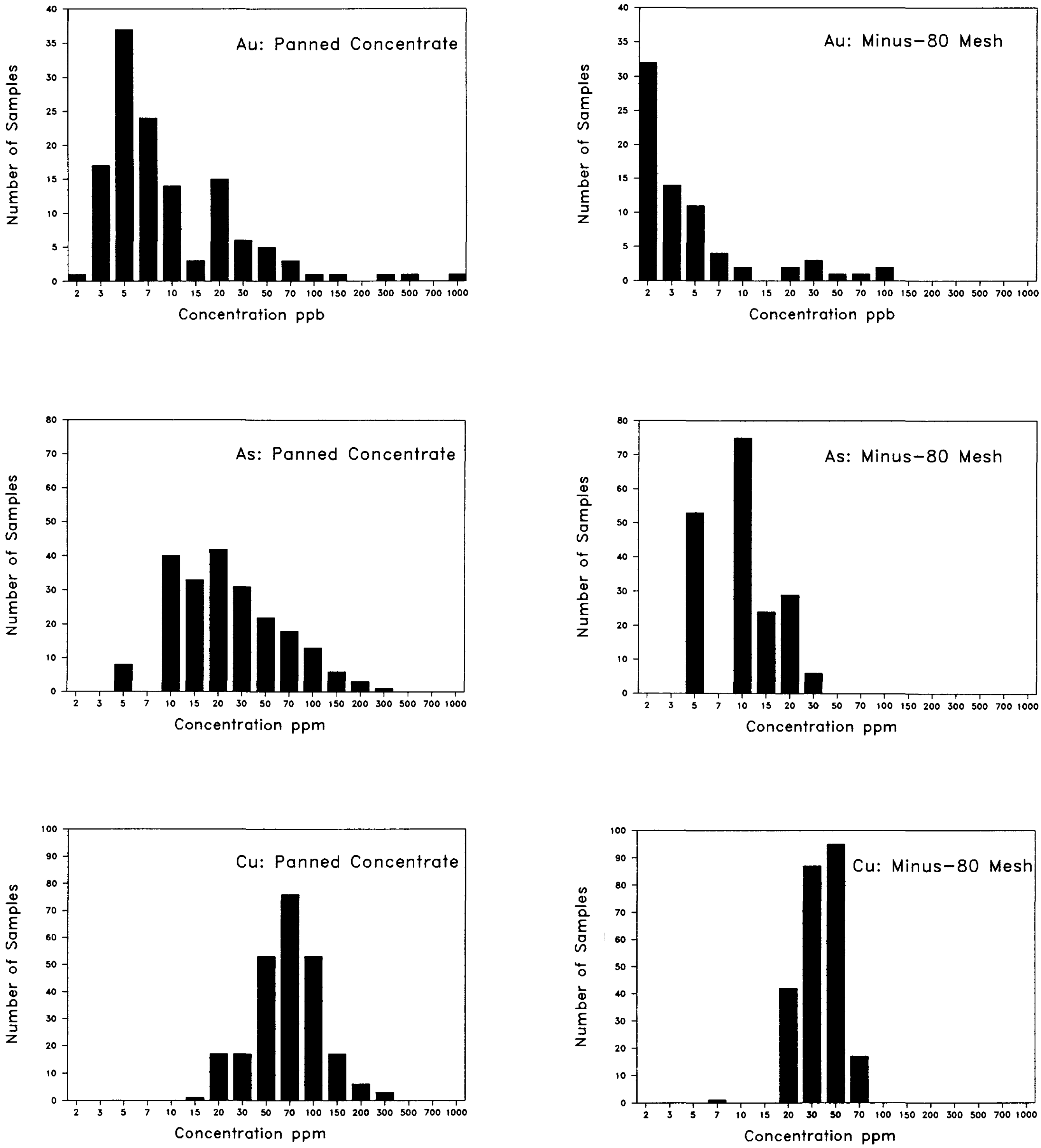

Figure 3.--Frequency-versus-element-concentration histograms for wadi-sediment samples in the Ad Darb area.

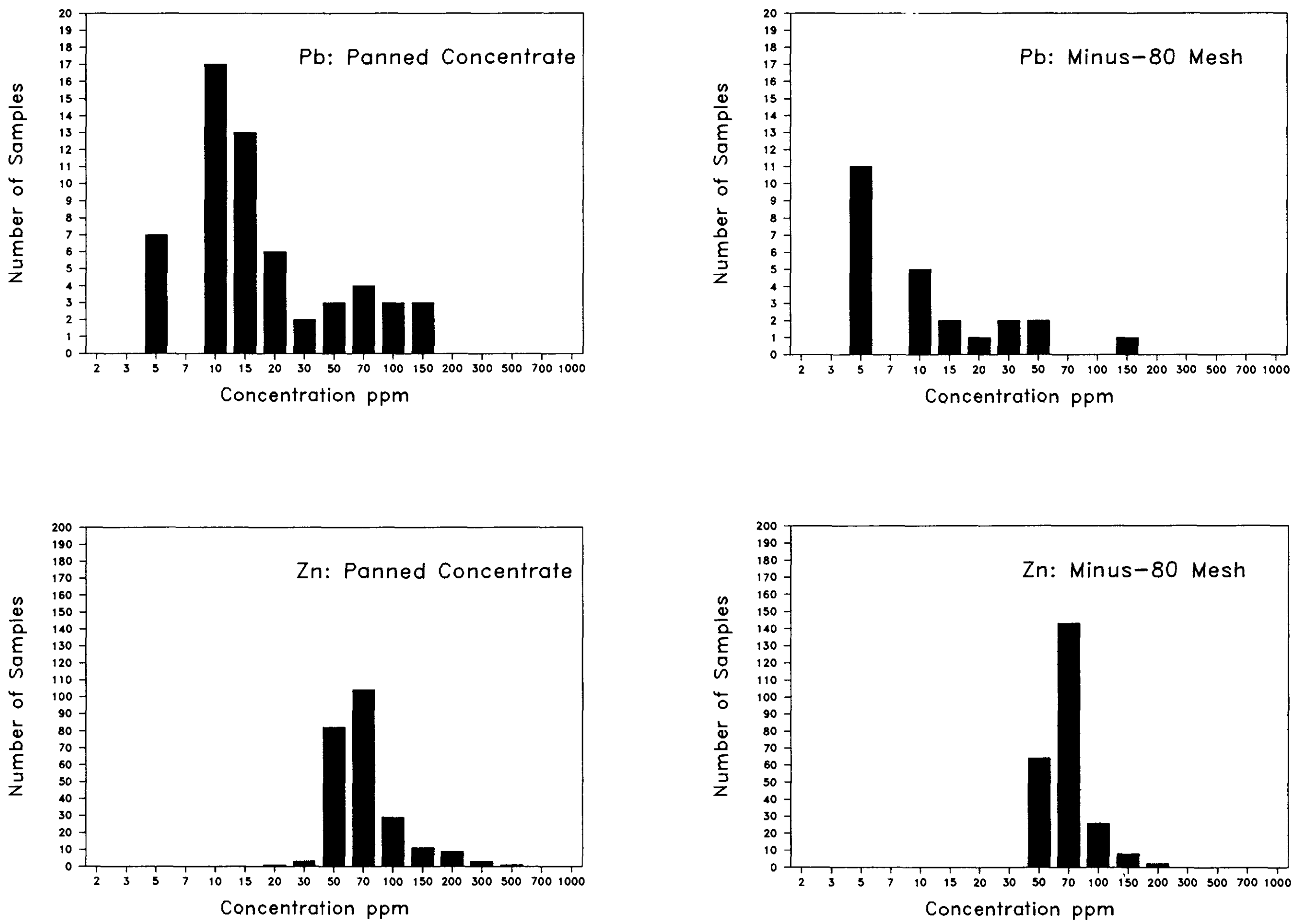

Figure 3.--Frequency-versus-element-concentration histograms for wadi-sediment samples--(continued).

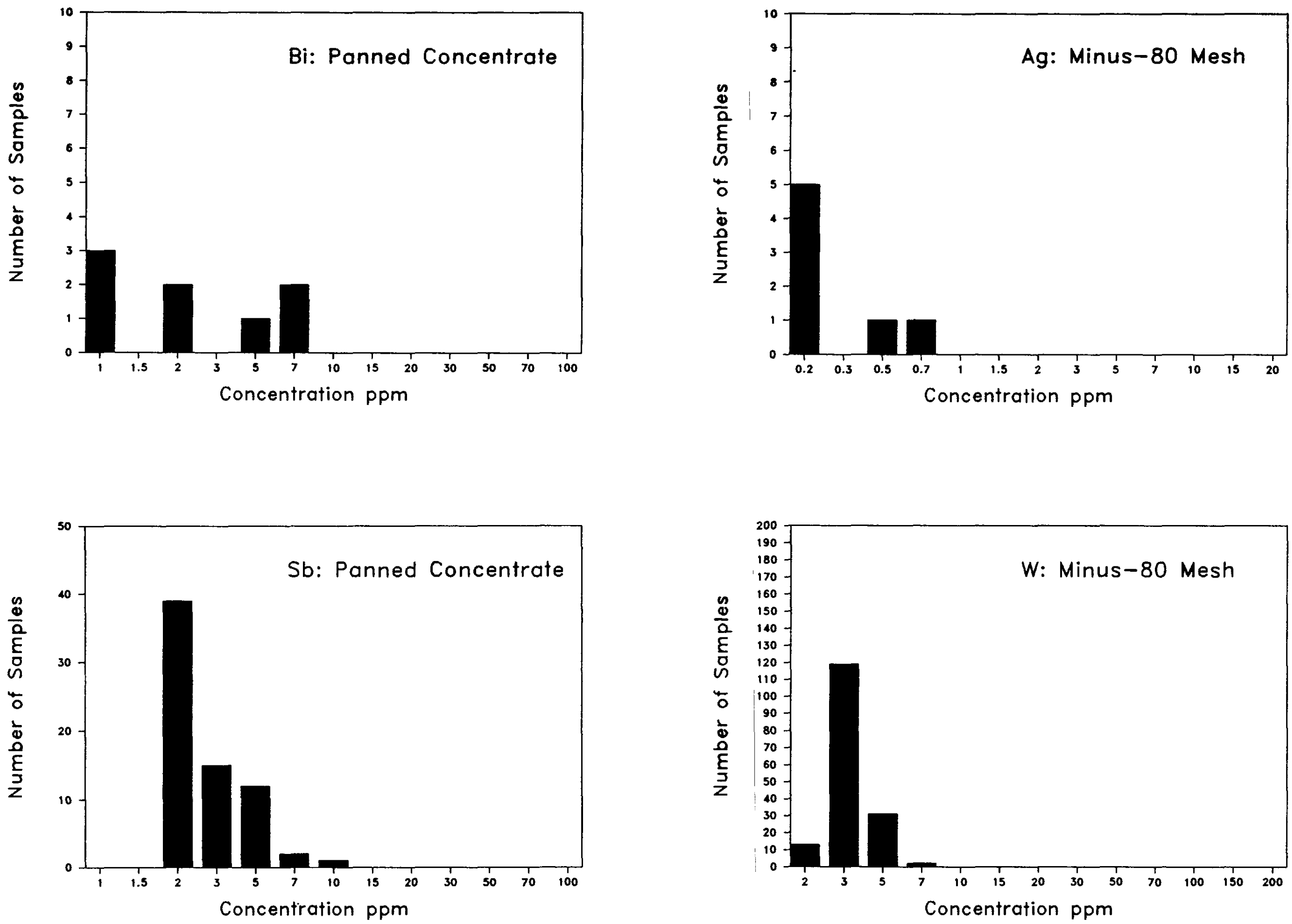

Figure 3.--Frequency-versus-element-concentration histograms for wadi-sediment samples--(continued).

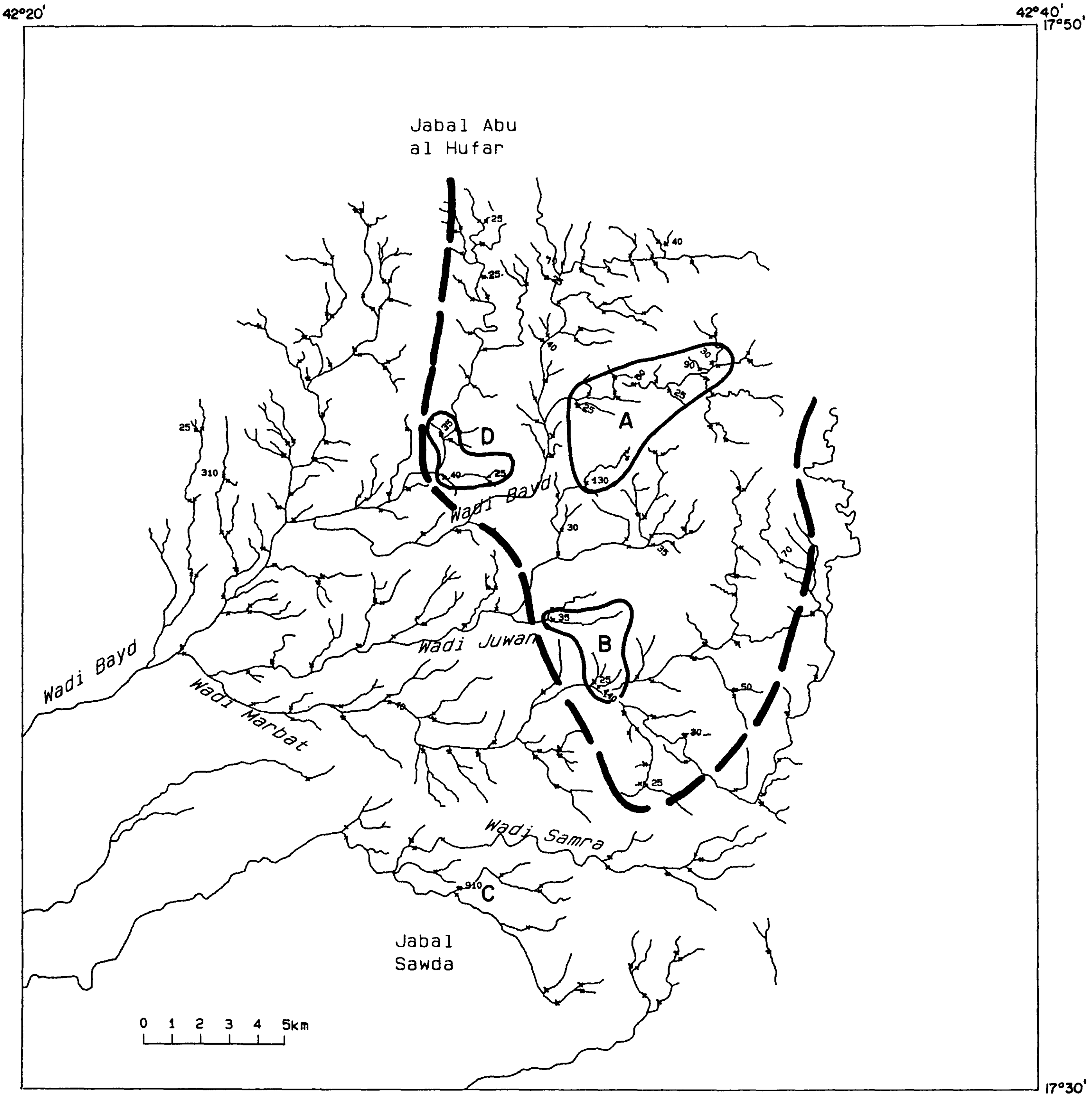

Figure 4a.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - gold (in ppb).

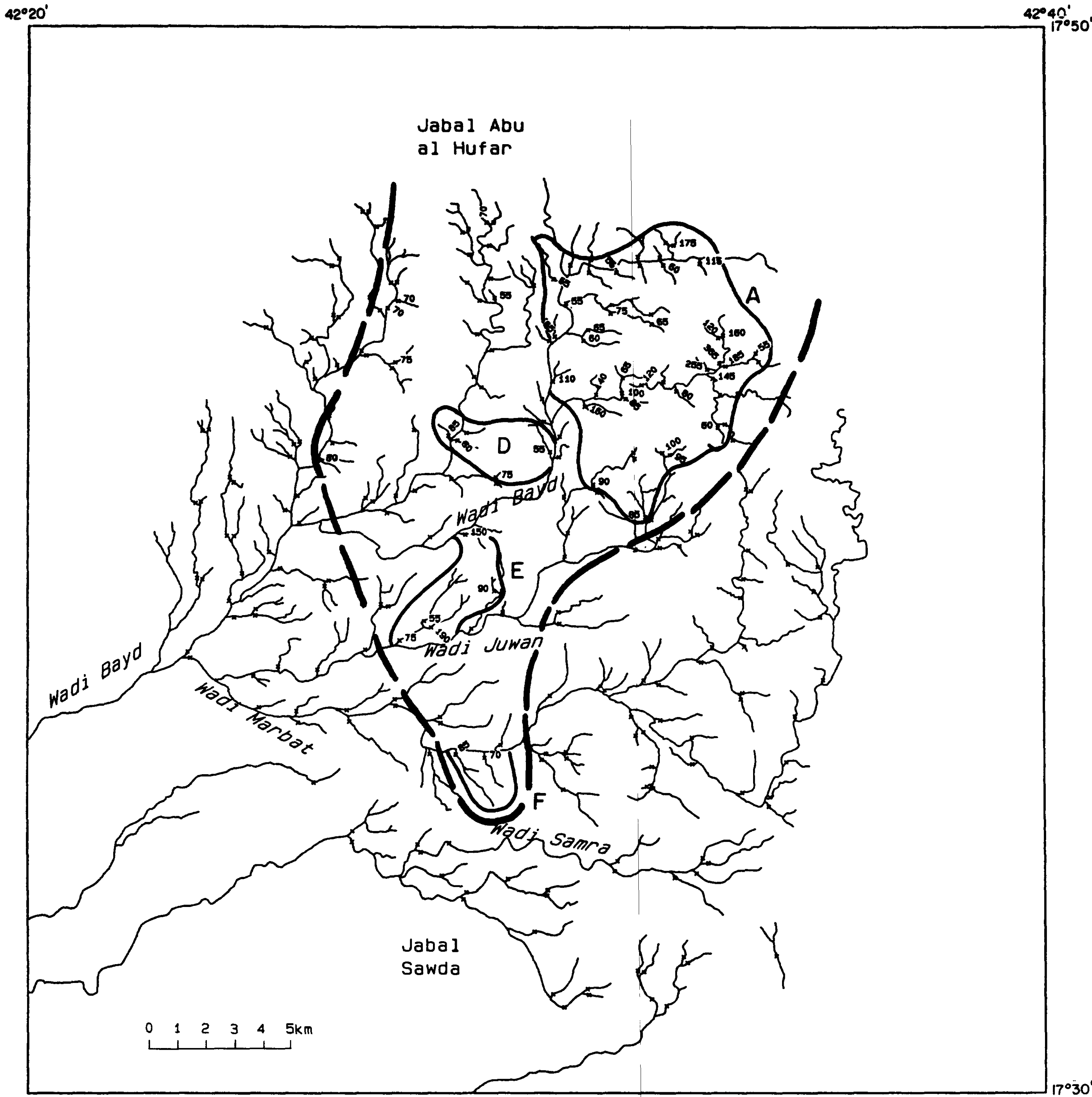

Figure 4b.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - arsenic (in ppm).

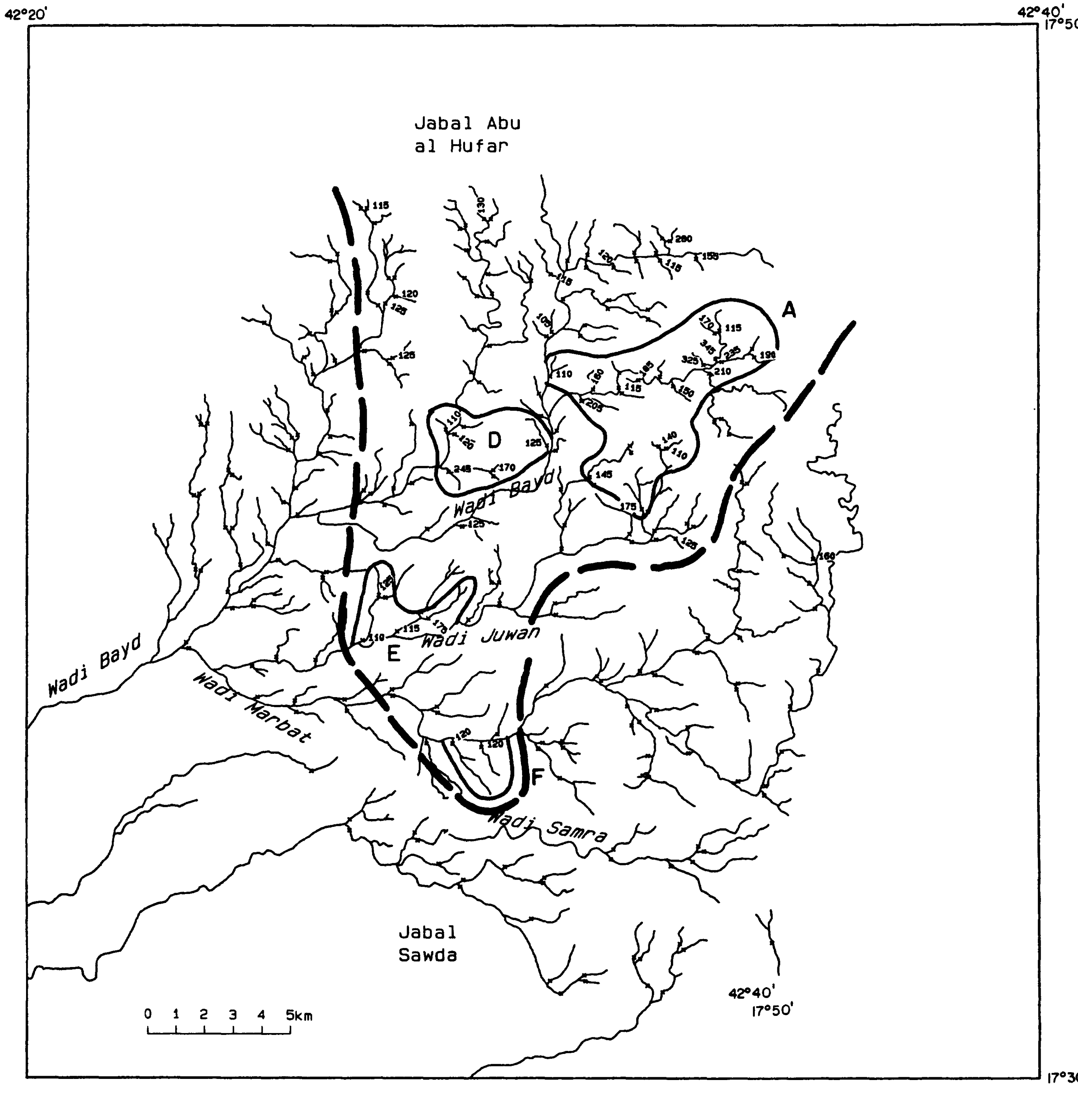

Figure 4c.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - copper (in ppm).

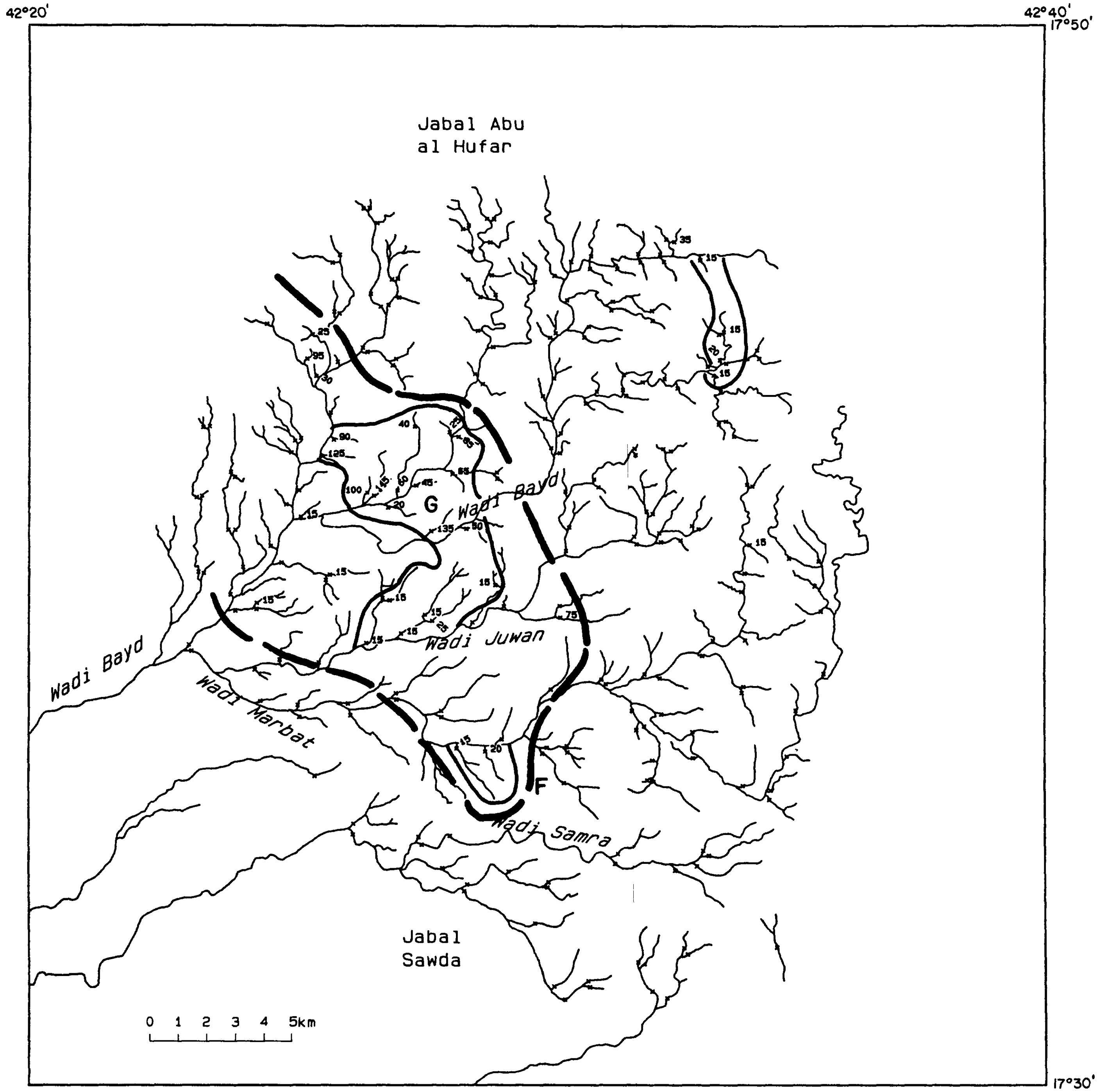

Figure 4d.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - lead (in ppm).

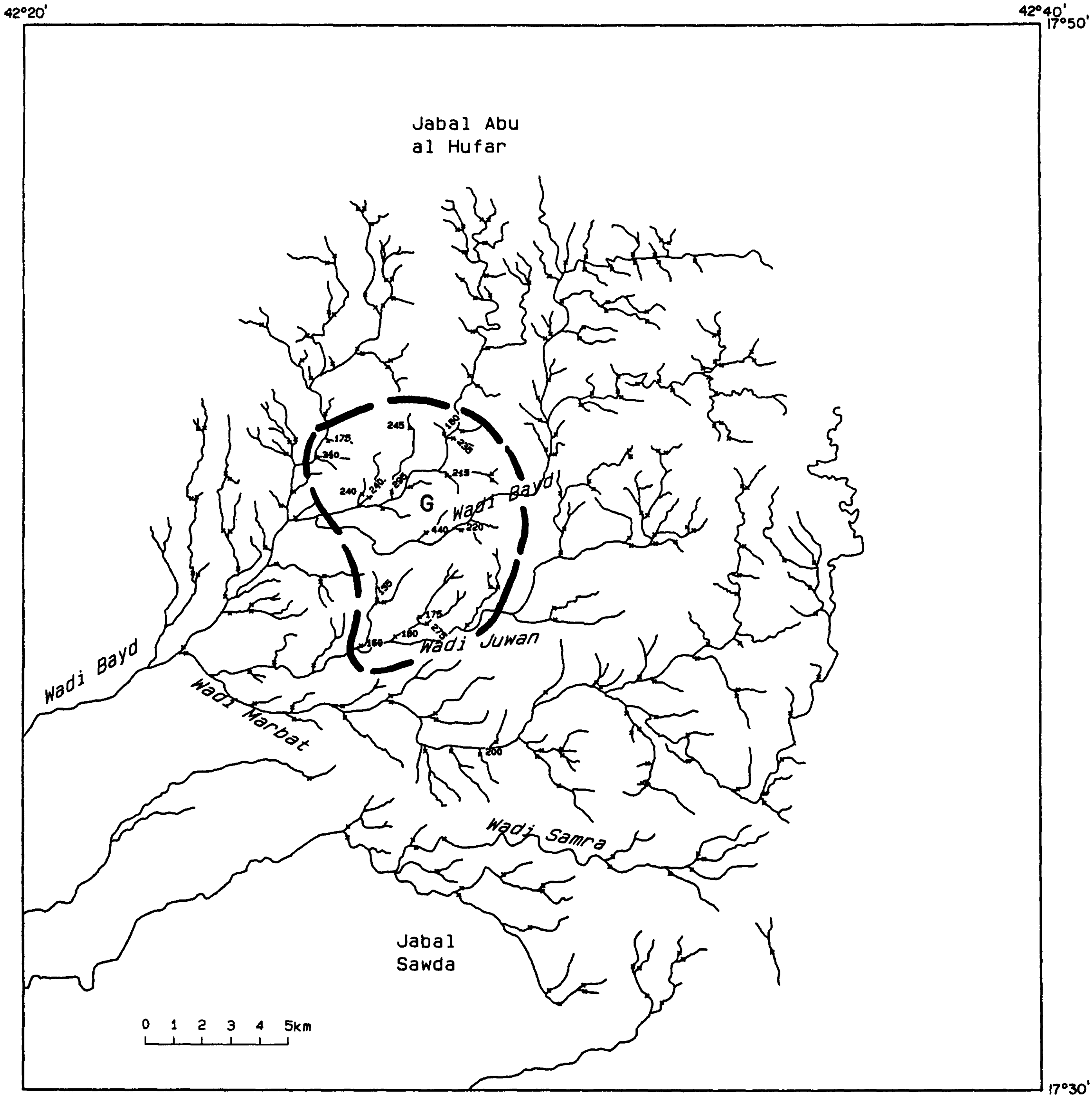

Figure 4e.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - zinc (in ppm).

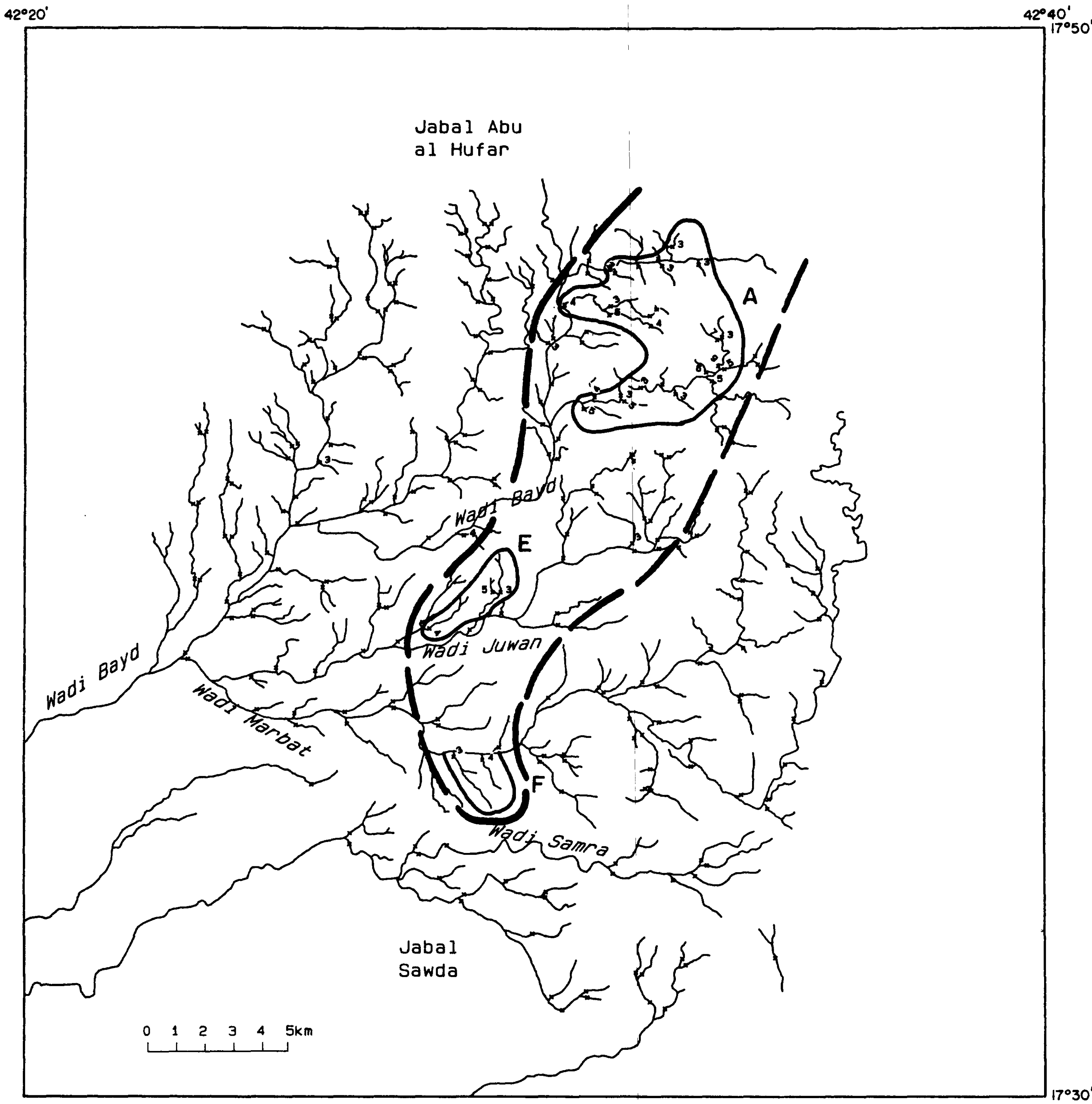

Figure 4f.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - antimony (in ppm).

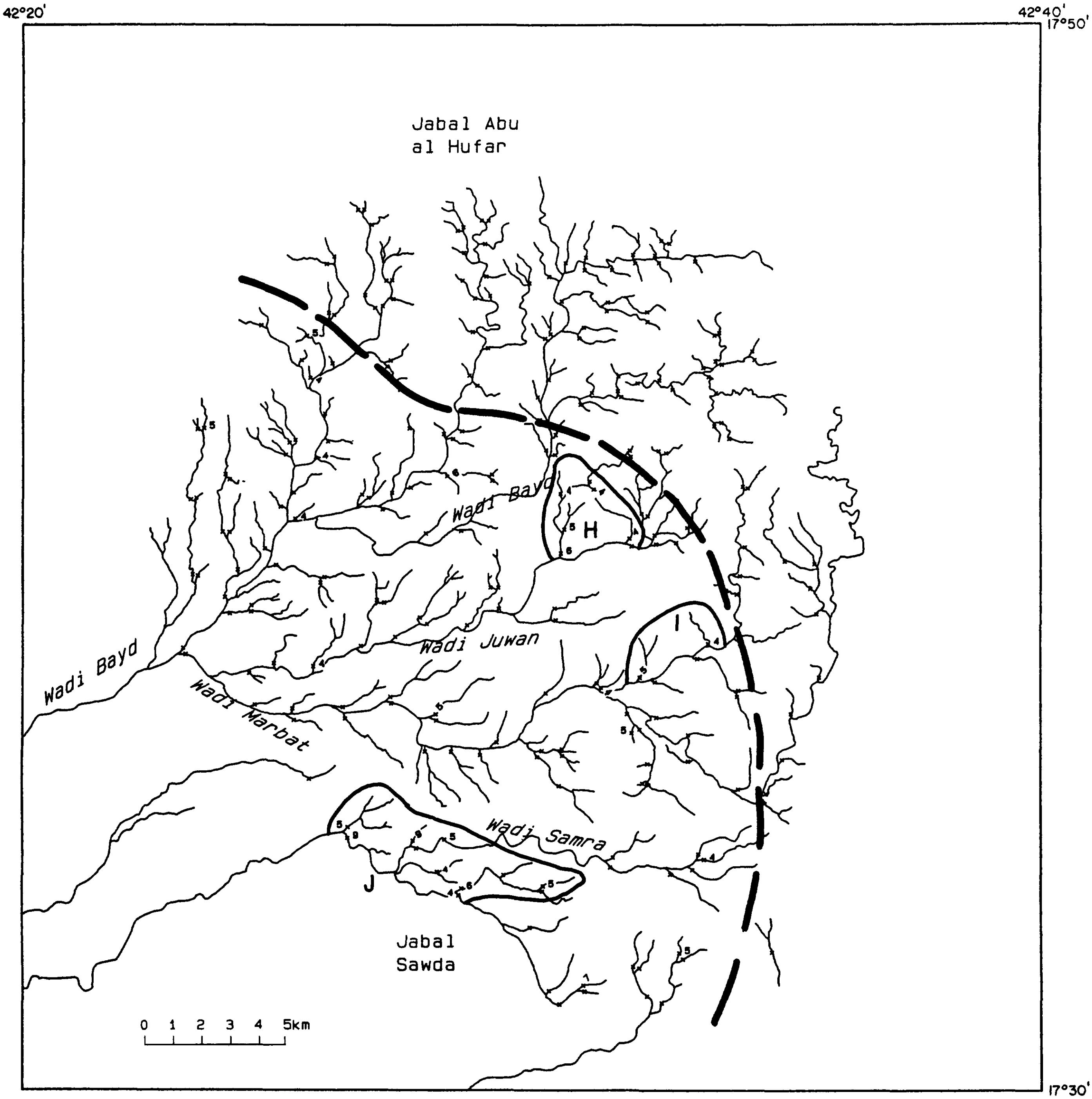

Figure 4g.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - tin (in ppm).

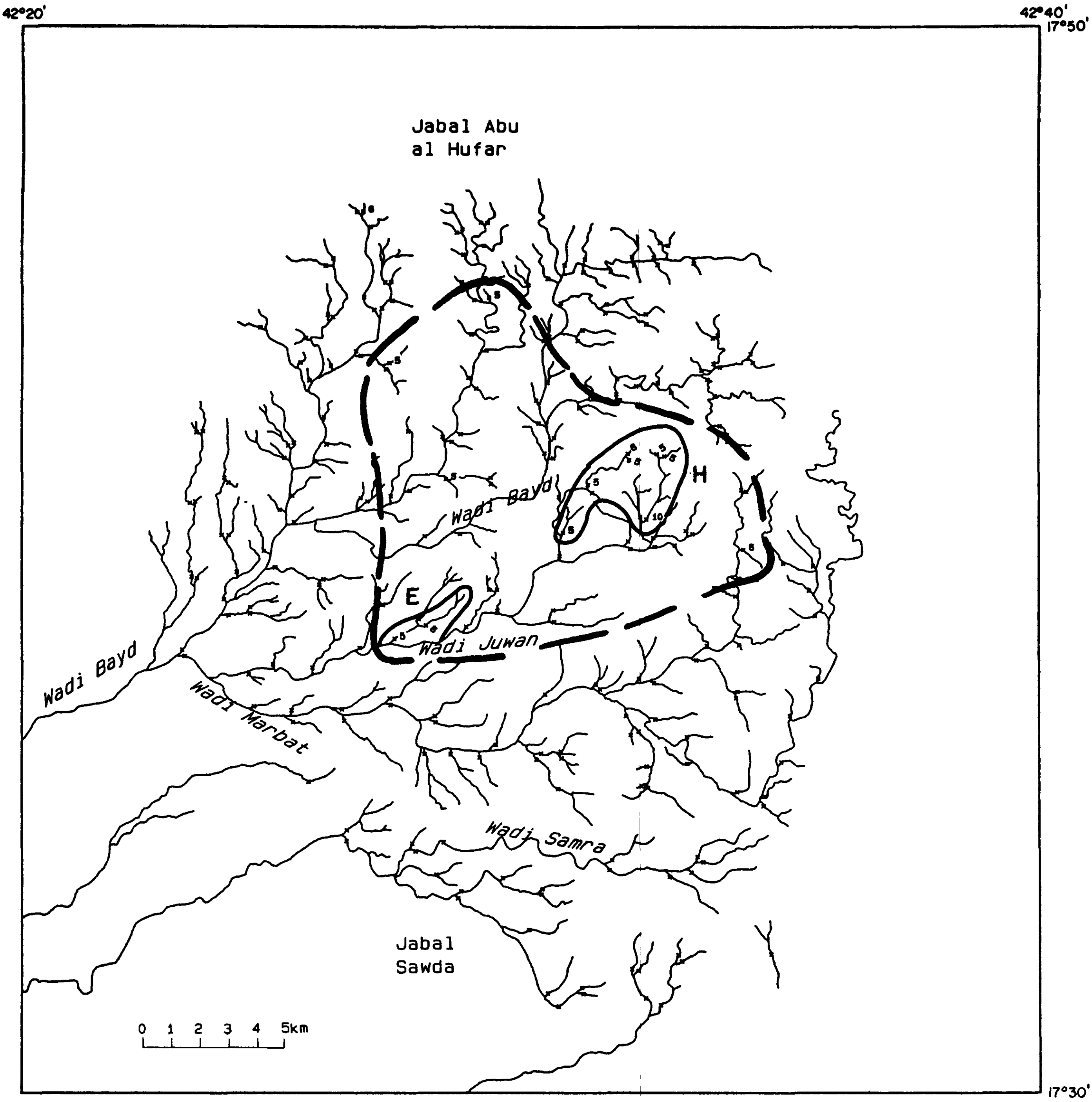

Figure 4h.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - tungsten (in ppm).

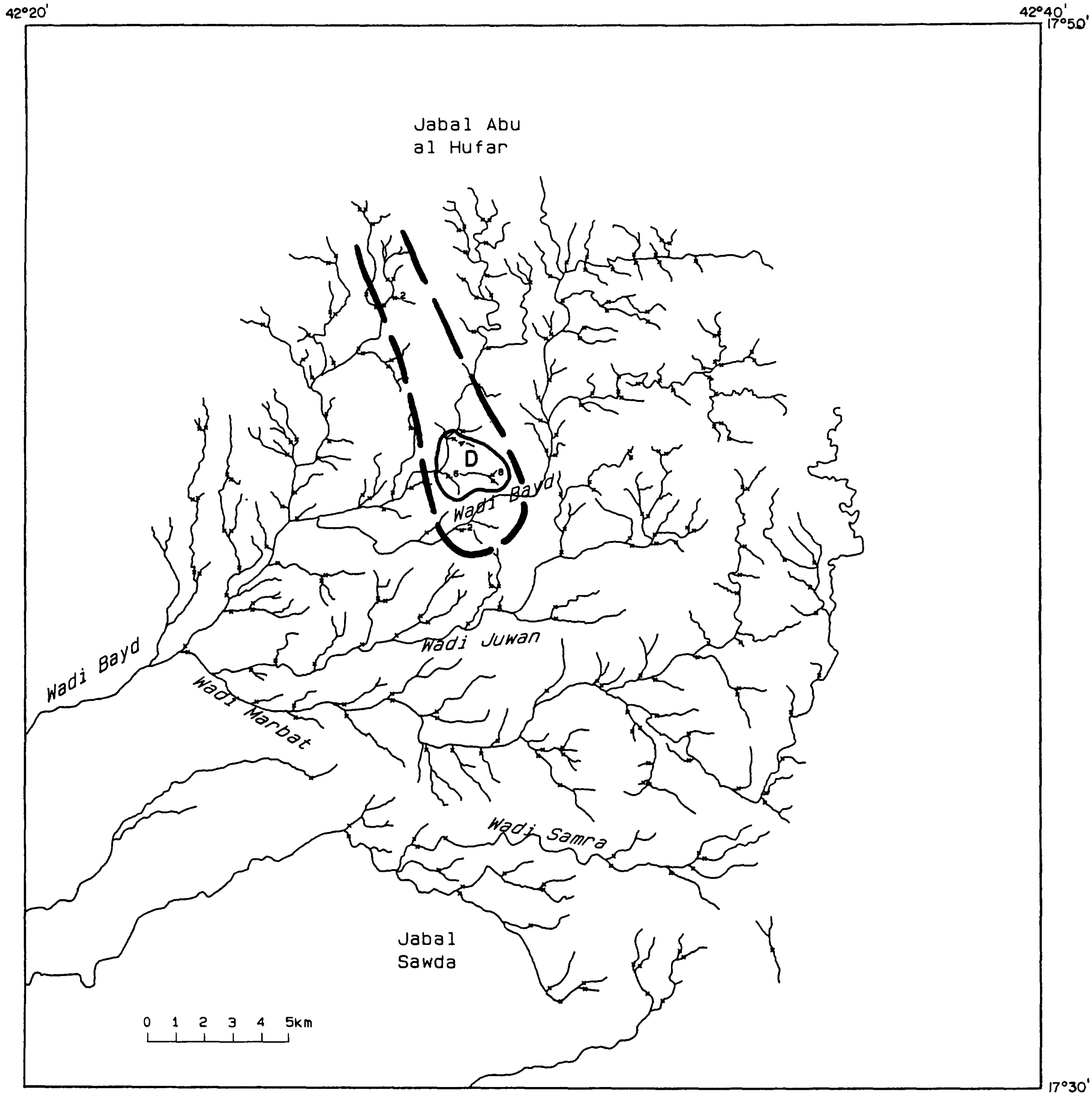

Figure 4i.--Ad Darb geochemical survey: anomalous concentrations of selected elements in panned-concentrate samples - bismuth (in ppm).

to Wadi Marbat (440 ppb Au; locality B) approximately 1 km along strike to the north from the kyanite target area; farther south, in a tributary to Wadi Samra (910 ppb; locality C) at the contact between the Sabya formation and the Tertiary diabase-gabbro dike swarm; and in the west, in a tributary to Wadi Bayd that drains Quaternary alluvium (310 ppb Au). No anomalous gold values occur in the immediate vicinity of the kyanite target.

Arsenic:--Anomalous concentrations of arsenic occur in the central and northeastern parts of the survey area (fig. 4b) with particular clusters at localities A, D, E, and F. No anomalous samples occur in the vicinity of the kyanite target. The arsenic anomaly A correlates in part with the gold anomaly A but is more extensive in area. Areas E and F are underlain by Sabya formation unit sa2, whereas area D spans the boundary between units sa3 and sa.

Copper:--The largest cluster of copper anomalies (fig. 4c; area A) occurs in tributaries to Wadi Bayd and Wadi Juwan in the northeastern part of the survey area. Smaller clusters occur to the southwest (areas D, E, and F). As the figures show, the distribution of copper is closely comparable to that of arsenic (correlation coefficient = 0.826 at 10% risk level) and to that of antimony (correlation coefficient = 0.642).

Lead:--Anomalous concentrations of lead are conspicuous in the western and southern parts of the survey area (fig. 4d; areas G and F), forming a distinctive distribution pattern that is mirrored by the distribution of zinc. Locally, samples that contain anomalous lead also contain anomalous concentrations of arsenic, copper, antimony, and rarely gold. Lead anomaly G is underlain by Sabya formation units sa2 and sa3, and intrusive andesite (Tan). At this stage however, the source of the lead anomalies is unknown.

Zinc:--The distribution of anomalous concentrations of zinc correlates with that of lead (correlation coefficient = 0.777). The anomalies tightly cluster in the west-central part of the survey area (fig. 4e; area G), in an area underlain by units of the Sabya formation (sa2 and sa3) and minor amounts of Tertiary andesite (Tan). As in the case of the lead anomalies, the source of the high zinc values is unknown.

Antimony:--Anomalous concentrations of antimony occur in a zone trending southwest across the central part of the survey area (fig. 4f.). Anomaly A coincides with anomalous concentrations of gold, arsenic, and copper, and anomalies E and F coincide with anomalous concentrations of arsenic, copper, and lead.

Tin:--The distribution of anomalous concentrations of tin in panned-concentrate samples in the Ad Darb survey area is distinctive. Overall, the high tin values occur in the southwestern half of the study area, but particular clusters occur in Wadi Juwan (fig. 4g; area H), upper Wadi Marbat (area I), and Wadi Samra (area J). The Wadi Juwan anomaly coincides with anomalous values of gold, antimony, and tungsten, but anomalies I and J are uniquely marked by tin and minor gold. The western part of anomaly I lies along strike north of the kyanite target area; a sample site adjacent to the target contains 5 ppm Sn. In contrast, area J is underlain by units of the Sabya formation (sa2 and sa3) and gabbro-diabase dikes (Tgb).

Tungsten:--Tungsten anomalies are scattered in the central part of the survey area, particularly in tributaries to Wadi Juwan (fig. 4h: areas E and H). Arsenic, copper, lead, zinc, and antimony coincide with tungsten in area E whereas, in area H, the coincident elements are arsenic, copper, gold, and tin.

Bismuth:--Only 5 samples contain values of bismuth above the threshold and these cluster in the core of the study area (fig. 4i; area D). The area is underlain by the Sabya formation (sa3) and minor Tertiary intrusive rocks (Tan).

Other elements:--The Ad Darb wadi-sediment samples were also analyzed for tellurium, molybdenum, and silver. However, values of tellurium and silver above the lower detection limit were reported in only two panned-concentrate samples, and molybdenum in none. In minus-80-mesh samples, a value of silver above the lower detection limit was reported in only one sample. Because of the low concentrations of these elements, maps showing their distribution are not included in this report, and the elements are not further discussed.

Anomalies from Minus-80-Mesh Samples

Gold:--Anomalous concentrations of gold in minus-80-mesh samples occur at isolated sites in several parts of the survey area and are locally clustered in tributaries to Wadi Juwan and Wadi Bayd (fig. 5a). Overall, the anomalies group in the northeastern half of the survey area in a pattern approximately similar to that shown by the panned-concentrate gold distribution. Three anomalous samples containing 4, 5, and 12 ppb Au, respectively, occur in the vicinity of the target area (area B).

Arsenic:--In marked contrast to the broad distribution of panned-concentrate anomalous arsenic samples, the minus-80-mesh samples anomalous in arsenic are virtually confined to the northeastern part of the survey area (fig. 5b).

Copper:--Copper anomalies occur in several tight clusters in the northeastern half of the survey area (fig. 5c), forming a pattern closely comparable to the distribution of gold anomalies. In contrast to the pattern of copper anomalies outlined from panned-concentrate samples (fig. 4c), minus-80-mesh copper anomalies do not occur in the southern part of the survey area.

Lead:--Anomalous lead values in minus-80-mesh samples are clustered in the northwestern part of the survey area in a region focused on outcropping Tertiary intrusions (fig. 5d). The geographic spread of this cluster is noticeably more restricted than the spread of anomalous lead values in panned-concentrate samples.

Zinc:--Anomalous zinc values in minus-80-mesh samples are dispersed across the northern half of the survey area (fig. 5e). A small cluster of zinc anomalies occurs in tributaries to Wadi Bayd in the west-central part of the area. This partly coincides with the cluster of anomalies in panned-concentrate zinc samples, but, in comparison to figure 4e, the center of the distribution of the minus-80-mesh zinc anomalies is northeast of the center of the distribution of panned-concentrate zinc anomalies.

Antimony:--Four minus-80-mesh samples are anomalous in antimony, three from a tight cluster in upper Wadi Bayd (fig. 5f) where they coincide with gold, copper, and arsenic anomalies. There is no evidence of anomalous samples to the southwest, as for the panned-concentrate samples.

Tin:--The minus-80-mesh samples yield a wide scatter of anomalous tin locations (fig. 5g), which correlate only weakly with the locations of anomalous tin in panned-concentrate samples. Locally, samples anomalous in tin are also anomalous in gold and copper; but in general, anomalous concentrations of tin occur by themselves, unaccompanied by anomalous concentrations of other elements.

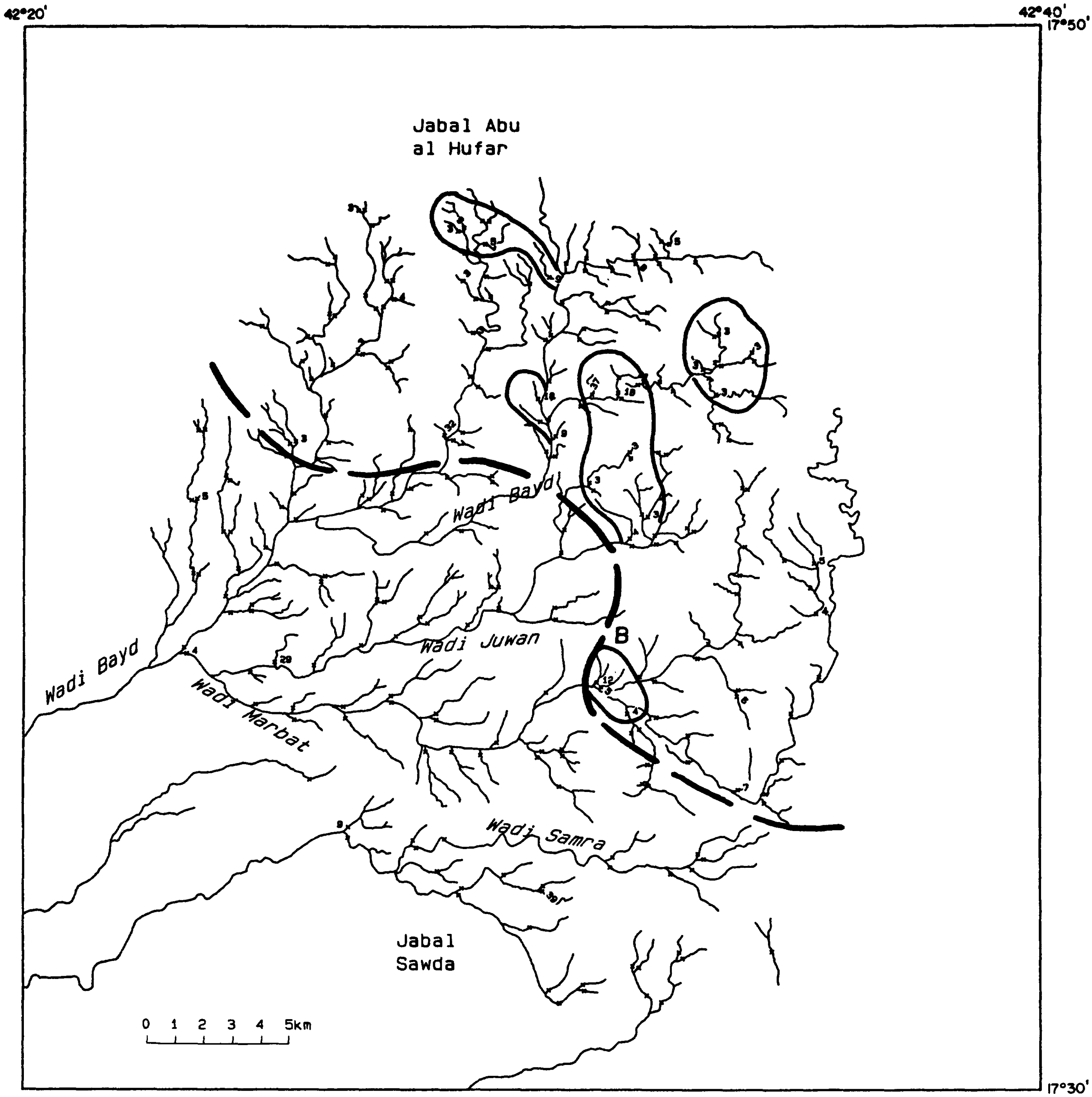

Figure 5a.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - gold (in ppb).

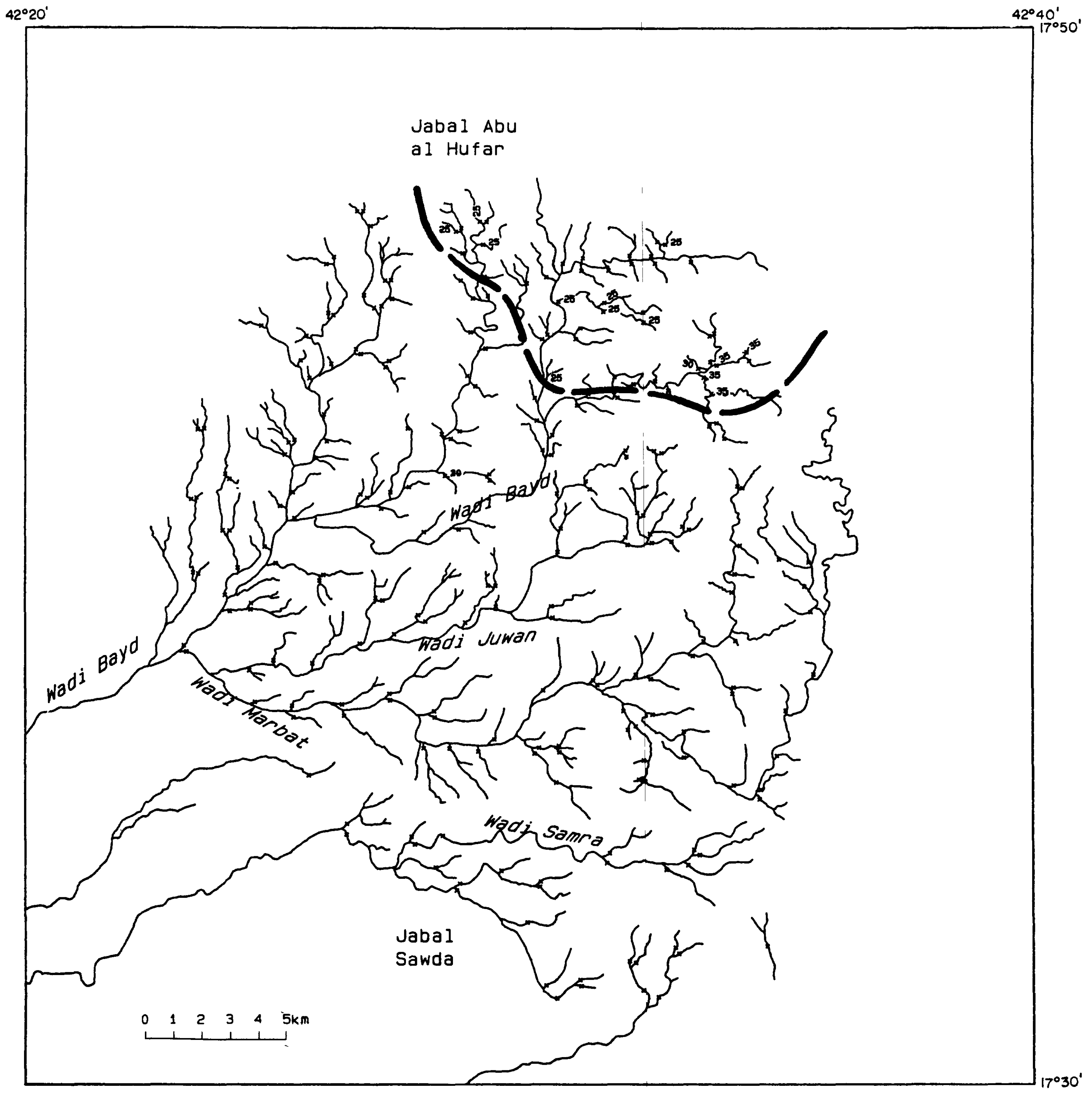

Figure 5b.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - arsenic (in ppm).

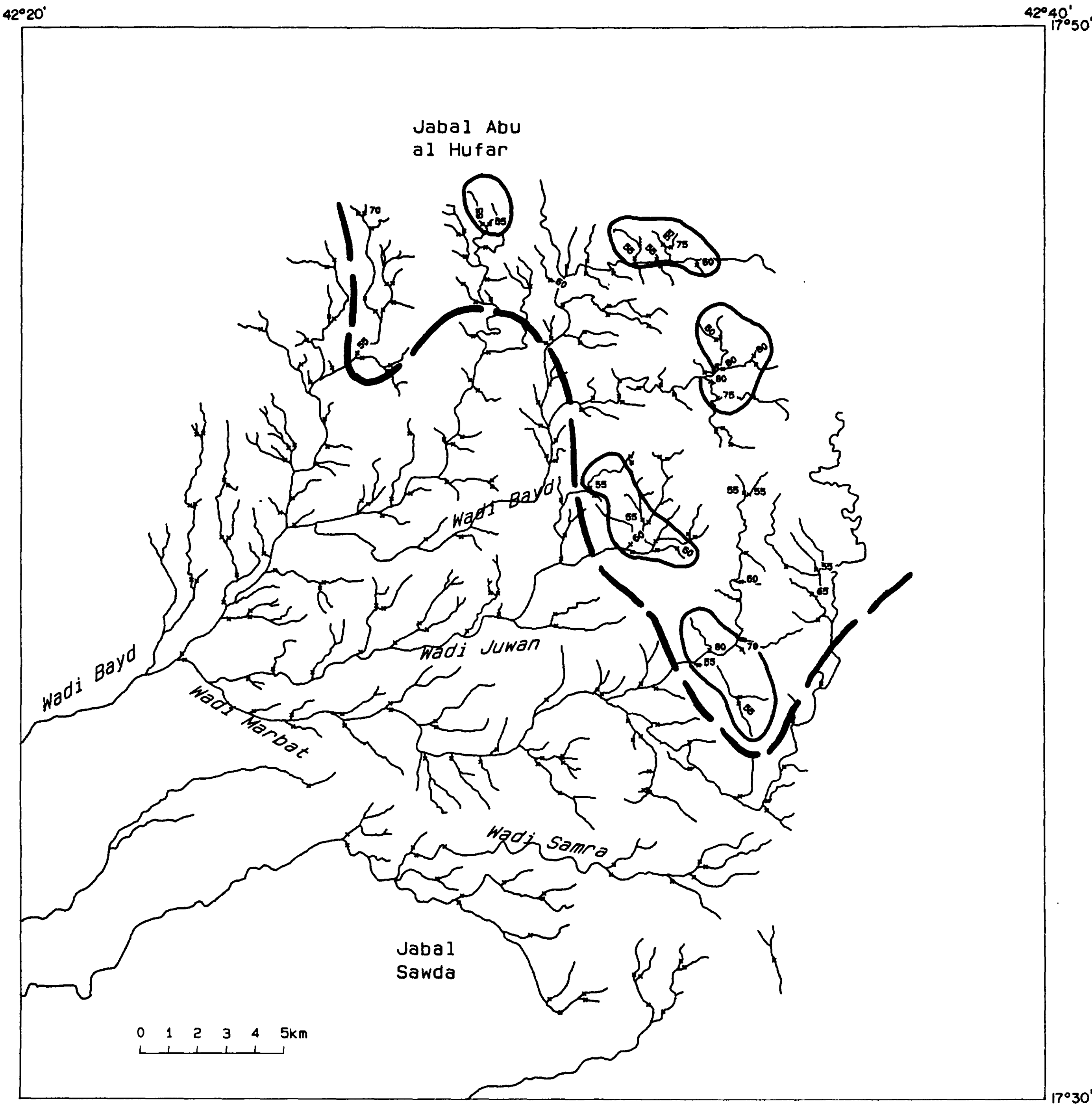

Figure 5c.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - copper (in ppm).

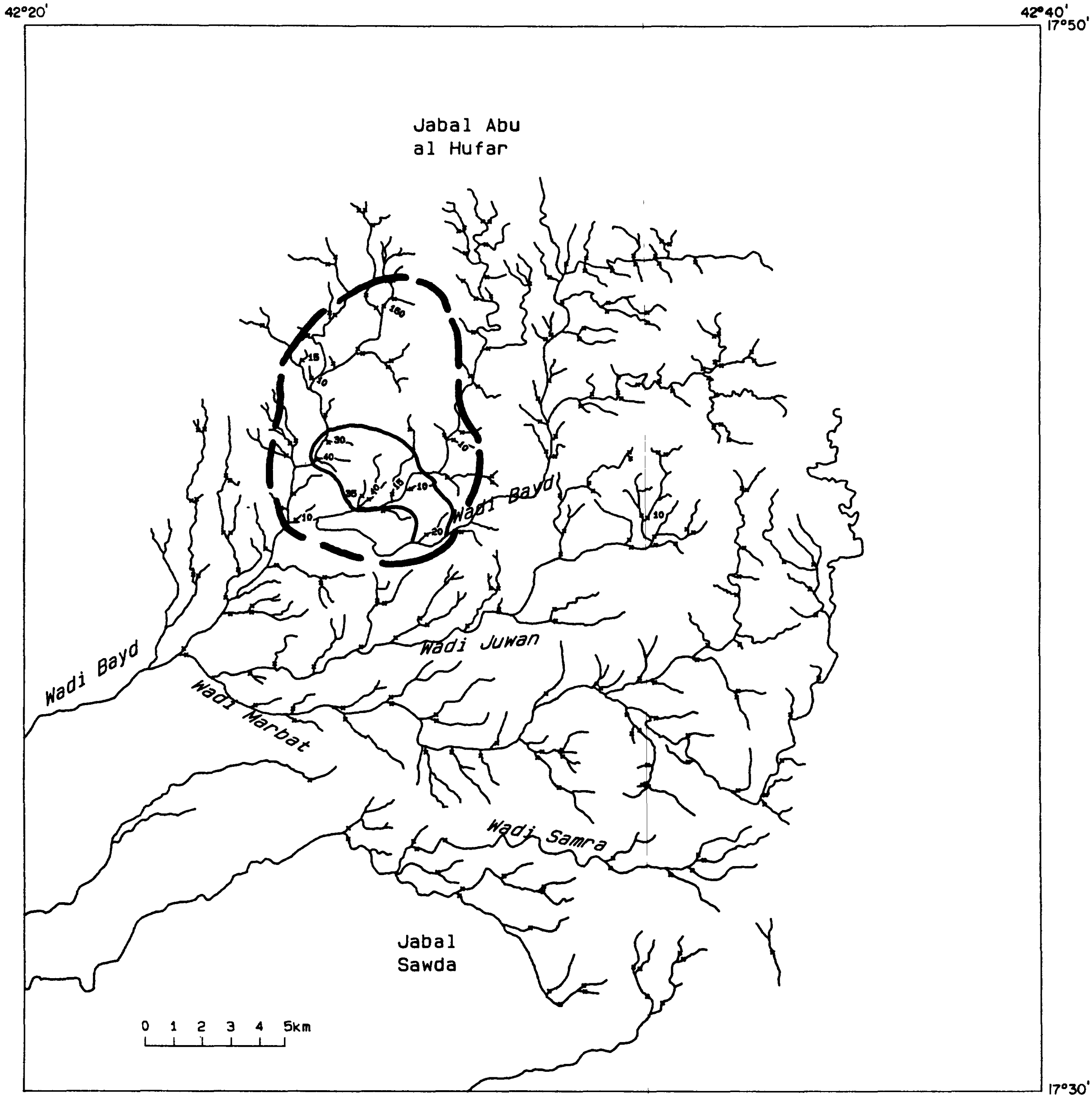

Figure 5d.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - lead (in ppm).

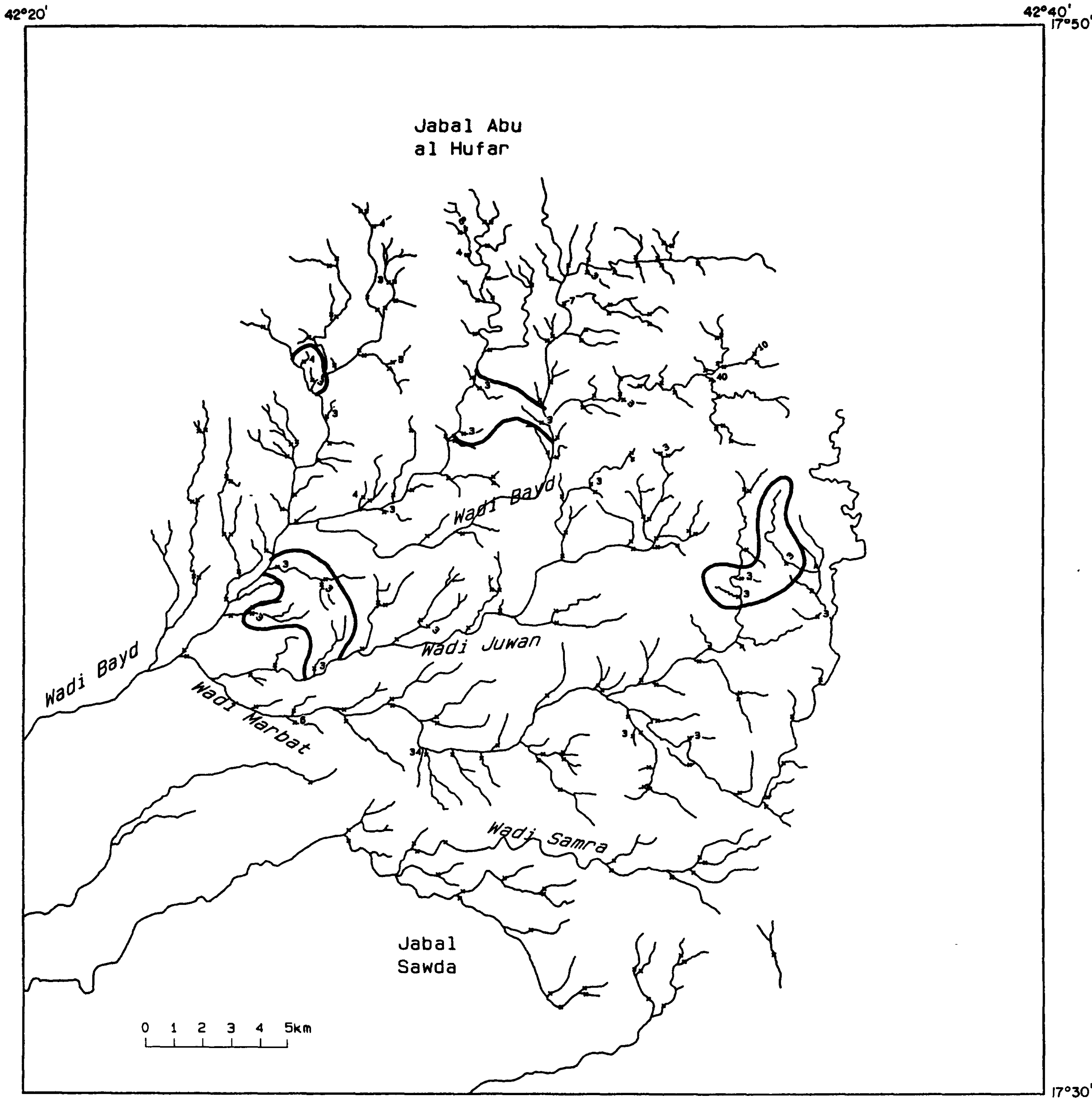

Figure 5g.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - tin (in ppm).

Summary of Results

The kyanite target area in Wadi Marbat is marked by a cluster of three minus-80-mesh samples anomalous in gold and one sample anomalous in tin (fig. 7; area 1). An adjacent area along strike to the north is marked by a slightly larger cluster of panned-concentrate samples anomalous in gold and tin (fig. 6; area 1).

The largest concentration of anomalous panned-concentrate gold values is in the northeast quadrant of the survey area, where gold is associated with arsenic, copper, antimony, tin, tungsten, and lead (fig. 6; area 2). Sieved, minus-80-mesh samples yield a cluster of gold, arsenic, copper, and minor tin and antimony anomalies in the northern part of this area (fig 7; area 2), and two clusters of gold, copper, and minor tin anomalies farther south (fig. 7; area 3).

Anomalous results for lead and zinc are principally concentrated in the west-central part of the survey area (figs. 6 and 7; area 4); and a small, distinctive cluster of copper, lead, arsenic, antimony, and minor zinc values, but no gold, is outlined by panned concentrate samples in the southern part of the area (fig 6; area 5).

Anomalous tin and rare anomalous gold values are noted for panned-concentrate samples from the southern part of the survey area (fig 6; area 6); whereas anomalous tin and minor gold, copper, and zinc values from minus-80-mesh samples cluster in three small areas farther north (fig. 7; area 7).

CONCLUSIONS AND RECOMMENDATIONS

The kyanite target area is marked by weak anomalous concentrations of gold and tin (figs. 6, 7; area 1). The anomalies are one having 440 ppb Au and three having less than 35 ppb Au; tin values are less than 5 ppm Sn. The samples were obtained from short first-order wadis and reflect metal concentrations in a small catchment area; dilution of the samples by extraneous material, such as would occur in a large drainage area, is at a minimum. The samples therefore reflect metal contents of the bedrock within a short distance of the sample sites, and the low metal values obtained are interpreted to indicate that there is no major bedrock concentration of gold in the target area.

Narrowly construed, the results of the reconnaissance geochemical survey do not identify the Wadi Marbat kyanite occurrence as a target for further exploration. On the other hand, the association of gold, tin, copper, arsenic, antimony, and tungsten demonstrated throughout the wider area by the results is comparable to the elemental association found in areas of known high-alumina alteration zones. As mentioned in the introduction, such alteration zones are the product of large diffuse hydrothermal systems, only parts of which (for reasons not fully understood) deposit

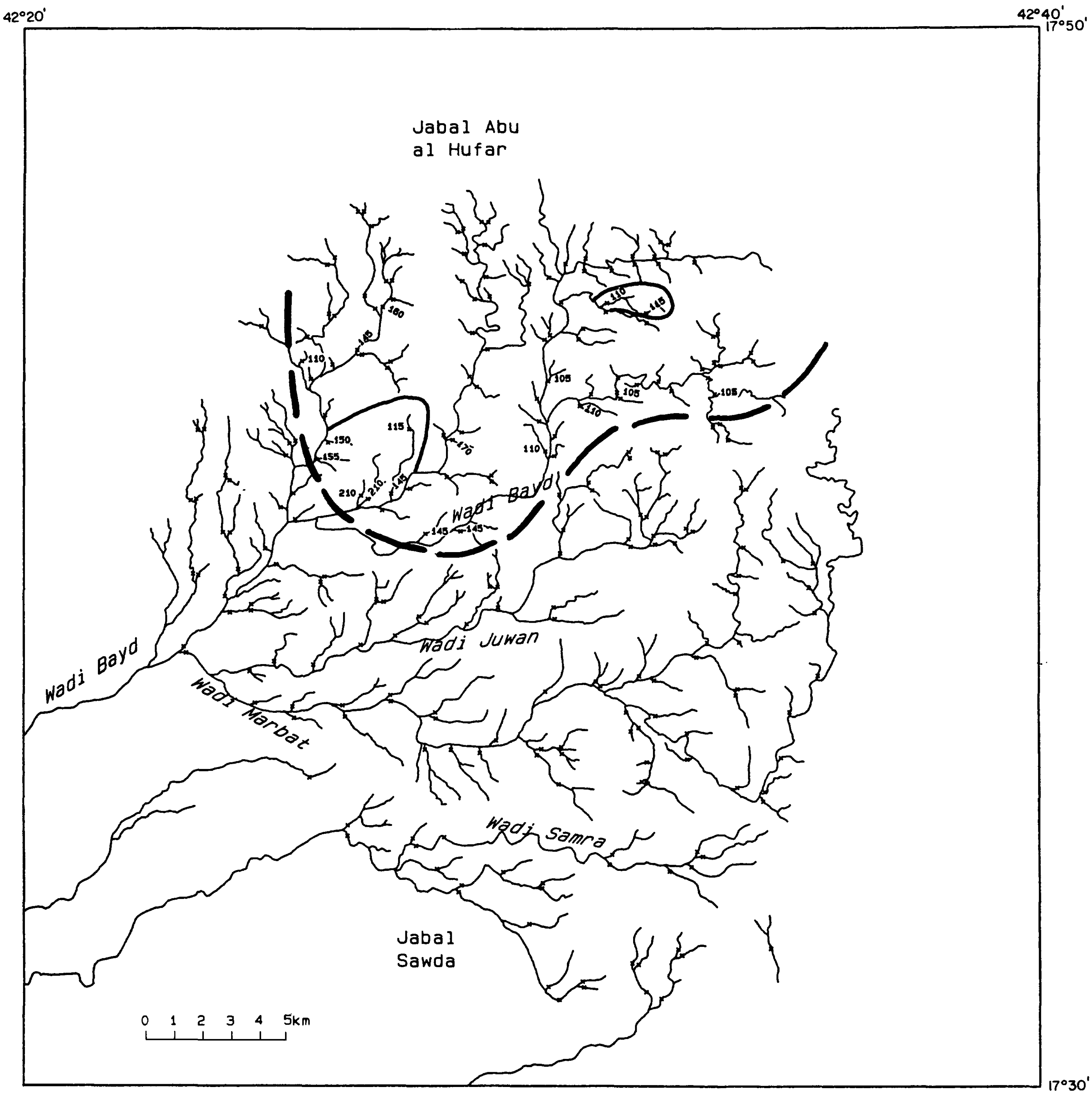

Figure 5e.—Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - zinc (in ppm).

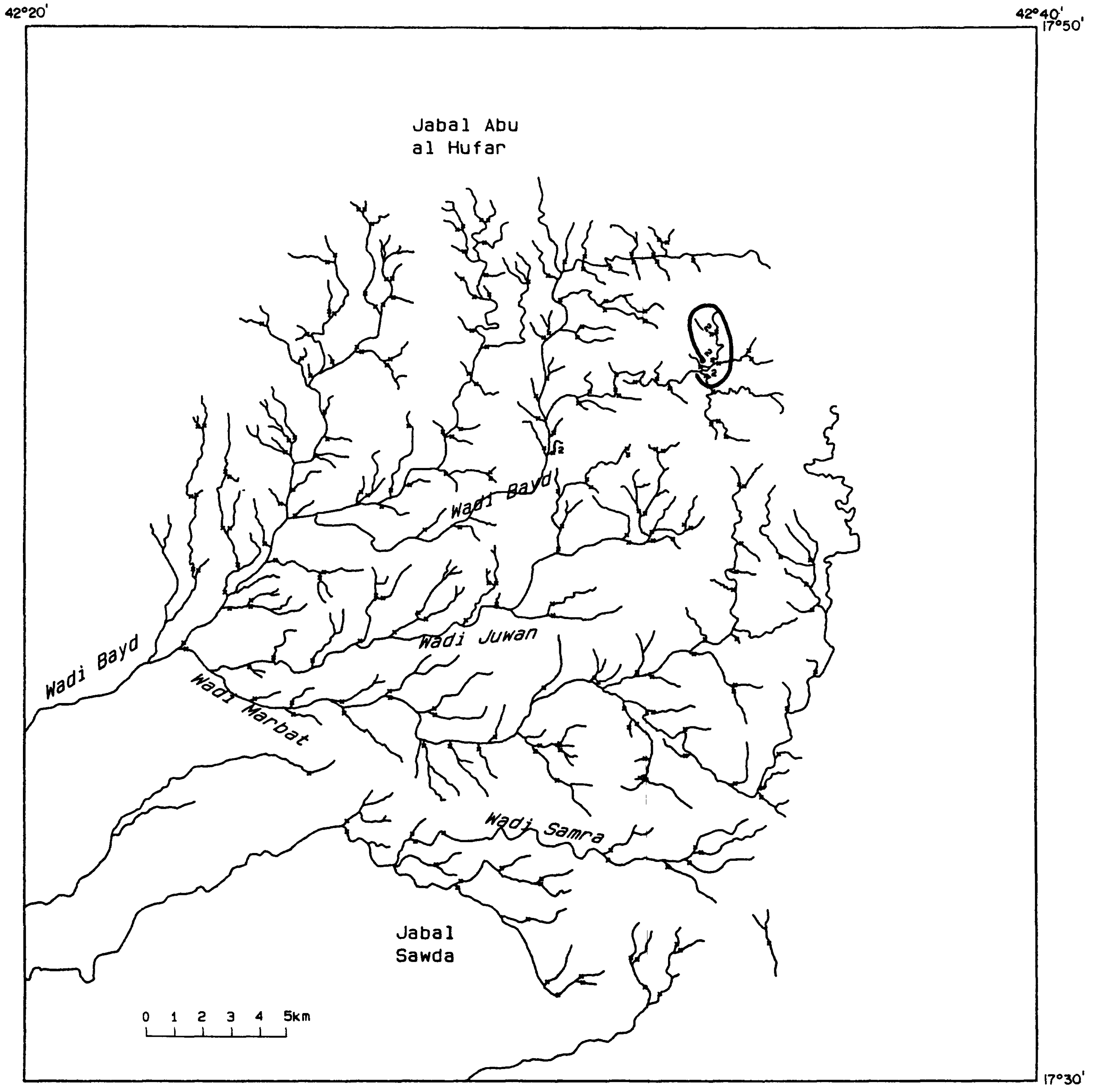

Figure 5f.--Ad Darb geochemical survey: anomalous concentrations of selected elements in minus-80-mesh samples - antimony (in ppm).

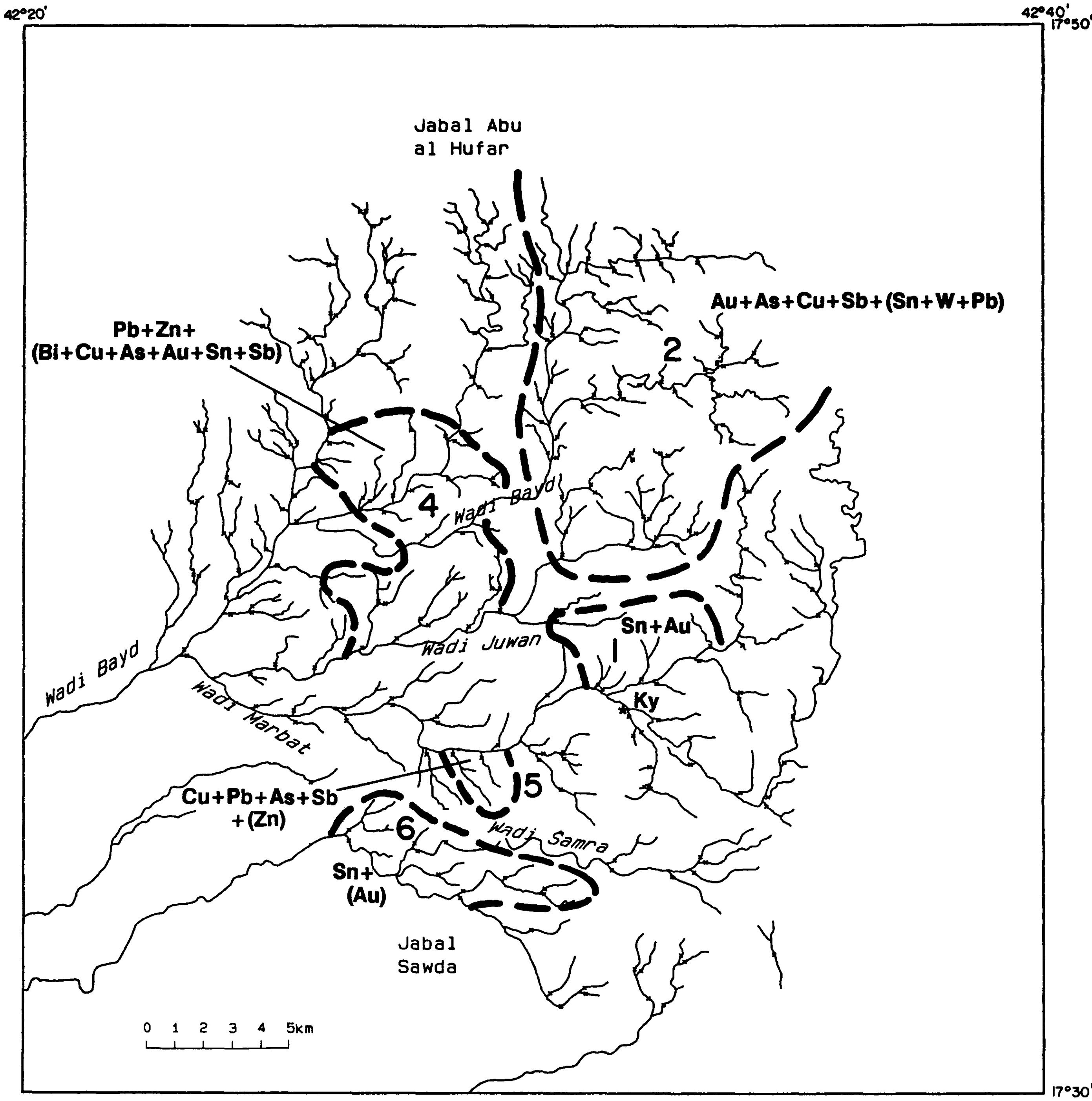

Figure 6.--Composite anomaly map of analytical results from Ad Darb panned-concentrate samples.
*Ky = Wadi Marbat kyanite occurrence (MODS3179).

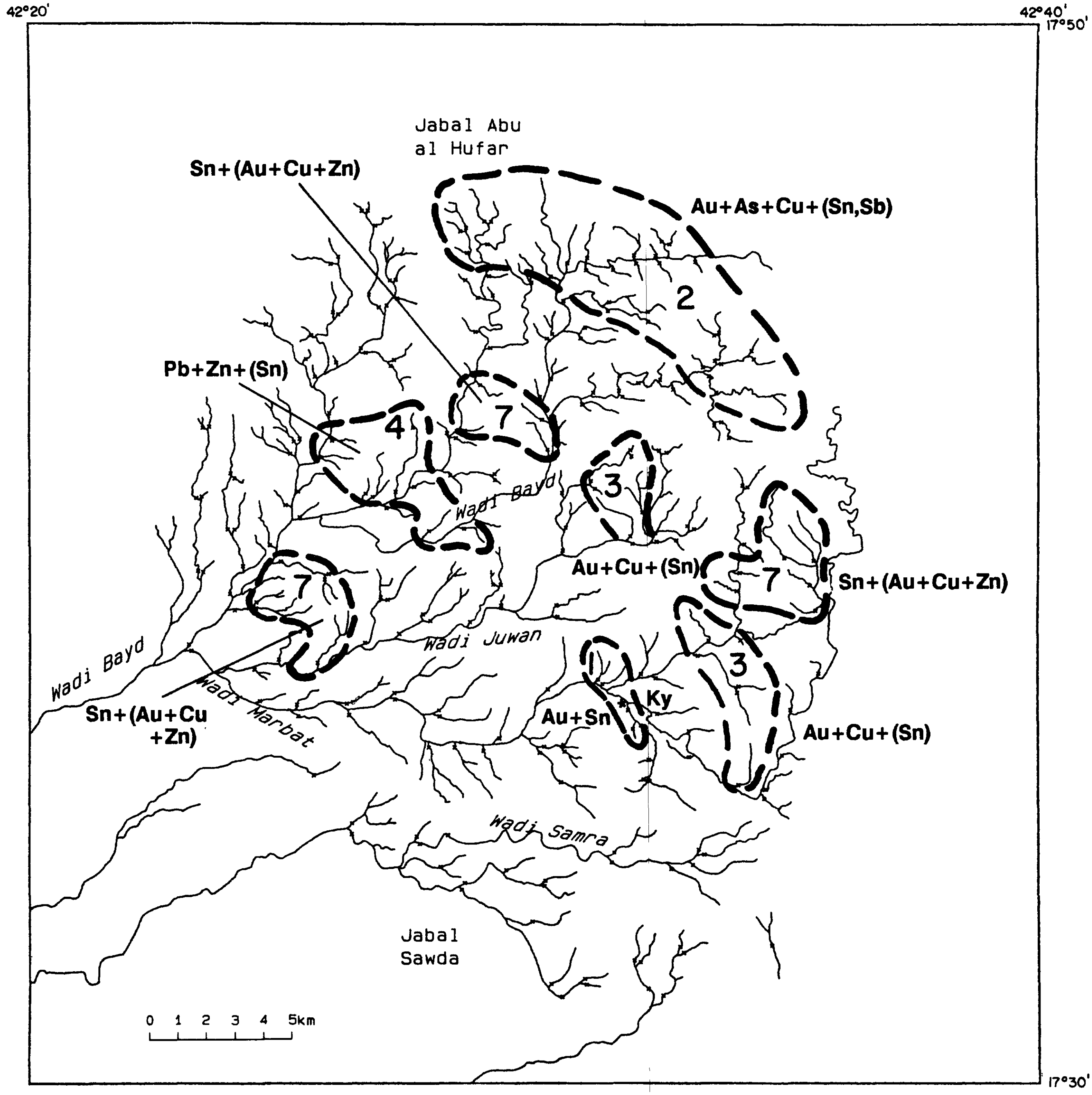

Figure 7.--Composite anomaly map of analytical results from Ad Darb minus-80-mesh samples. *Ky = Wadi Marbat kyanite occurrence (MODS3179).

economic concentrations of metals. The present geochemical results do not define a specific gold exploration target. Conversely they do not negate the possibility that a high-alumina hydrothermal system may have operated in the region during the late Proterozoic. In general terms, the authors believe the exploration concept behind this Ad Darb geochemical survey is sound, and there is sufficient encouragement from the geochemical results to believe that a search for high-alumina alteration zones may be warranted elsewhere in the Shield.

Samples anomalous in gold are abundant in the northeast quadrant of the Ad Darb survey area (fig.6, 7; areas 2, 3) where the gold is associated with a range of other elements, including arsenic, which is known to be a gold "pathfinder." (Elsewhere in the survey area, the correlation between gold and arsenic is not close; the correlation coefficient for all panned-concentrate samples is 0.035 at 10 percent risk). At this stage, the significance with respect to mineralization of small, magnetically defined, intrusions in the Sabya formation is untested, and the area is judged to warrant further investigation.

The cause of the lead-zinc anomaly in the west-central part of the survey area (figs. 6, 7; area 4) is unknown. Although Tertiary intrusions occur in the region, and may be a local source of the metals, the size of the anomaly area is considerably larger than the known outcrop extent of the Tertiary intrusions. This raises the question of whether sedimentary units in the Sabya formation may contain anomalous concentrations of the metals. Further low-priority reconnaissance would be justified to define the source of the metals. The low-grade tin anomaly outlined by panned-concentrate samples in Wadi Samra (fig 6; area 6) is situated in an area where an older Quaternary terrace deposit is apparently being dissected and reworked by Wadi Samra and its tributaries. Although the source of the tin anomaly is unknown, we note that the anomalous concentrations are in panned-concentrate samples rather than in minus-80-mesh samples. This suggests that the anomalies may reflect concentrations of cassiterite grains in heavy-mineral samples. A possible source of such heavy minerals is the older terrace deposit. Heavy-mineral layers in the older terrace probably would not be significant exploration targets by themselves, but they may be an indication of a possible tin-rich granite upslope in the escarpment region.

Overall, the Ad Darb wadi-sediment analytical results are low in value and do not outline areas that justify high-priority follow-up. Nevertheless, the sources of the low-grade gold, lead-zinc, and tin anomalies are unknown, and further investigations by geologic inspection, and wadi-sediment and rock-chip sampling would be justified as part of a larger program that appraised the mineral resource potential of the entire belt of the Sabya formation.

DATA STORAGE

Data and work materials used in preparation of this report include analytical results and Landsat images and are archived as datafile USGS-DF-10-4, which is stored at the office of the U.S. Geological Survey Mission in Jiddah, Saudi Arabia. No Mineral Occurrence Documentation System (MODS) localities were established in connection with work on this report, although the Wadi Marbat kyanite occurrence record (MODS 3179) was updated by addition of this report number.

REFERENCES CITED

Allard, G.O., and Carpenter, R.H., convenors, 1982, Exploration for metallic resources in the Southeast: University of Georgia Department of Geology and Center for Continuing Education, Athens, Georgia.

Barbier, J., 1987, Arid environment geochemical exploration in Saudi Arabia--The problem of aeolian contamination: Journal of Geochemical Exploration, v. 27, pp. 29-51.

Bell, Henry, 1982, Strata-bound sulfide deposits, wall-rock alteration, and associated tin-bearing minerals in the Carolina Slate Belt, South Carolina and Georgia: Economic Geology, 77, pp. 294-311.

Brown, G.F., and Jackson, R.O., 1959, Geologic map of the Asir Quadrangle, Kingdom of Saudi Arabia: U.S. Geological Survey Miscellaneous Geologic Investigations Map I-217A, scale 1:500,000.

Cartier, A., and Laurent, D., 1987, Industrial minerals in the Abha-Khamis Mushayt region (preliminary report): Sàudi Arabian Deputy Ministry for Mineral Resources Open-File Report BRGM-OF-06-33, 25 p.

Coleman, R. G., Hadley, D. G., Fleck, R. J., Hedge, C. T., and Donato, M. M., 1979, The Miocene Tihama Asir ophiolite and its bearing on the opening of the Red Sea: King Abdulaziz University Institute of Applied Geology Symposium on the Evolution and mineralization of the Arabian-Nubian shield, Jiddah, February 1978, Bulletin, 3., v. 1, p. 173-186.

Consortium Members, 1966-67, Airborne magnetometer survey: Saudi Arabian Directorate General of Mineral Resources Sheet 172, scale 1:100,000.

Fairer, G.M., 1982a, Reconnaissance geology of the Ad Darb quadrangle, sheet 17/42A, Kingdom of Saudi Arabia: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report USGS-OF-02-87, no text, scale 1:100,000. Saudi Arabian Deputy Ministry for Mineral Resources Map Series (in press)

Fairer, G.M., 1982b, Reconnaissance geology of the Wadi Baysh quadrangle, sheet 17/42B, Kingdom of Saudi Arabia: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report USGS-OF-02-85, 23 p., scale 1:100,000. IGCP Project 164.

Fairer, G.M., 1983, Reconnaissance geologic map of the Sabya quadrangle, sheet 17/42D, Kingdom of Saudi Arabia: Saudi Arabian Deputy Ministry for Mineral Resources Geoscience Map GM-68, 12 p., scale 1:100,000.

Fairer, G.M., 1985, Geologic map of the Wadi Baysh quadrangle, sheet 17F, Kingdom of Saudi Arabia: Saudi Arabian Deputy Ministry for Mineral Resources Geoscience Map GM-77, 23 p., scale 1:250,000.

Gaukroger, K.F., and Sale, S.V., 1985, Geochemical orientation studies of gold in drainage sediments on the Arabian Shield: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report RF-OF-05-26, 39 p.

Hawkes, H.E., and Webb, J.S., 1962, Geochemistry in mineral exploration: New York, Harper and Row, 415 p.

Klein, T.L., and Criss, R.E., 1988, An oxygen isotope and geochemical study of meteoric-hydrothermal systems at Pilot Mountain and selected other localities, Carolina Slate Belt: Economic Geology, v. 83, pp. 801-821.

Miesch, A.T., 1967, Methods of computation for estimating geochemical abundance: U. S. Geological Survey Professional Paper 574-B, 15 p.

Overstreet, W.C., and Day, G.W., 1985, Review of the use of magnetic concentrates in geochemical exploration: Saudi Arabia Deputy Ministry for Mineral Resources Technical Record USGS-TR-05-4, 38 p. U.S. Geological Survey Open-File Report 85-541.

Parker, T.W.H., 1982, Assessment of the mineral potential of the Kutam-Halahila district, south-east Asir: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report RF-OF-02-11, 149 p.

Saleh, Y.T., 1985, Follow-up geochemical sampling in the Farah Garan area, southeast Asir: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report RF-OF-05-13, 27 p.

Samater, R.M., 1982, Reconnaissance geochemical survey of the Al Jurdhawiyah and Wadi al Jirir quadrangles, sheets 25/42D and 25/42C, Kingdom of Saudi Arabia: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report USGS-OF-02-89, 19 p. U.S. Geological Survey Open-File Rept 83-299.

Samater, R.M., Christian, R.P., and Walker, B.M., 1989, Reconnaissance wadi-sediment geochemical survey of the Bi'r Jarbuah area, Kingdom of Saudi Arabia: Saudi Arabian Directorate General of Mineral Resources Open-File Report USGS-OF-10-1, 32 p. U.S. Geological Survey Open-File Rept (in press)

Sanderson, P.M., 1984, Progress report on the assessment of south-east Asir: Saudi Arabian Deputy Ministry for Mineral Resources Open-File Report RF-OF-O4-11, 29 p.

Schmidt, R.G., 1985, High-alumina hydrothermal systems in volcanic rocks and their significance to mineral prospecting in the Carolina Slate Belt: U.S.Geological Survey Bulletin 1562, 59 p.

Selner, G.I., and Taylor, R.B., 1988, GSDRAW and GSMAP version 5.0; Prototype programs for the IBM PC and compatible microcomputers, to assist compilation and publication of geologic maps and illustrations: U.S. Geological Survey Open-File Reports 88-295A, Documentation and tutorial, and 88-295B, Executable program disks.

Sower, F.B., Eicher, R.N., and Selner, G.I., 1971, The Statpac system: U.S. Geological Survey Computer Center Division, Computer Contributions no. 11, 36 p.

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APPENDIX

Figure A-1.--Location and numbers of samples sites, Ad Darb reconnaissance geochemical survey

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey

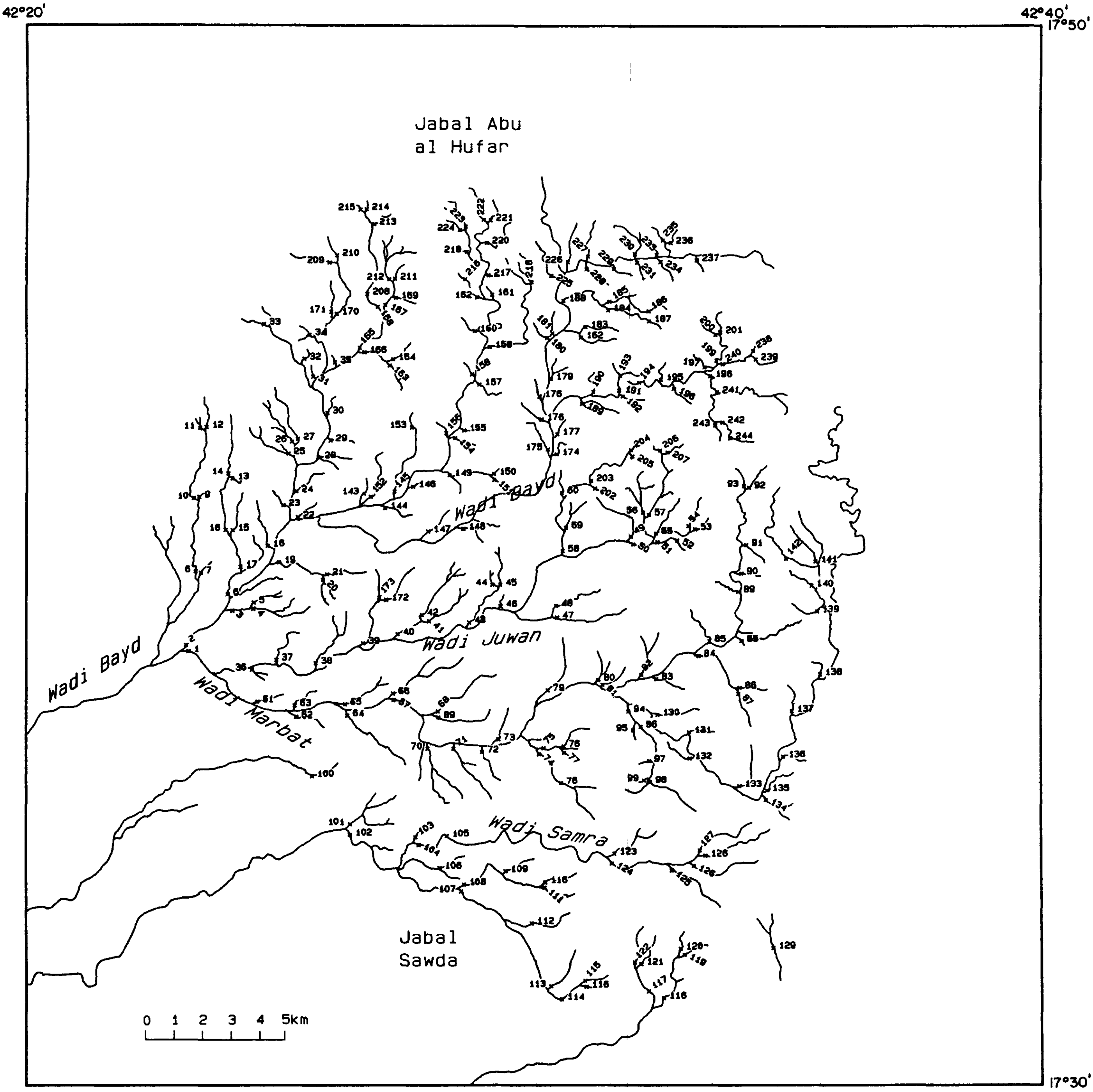

Figure A-1.--Location and numbers of samples sites, Ad Darb reconnaissance geochemical survey. Location numbers are last three digits of RASS numbers: 244,XXX.

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey. RASS numbers for panned-concentrate samples are 244001 to 244244, and correspond to locations 1-244.

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
1	244001	2	2	1	20	75	5	70	0.2	1	1	<2	2
2	244002	2	2	1	10	40	5	55	0.2	1	1	<2	3
3	244003	2	2	1	20	70	5	75	0.2	1	1	<2	4
4	244004	3	2	1	5	50	5	70	0.2	1	1	<2	3
5	244005	2	2	1	35	95	15	65	0.2	1	2	<2	3
6	244006	2	2	1	20	65	10	60	0.2	1	1	<2	4
7	244007	2	2	1	5	35	5	45	0.2	1	1	<2	4
8	244008	3	2	1	5	30	5	50	0.2	1	1	<2	4
9	244009	2	2	1	5	30	5	45	0.2	1	1	<2	3
10	244010	2	2	1	5	25	5	45	0.2	1	1	<2	3
11	244011	2	25	1	5	25	10	40	0.2	1	1	<2	2
12	244012	5	2	1	5	20	5	40	0.2	1	1	<2	2
13	244013	2	2	1	5	20	5	45	0.2	1	1	<2	4
14	244014	3	310	1	5	25	5	45	0.2	1	1	<2	4
15	244015	2	2	1	5	25	5	40	0.2	1	1	<2	2
16	244016	2	2	1	5	40	5	70	0.2	1	1	<2	4
17	244017	2	2	1	5	35	5	60	0.2	1	1	<2	3
18	244018	2	2	1	10	40	5	55	0.2	1	1	<2	4
19	244019	2	2	1	15	60	10	75	0.2	1	1	<2	3
20	244020	2	2	1	5	25	5	60	0.2	1	1	<2	2
21	244021	2	2	1	20	75	15	95	0.2	1	2	<2	3
22	244022	4	4	1	30	65	15	75	0.2	1	2	<2	2
23	244023	2	2	1	5	40	5	75	0.2	1	1	<2	3
24	244024	3	2	1	10	45	5	55	0.2	1	1	<2	3
25	244025	2	3	1	25	70	10	80	0.2	1	2	<2	3
26	244026	3	2	1	15	45	5	65	0.2	1	1	<2	4
27	244027	2	2	1	10	35	5	70	0.2	1	1	<2	4
28	244028	4	2	1	60	55	125	310	0.2	1	3	<2	4
29	244029	2	2	1	20	30	90	175	0.2	1	1	<2	3
30	244030	2	2	1	10	40	5	60	0.2	1	1	<2	3
31	244031	4	2	1	20	65	30	80	0.2	1	1	<2	3
32	244032	3	2	1	20	60	95	125	0.2	1	1	<2	2
33	244033	3	2	1	5	25	5	45	0.2	1	1	<2	3
34	244034	5	2	1	10	45	25	110	0.2	1	1	<2	3
35	244035	3	2	1	15	60	5	50	0.2	1	1	<2	3
36	244036	3	3	1	25	65	5	50	0.2	1	1	<2	4
37	244037	2	2	1	5	40	5	65	0.2	1	1	<2	2
38	244038	4	2	1	10	45	5	75	0.2	1	1	<2	3
39	244039	3	2	1	15	110	15	160	0.2	1	2	<2	4
40	244040	2	2	1	75	115	15	180	0.2	1	1	<2	5
41	244041	2	2	1	190	175	25	275	0.2	1	4	<2	6
42	244042	2	2	1	55	95	15	175	0.2	1	2	<2	4
43	244043	2	2	1	35	55	10	120	0.2	1	2	<2	3
44	244044	2	2	1	90	80	15	130	0.2	1	5	<2	3
45	244045	2	2	1	45	70	10	75	0.2	1	3	<2	4
46	244046	2	2	1	20	45	5	55	0.2	1	2	<2	4
47	244047	2	35	1	25	80	75	60	0.2	1	2	<2	3

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
48	244048	2	5	1	20	55	5	65	0.2	1	2	<2	4
49	244049	4	6	1	10	95	5	60	0.2	1	3	<2	4
50	244050	2	14	1	35	80	5	50	0.2	1	2	<2	3
51	244051	2	35	1	20	65	5	65	0.2	1	1	<2	2
52	244052	3	7	1	35	125	5	75	0.2	1	1	<2	3
53	244053	3	3	1	25	60	10	55	0.2	1	1	<2	3
54	244054	2	2	1	15	50	5	50	0.2	1	1	<2	3
55	244055	2	2	1	10	45	5	50	0.2	1	1	<2	3
56	244056	2	4	1	85	175	5	50	0.2	1	2	<2	3
57	244057	2	9	1	40	80	5	45	0.2	1	2	<2	10
58	244058	6	2	1	15	50	5	55	0.2	1	1	<2	3
59	244059	5	30	1	35	65	5	85	0.2	1	1	<2	5
60	244060	4	8	1	15	80	5	65	0.2	1	2	<2	4
61	244061	2	2	1	10	40	5	45	0.2	1	1	<2	4
62	244062	2	2	1	10	45	5	50	0.2	1	1	<2	3
63	244063	2	2	1	15	50	5	55	0.2	1	1	<2	2
64	244064	2	2	1	10	50	5	60	0.2	1	1	<2	2
65	244065	2	2	1	25	65	10	70	0.2	1	2	<2	3
66	244066	3	2	1	15	55	5	70	0.2	1	2	<2	3
67	244067	2	40	1	30	95	5	50	0.2	1	2	<2	3
68	244068	5	2	1	45	85	10	130	0.2	1	2	<2	3
69	244069	3	2	1	20	80	10	130	0.2	1	2	<2	3
70	244070	3	2	1	15	50	5	65	0.2	1	1	<2	3
71	244071	2	12	2	55	120	15	130	0.2	1	3	<2	4
72	244072	2	2	1	70	120	20	200	0.2	1	4	<2	3
73	244073	2	2	1	35	75	10	110	0.2	1	2	<2	3
74	244074	2	2	1	20	40	5	50	0.2	1	1	<2	3
75	244075	2	2	1	5	20	5	45	0.2	1	1	<2	2
76	244076	2	2	1	25	50	5	50	0.2	1	1	<2	2
77	244077	2	10	1	5	25	5	40	0.2	1	1	<2	2
78	244078	2	2	1	10	35	5	65	0.2	1	1	<2	2
79	244079	2	2	1	10	30	5	55	0.2	1	1	<2	2
80	244080	2	25	1	25	70	5	55	0.2	1	1	<2	3
81	244081	4	440	1	30	60	5	60	0.2	1	1	<2	2
82	244082	5	4	1	10	80	5	50	0.2	1	1	<2	3
83	244083	2	5	1	10	70	5	40	0.2	1	1	<2	3
84	244084	3	10	1	15	90	5	55	0.2	1	1	<2	2
85	244085	4	2	1	15	100	5	60	0.2	1	1	<2	4
86	244086	3	50	1	15	80	5	60	0.2	1	1	<2	3
87	244087	2	2	1	10	80	5	55	0.2	1	1	<2	2
88	244088	2	4	1	15	100	5	50	0.2	1	1	<2	2
89	244089	2	10	1	30	85	5	55	0.2	1	1	<2	2
90	244090	2	8	1	30	95	5	60	0.2	1	1	<2	3
91	244091	2	8	1	30	90	15	45	0.2	1	1	<2	6
92	244092	2	2	1	5	50	5	50	0.2	1	1	<2	2
93	244093	2	2	1	5	55	5	55	0.2	1	1	<2	3
94	244094	3	2	1	15	60	5	50	0.2	1	1	<2	3
95	244095	5	2	1	10	60	5	70	0.2	1	2	<2	2
96	244096	2	8	1	15	70	5	50	0.2	1	1	<2	4
97	244097	2	2	1	10	40	5	60	0.2	1	1	<2	3

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
98	244098	3	25	1	10	95	5	50	0.2	1	1	<2	3
99	244099	2	2	1	10	50	5	60	0.2	1	1	<2	3
100	244100	2	2	1	5	40	5	60	0.2	1	1	<2	3
101	244101	5	2	1	5	30	5	50	0.2	1	1	<2	3
102	244102	9	5	1	5	15	5	40	0.2	1	1	<2	4
103	244103	9	2	1	5	25	5	45	0.2	1	1	<2	3
104	244104	3	2	1	10	45	5	50	0.2	1	1	<2	2
105	244105	8	2	1	5	25	5	35	0.2	1	1	<2	2
106	244106	4	2	1	5	25	5	45	0.2	1	1	<2	2
107	244107	4	2	1	10	30	5	55	0.2	1	1	<2	2
108	244108	6	910	1	10	20	5	55	0.2	1	1	<2	2
109	244109	3	2	1	5	30	5	35	0.2	1	1	<2	3
110	244110	5	2	1	5	35	5	50	0.2	1	1	<2	2
111	244111	2	2	1	10	25	5	60	0.2	1	1	<2	3
112	244112	2	2	1	10	30	5	55	0.2	1	1	<2	3
113	244113	2	2	1	15	35	5	70	0.2	1	1	<2	3
114	244114	2	4	1	15	30	5	50	0.2	1	1	<2	3
115	244115	7	5	1	20	30	5	85	0.2	1	1	<2	2
116	244116	2	2	1	25	40	5	65	0.2	1	1	<2	2
117	244117	2	9	1	15	35	5	45	0.2	1	1	<2	3
118	244118	2	2	1	10	50	5	50	0.2	1	1	<2	2
119	244119	2	5	1	10	80	5	55	0.2	1	1	<2	3
120	244120	5	6	1	15	85	5	50	0.2	1	1	<2	2
121	244121	3	7	1	25	55	5	45	0.2	1	1	<2	3
122	244122	3	2	1	10	45	5	50	0.2	1	1	<2	2
123	244123	3	2	1	5	20	5	25	0.2	1	1	<2	3
124	244124	2	2	1	5	50	5	55	0.2	1	1	<2	3
125	244125	2	5	1	15	85	5	80	0.2	1	1	<2	3
126	244126	2	5	1	5	50	5	45	0.2	1	1	<2	4
127	244127	2	3	1	10	55	5	40	0.2	1	1	<2	2
128	244128	4	2	1	10	50	5	45	0.2	1	1	<2	2
129	244129	3	2	1	10	25	5	35	0.2	1	1	<2	3
130	244130	2	2	1	5	80	5	50	0.2	1	1	<2	3
131	244131	2	30	1	10	70	5	45	0.2	1	1	<2	3
132	244132	2	2	1	10	65	5	50	0.2	1	1	<2	3
133	244133	2	2	1	10	70	5	45	0.2	1	1	<2	3
134	244134	2	2	1	10	45	5	50	0.2	1	1	<2	3
135	244135	2	4	1	10	55	5	45	0.2	1	1	<2	3
136	244136	2	6	1	15	70	5	55	0.2	1	1	<2	3
137	244137	2	4	1	20	65	5	50	0.2	1	1	<2	3
138	244138	2	2	1	15	60	5	50	0.2	1	1	<2	3
139	244139	2	10	1	15	85	5	80	0.2	1	1	<2	2
140	244140	3	3	1	20	85	5	50	0.2	1	1	<2	2
141	244141	2	12	1	35	160	5	50	0.2	1	1	<2	4
142	244142	2	70	1	30	75	5	65	0.2	1	1	<2	3
143	244143	2	6	1	30	55	100	240	0.2	1	1	<2	4
144	244144	2	2	1	30	60	20	150	0.2	1	1	<2	3
145	244145	3	2	1	35	75	60	295	0.2	1	1	<2	2
146	244146	2	2	1	20	45	45	105	0.2	1	1	<2	3
147	244147	2	2	1	35	70	135	440	0.2	1	1	<2	3

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
148	244148	2	4	1	150	125	50	220	0.2	2	4	<2	3
149	244149	6	40	1	35	245	65	215	0.4	6	1	<2	5
150	244150	3	25	1	75	170	5	75	0.2	8	1	<2	2
151	244151	2	4	1	25	75	10	75	0.2	1	1	<2	3
152	244152	3	3	1	25	60	145	240	0.2	1	1	<2	3
153	244153	2	5	1	30	95	40	245	0.2	1	1	<2	3
154	244154	3	10	1	60	120	65	235	0.2	4	1	<2	4
155	244155	2	5	1	20	85	5	70	0.2	1	1	<2	3
156	244156	2	35	1	85	110	25	180	0.2	1	1	<2	4
157	244157	2	4	1	15	50	5	55	0.2	1	1	<2	2
158	244158	2	6	1	35	70	10	65	0.2	1	1	<2	3
159	244159	2	3	1	35	75	5	65	0.2	1	1	<2	2
160	244160	2	8	1	35	75	5	65	0.2	1	1	<2	2
161	244161	2	2	1	55	90	5	90	0.2	1	1	<2	5
162	244162	2	2	1	40	65	5	90	0.2	1	1	<2	3
163	244163	2	8	1	40	85	10	85	0.2	1	1	<2	3
164	244164	2	4	1	75	125	5	80	0.2	1	2	<2	5
165	244165	2	5	1	35	90	5	60	0.2	1	1	<2	3
166	244166	2	18	1	45	90	5	70	0.2	1	2	<2	4
167	244167	2	5	1	70	125	5	75	0.2	1	1	<2	2
168	244168	2	5	1	30	90	5	55	0.2	1	1	<2	2
169	244169	2	2	1	70	120	5	80	0.2	2	1	<2	2
170	244170	2	2	1	15	85	5	65	0.2	1	1	<2	2
171	244171	2	2	1	15	90	5	65	0.2	1	1	<2	2
172	244172	2	4	1	25	100	15	130	0.2	1	1	<2	3
173	244173	2	2	1	10	125	10	155	0.2	1	1	<2	2
174	244174	2	3	1	20	75	5	75	0.2	1	2	<2	2
175	244175	2	8	1	55	125	5	75	0.2	1	2	<2	2
176	244176	2	2	1	15	65	5	70	0.2	1	1	<2	3
177	244177	2	9	1	30	75	5	60	0.2	1	1	<2	3
178	244178	2	20	1	40	70	5	50	0.2	1	1	<2	3
179	244179	2	2	1	110	110	5	60	0.2	1	2	<2	2
180	244180	2	40	1	45	50	5	50	0.2	1	3	<2	2
181	244181	2	6	1	85	105	5	55	0.2	1	2	<2	2
182	244182	2	4	1	60	75	5	65	0.2	1	2	<2	2
183	244183	2	3	1	65	85	5	60	0.2	1	2	<2	2
184	244184	2	2	1	75	95	5	65	0.2	1	5	<2	2
185	244185	3	2	1	50	65	5	75	0.2	1	3	<2	2
186	244186	3	3	1	50	75	5	70	0.2	1	4	<2	2
187	244187	2	2	1	65	85	5	70	0.2	1	4	<2	3
188	244188	2	6	1	55	75	5	65	0.2	1	4	<2	3
189	244189	2	25	1	160	205	5	70	0.2	1	5	<2	3
190	244190	2	7	1	140	160	5	60	0.2	1	4	<2	3
191	244191	2	12	1	100	115	5	75	0.2	1	3	<2	3
192	244192	2	10	1	95	85	5	70	0.2	1	3	<2	2
193	244193	2	2	1	65	70	5	80	0.2	1	2	<2	2
194	244194	2	80	1	120	185	5	60	0.2	1	3	<2	2
195	244195	2	4	1	25	70	5	50	0.2	1	2	<2	2
196	244196	2	25	1	80	150	5	65	0.2	1	3	<2	2
197	244197	2	90	1	255	325	5	95	0.2	1	6	<2	3

Table A-1.--Analytical results for panned-concentrate samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
198	244198	2	18	1	145	210	15	95	0.2	1	5	<2	3
199	244199	2	30	2	365	345	20	100	0.2	1	9	<2	3
200	244200	2	4	1	120	170	5	85	0.2	1	7	<2	2
201	244201	3	18	1	160	115	15	115	0.2	1	3	4	2
202	244202	4	7	1	10	55	5	75	0.2	1	1	<2	2
203	244203	2	130	1	90	145	5	65	0.2	1	2	<2	5
204	244204	2	5	1	25	65	5	60	0.2	1	1	<2	6
205	244205	2	5	1	20	50	5	65	0.2	1	1	<2	5
206	244206	2	8	1	100	140	5	60	0.2	1	1	<2	5
207	244207	2	16	1	95	110	5	75	0.2	1	2	<2	5
208	244208	2	3	1	5	100	5	65	0.2	1	1	<2	2
209	244209	2	2	1	5	65	5	65	0.2	1	1	<2	2
210	244210	2	2	1	10	65	5	75	0.2	1	1	<2	2
211	244211	2	2	1	25	90	5	85	0.2	1	1	<2	2
212	244212	2	3	1	25	75	5	65	0.2	1	1	<2	2
213	244213	2	3	1	30	55	5	70	0.2	1	1	<2	3
214	244214	2	4	1	35	115	5	80	0.2	1	1	<2	6
215	244215	2	2	1	25	80	5	65	0.2	1	1	<2	2
216	244216	2	2	1	15	55	5	65	0.2	1	1	<2	2
217	244217	2	25	1	45	85	5	75	0.2	1	1	<2	2
218	244218	2	4	1	40	75	5	75	0.2	1	1	<2	3
219	244219	2	2	1	15	50	5	65	0.2	1	1	<2	2
220	244220	2	7	1	35	60	5	75	0.2	1	1	<2	2
221	244221	2	25	1	50	90	5	80	0.2	1	1	<2	3
222	244222	2	20	1	70	130	5	85	0.2	1	1	<2	2
223	244223	2	3	1	25	65	5	60	0.2	1	1	<2	2
224	244224	2	4	1	45	75	5	65	0.2	1	1	<2	2
225	244225	2	25	1	65	115	5	80	0.2	1	1	<2	2
226	244226	2	70	1	15	60	5	90	0.2	1	1	<2	2
227	244227	2	5	1	50	80	5	85	0.2	1	2	<2	2
228	244228	2	6	1	25	70	5	80	0.2	1	2	<2	2
229	244229	2	18	1	55	120	10	100	0.2	1	3	<2	2
230	244230	2	4	1	20	70	5	85	0.2	1	1	<2	2
231	244231	2	3	1	35	65	5	95	0.2	1	1	<2	2
233	244233	2	3	1	20	95	5	85	0.2	1	1	<2	2
234	244234	2	7	1	60	115	5	75	0.2	1	3	<2	3
235	244235	2	4	1	30	100	5	75	0.2	1	1	<2	2
236	244236	2	40	1	175	280	35	105	0.2	1	3	<2	3
237	244237	2	6	1	115	155	15	90	0.2	1	3	<2	2
238	244238	2	8	1	55	95	5	110	0.2	1	2	<2	2
239	244239	2	12	1	14	190	5	90	0.2	1	2	<2	2
240	244240	2	16	1	185	235	10	100	0.2	1	5	<2	2
241	244241	2	3	1	20	50	5	80	0.2	1	1	<2	2
242	244242	3	9	1	25	65	5	70	0.2	1	1	<2	2
243	244243	2	5	1	60	65	5	90	0.4	1	2	<2	2
244	244244	2	5	1	15	55	5	70	0.2	1	2	<2	2

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey. RASS numbers for minus-80-mesh samples are 244501 to 244744, and correspond to locations 1-244.

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
1	244501	2	4	1	5	35	5	80	0.2	1	1	<2	3
2	244502	2	2	1	5	30	5	60	0.2	1	1	<2	3
3	244503	2	2	1	10	35	5	70	0.2	1	1	<2	2
4	244504	3	2	1	5	35	5	65	0.2	1	1	<2	2
5	244505	2	2	1	10	35	5	55	0.2	1	1	2	2
6	244506	2	2	1	5	35	5	75	0.2	1	1	<2	3
7	244507	2	2	1	5	30	5	60	0.2	1	1	<2	2
8	244508	2	2	1	5	25	5	60	0.2	1	1	<2	2
9	244509	2	5	1	5	30	5	55	0.2	1	1	<2	2
10	244510	2	2	1	5	5	5	55	0.2	1	1	<2	2
11	244511	2	2	1	5	25	5	55	0.2	1	1	<2	2
12	244512	2	2	1	5	30	5	60	0.2	1	1	<2	2
13	244513	2	2	1	5	25	5	55	0.2	1	1	<2	2
14	244514	2	2	1	5	25	5	65	0.2	1	1	<2	2
15	244515	2	2	1	5	30	5	55	0.2	1	1	<2	2
16	244516	2	2	1	5	25	5	70	0.2	1	1	<2	2
17	244517	2	2	1	5	25	5	60	0.2	1	1	2	2
18	244518	2	2	1	10	30	5	60	0.2	1	1	<2	2
19	244519	3	2	1	10	30	5	60	0.2	1	1	2	3
20	244520	3	2	1	5	25	5	70	0.2	1	1	<2	2
21	244521	2	2	1	10	25	5	65	0.2	1	1	2	2
22	244522	2	2	1	10	30	10	55	0.2	1	1	2	2
23	244523	2	2	1	5	30	5	65	0.2	1	1	<2	2
24	244524	2	2	1	5	25	5	55	0.2	1	1	<2	3
25	244525	2	2	1	5	35	5	70	0.2	1	1	<2	2
26	244526	2	2	1	5	30	5	60	0.2	1	1	<2	2
27	244527	2	3	1	10	25	5	60	0.2	1	1	<2	2
28	244528	2	2	1	10	30	40	155	0.2	1	1	<2	2
29	244529	2	2	1	5	25	30	150	0.2	1	1	<2	2
30	244530	3	2	1	5	30	5	65	0.2	1	1	<2	3
31	244531	3	2	1	5	25	10	85	0.2	1	1	<2	2
32	244532	4	2	1	5	25	15	110	0.2	1	1	<2	2
33	244533	2	2	1	5	25	5	55	0.2	1	1	<2	2
34	244534	2	2	1	5	30	5	75	0.2	1	1	<2	2
35	244535	2	2	1	5	30	5	55	0.2	1	1	<2	2
36	244536	2	2	1	5	30	5	50	0.2	1	1	<2	4
37	244537	2	29	1	5	25	5	60	0.2	1	1	<2	4
38	244538	3	2	1	5	30	5	70	0.2	1	1	2	3
39	244539	2	2	1	5	30	5	70	0.2	1	1	<2	4
40	244540	2	2	1	10	35	5	75	0.2	1	1	2	3
41	244541	3	2	1	20	40	5	80	0.2	1	1	<2	5
42	244542	2	2	1	10	30	5	75	0.2	1	1	<2	4
43	244543	2	2	1	10	30	5	70	0.2	1	1	2	3
44	244544	2	2	1	10	30	5	65	0.2	1	1	<2	3
45	244545	2	2	1	10	35	5	75	0.2	1	1	<2	4
46	244546	2	2	1	5	30	5	65	0.2	1	1	2	3
47	244547	2	2	1	10	45	5	65	0.2	1	1	<2	4
48	244548	2	2	1	10	35	5	65	0.2	1	1	<2	3

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
49	244549	2	4	1	5	60	5	60	0.2	1	1	<2	3
50	244550	2	2	1	10	50	5	70	0.2	1	1	<2	4
51	244551	2	2	1	10	35	5	55	0.2	1	1	<2	3
52	244552	2	2	1	10	60	5	65	0.2	1	1	<2	4
53	244553	2	2	1	10	45	5	65	0.2	1	1	<2	3
54	244554	2	2	1	15	50	5	55	0.2	1	1	<2	4
55	244555	2	2	1	5	35	5	50	0.2	1	1	<2	3
56	244556	2	2	1	10	55	5	50	0.2	1	1	<2	4
57	244557	2	3	1	10	45	10	45	0.2	1	1	2	4
58	244558	2	2	1	10	30	5	75	0.2	1	1	<2	3
59	244559	2	2	1	10	45	5	55	0.2	1	1	2	3
60	244560	2	2	1	5	50	5	55	0.2	1	1	<2	3
61	244561	2	2	1	10	40	5	45	0.2	1	1	<2	3
62	244562	6	2	1	10	35	5	60	0.4	1	1	<2	3
63	244563	2	2	1	5	25	5	60	0.2	1	1	2	3
64	244564	2	2	1	5	30	5	55	0.2	1	1	<2	3
65	244565	2	2	1	10	30	5	65	0.2	1	1	<2	3
66	244566	2	2	1	5	30	5	60	0.2	1	1	<2	3
67	244567	2	2	1	5	35	5	55	0.2	1	1	<2	2
68	244568	2	2	1	10	25	5	70	0.2	1	1	<2	4
69	244569	2	2	1	5	30	5	55	0.2	1	1	<2	3
70	244570	34	2	1	5	30	5	80	0.2	1	1	<2	3
71	244571	2	2	1	5	30	5	65	0.2	1	1	2	2
72	244572	2	2	1	10	30	5	65	0.2	1	1	<2	2
73	244573	2	2	1	10	25	5	55	0.2	1	1	2	3
74	244574	2	2	1	10	25	5	50	0.2	1	1	<2	3
75	244575	2	2	1	5	25	5	50	0.2	1	1	<2	3
76	244576	2	2	1	5	30	5	60	0.2	1	1	<2	3
77	244577	2	2	1	5	25	5	40	0.2	1	1	<2	2
78	244578	2	2	1	5	25	5	60	0.2	1	1	<2	3
79	244579	2	2	1	5	20	5	50	0.2	1	1	2	3
80	244580	2	12	1	10	30	5	40	0.2	1	1	<2	2
81	244581	2	5	1	10	35	5	50	0.2	1	1	2	3
82	244582	2	2	1	5	45	5	50	0.2	1	1	<2	2
83	244583	2	2	1	5	35	5	45	0.2	1	1	<2	3
84	244584	2	2	1	5	55	5	55	0.2	1	1	2	3
85	244585	2	2	1	5	60	5	60	0.2	1	1	<2	3
86	244586	2	2	1	5	40	5	60	0.2	1	1	2	2
87	244587	2	6	1	5	65	5	60	0.2	1	1	<2	2
88	244588	2	2	1	5	70	5	65	0.2	1	1	<2	2
89	244589	3	2	1	5	40	5	65	0.2	1	1	<2	3
90	244590	3	2	1	5	60	5	65	0.2	1	1	<2	2
91	244591	2	2	1	10	45	5	70	0.2	1	1	<2	3
92	244592	2	2	1	5	55	5	65	0.2	1	1	2	3
93	244593	2	2	1	5	55	5	55	0.2	1	1	2	3
94	244594	2	4	1	5	40	5	45	0.2	1	1	<2	3
95	244595	3	2	1	5	30	5	65	0.2	1	1	2	3
96	244596	2	2	1	5	35	5	55	0.2	1	1	<2	3
97	244597	2	2	1	5	30	5	50	0.2	1	1	<2	2
98	244598	2	2	1	10	40	5	55	0.2	1	1	<2	3
99	244599	2	2	1	5	35	5	55	0.2	1	1	<2	2

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
100	244600	2	2	1	5	30	5	65	0.2	1	1	<2	2
101	244601	2	8	1	5	30	5	65	0.2	1	1	<2	3
102	244602	2	2	1	5	20	5	50	0.2	1	1	2	3
103	244603	2	2	1	5	25	5	55	0.2	1	1	<2	3
104	244604	2	2	1	5	30	5	55	0.2	1	1	<2	3
105	244605	2	2	1	5	25	5	50	0.2	1	1	<2	3
106	244606	2	2	1	5	25	5	55	0.2	1	1	2	3
107	244607	2	2	1	5	25	5	50	0.2	1	1	<2	2
108	244608	2	2	1	5	25	5	50	0.2	1	1	<2	3
109	244609	2	2	1	5	20	5	55	0.2	1	1	<2	3
110	244610	2	2	1	5	25	5	60	0.2	1	1	<2	2
111	244611	2	39	1	5	35	5	80	0.2	1	1	<2	2
112	244612	2	2	1	5	25	5	65	0.2	1	1	<2	2
113	244613	2	2	1	10	25	5	60	0.2	1	1	<2	2
114	244614	2	2	1	10	25	5	55	0.2	1	1	<2	2
115	244615	2	2	1	5	30	5	70	0.2	1	1	<2	2
116	244616	2	2	1	10	30	5	60	0.2	1	1	<2	2
117	244617	2	2	1	5	35	5	60	0.2	1	1	<2	2
118	244618	2	2	1	5	35	5	50	0.2	1	1	<2	3
119	244619	2	2	1	10	35	5	60	0.2	1	1	<2	2
120	244620	2	2	1	5	35	5	70	0.6	1	1	<2	3
121	244621	2	2	1	10	35	5	55	0.2	1	1	2	2
122	244622	2	2	1	5	30	5	55	0.2	1	1	2	2
123	244623	2	2	1	5	35	5	45	0.2	1	1	<2	2
124	244624	2	2	1	5	35	5	65	0.2	1	1	<2	2
125	244625	2	2	1	5	35	5	60	0.2	1	1	<2	2
126	244626	2	2	1	5	35	5	60	0.2	1	1	<2	3
127	244627	2	2	1	5	25	5	55	0.2	1	1	<2	3
128	244628	2	2	1	5	30	5	55	0.2	1	1	<2	2
129	244629	2	2	1	5	25	5	45	0.2	1	1	<2	3
130	244630	2	2	1	5	40	5	45	0.2	1	1	<2	2
131	244631	3	2	1	5	35	5	40	0.2	1	1	<2	2
132	244632	2	2	1	5	45	5	50	0.2	1	1	<2	3
133	244633	2	7	1	10	50	5	50	0.2	1	1	<2	4
134	244634	2	2	1	10	40	5	65	0.2	1	1	<2	2
135	244635	2	2	1	10	30	5	50	0.2	1	1	2	3
136	244636	2	2	1	5	35	5	55	0.2	1	1	<2	3
137	244637	2	2	1	10	40	5	55	0.2	1	1	<2	3
138	244638	2	2	1	5	40	5	60	0.2	1	1	2	3
139	244639	3	4	1	5	50	5	70	0.2	1	1	<2	2
140	244640	2	2	1	5	65	5	55	0.2	1	1	<2	3
141	244641	2	5	1	10	55	5	50	0.2	1	1	<2	3
142	244642	3	2	1	10	35	5	70	0.2	1	1	2	3
143	244643	4	2	1	10	25	35	210	0.2	1	1	<2	3
144	244644	3	2	1	10	30	5	90	0.2	1	1	<2	3
145	244645	2	2	1	10	30	15	145	0.2	1	1	<2	3
146	244646	2	2	1	10	25	10	85	0.2	1	1	2	3
147	244647	2	2	1	10	25	20	145	0.2	1	1	<2	4
148	244648	2	2	1	20	30	5	145	0.2	1	1	<2	3
149	244649	2	2	1	30	40	5	95	0.2	1	1	2	3

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
150	244650	2	2	1	5	25	5	55	0.2	1	1	<2	3
151	244651	2	2	1	5	30	5	70	0.2	1	1	<2	3
152	244652	2	2	1	10	30	40	210	0.2	1	1	<2	3
153	244653	2	2	1	10	25	5	115	0.2	1	1	<2	2
154	244654	2	7	1	15	40	10	170	0.2	1	1	2	3
155	244655	3	2	1	5	40	5	70	0.2	1	1	2	2
156	244656	2	32	1	20	40	5	90	0.2	1	1	<2	3
157	244657	3	2	1	5	35	5	75	0.2	1	1	<2	2
158	244658	2	2	1	15	45	5	75	0.2	1	1	<2	2
159	244659	2	2	1	15	40	5	80	0.2	1	1	2	2
160	244660	2	3	1	15	40	5	60	0.2	1	1	<2	2
161	244661	2	2	1	15	30	5	75	0.2	1	1	<2	2
162	244662	2	2	1	15	35	5	85	0.2	1	1	<2	2
163	244663	2	2	1	10	30	5	80	0.2	1	1	<2	2
164	244664	3	2	1	10	35	5	75	0.2	1	1	<2	2
165	244665	2	3	1	15	55	5	145	0.2	1	1	<2	2
166	244666	2	2	1	10	35	5	70	0.2	1	1	<2	3
167	244667	2	2	1	10	40	160	160	0.2	1	1	<2	2
168	244668	2	2	1	10	40	5	60	0.2	1	1	<2	2
169	244669	2	4	1	10	45	5	75	0.2	1	1	<2	2
170	244670	2	2	1	10	40	5	65	0.2	1	1	<2	2
171	244671	2	2	1	10	40	5	70	0.2	1	1	<2	2
172	244672	2	2	1	5	25	5	65	0.2	1	1	2	2
173	244673	2	2	1	5	30	5	70	0.2	1	1	2	3
174	244674	2	2	1	5	40	5	65	0.2	1	2	<2	2
175	244675	2	2	1	10	50	5	110	0.2	1	1	<2	2
176	244676	3	4	1	5	40	5	75	0.2	1	1	<2	4
177	244677	2	9	1	10	45	5	65	0.2	1	1	<2	2
178	244678	2	18	1	15	40	5	65	0.2	1	1	<2	4
179	244679	2	2	1	25	50	5	105	0.2	1	1	<2	4
180	244680	2	2	1	10	30	5	60	0.2	1	1	<2	4
181	244681	2	2	1	15	45	5	75	0.2	1	1	<2	3
182	244682	2	2	1	20	40	5	70	0.2	1	1	<2	3
183	244683	2	2	1	15	45	5	70	0.2	1	1	<2	3
184	244684	2	2	1	25	50	5	75	0.2	1	1	<2	3
185	244685	2	2	1	25	50	5	110	0.2	1	1	<2	4
186	244686	2	2	1	20	45	5	115	0.2	1	1	2	4
187	244687	2	2	1	25	40	5	85	0.2	1	1	2	4
188	244688	7	2	1	25	50	5	75	0.2	1	1	<2	3
189	244689	2	2	1	20	45	5	110	0.2	1	1	<2	3
190	244690	2	37	1	20	50	5	65	0.2	1	1	<2	2
191	244691	2	18	1	20	50	5	105	0.2	1	1	2	3
192	244692	3	2	1	15	50	5	90	0.2	1	1	<2	4
193	244693	2	2	1	5	40	5	90	0.2	1	1	<2	3
194	244694	2	3	1	20	50	5	90	0.2	1	1	<2	3
195	244695	2	2	1	10	45	5	70	0.2	1	1	<2	3
196	244696	2	2	1	15	45	5	90	0.2	1	1	<2	4
197	244697	2	3	1	30	6	5	85	0.2	1	1	<2	4
198	244698	40	2	1	35	80	5	80	0.2	1	2	2	3
199	244699	2	2	1	20	50	5	90	0.2	1	2	<2	6

Table A-2.--Analytical results for minus-80-mesh samples, Ad Darb reconnaissance geochemical survey--(continued).

Loc #	RASS #	ppm Sn	ppb Au	ppm Te	ppm As	ppm Cu	ppm Pb	ppm Zn	ppm Ag	ppm Bi	ppm Sb	ppm Mo	ppm W
200	244700	2	2	1	20	60	5	80	0.2	1	2	<2	3
201	244701	2	3	1	20	40	5	90	0.2	1	1	<2	3
202	244702	2	2	1	5	40	5	75	0.2	1	1	<2	2
203	244703	3	3	1	10	55	5	65	0.2	1	1	<2	2
204	244704	2	3	1	5	30	5	80	0.2	1	1	2	3
205	244705	2	2	1	5	30	5	75	0.2	1	1	2	3
206	244706	3	2	1	10	45	5	75	0.2	1	1	2	4
207	244707	2	2	1	15	45	5	75	0.2	1	1	2	3
208	244708	2	2	1	10	50	5	70	0.2	1	1	<2	4
209	244709	2	2	1	5	50	5	65	0.2	1	1	2	3
210	244710	2	2	1	5	45	5	75	0.2	1	1	<2	3
211	244711	2	2	1	10	45	5	75	0.2	1	1	<2	6
212	244712	3	2	1	10	45	5	70	0.2	1	1	<2	3
213	244713	4	2	1	20	50	5	70	0.2	1	1	<2	2
214	244714	2	2	1	20	70	5	75	0.2	1	1	2	3
215	244715	2	3	1	15	50	5	75	0.2	1	1	<2	4
216	244716	2	3	1	10	45	5	75	0.2	1	1	<2	3
217	244717	2	2	1	20	50	5	65	0.2	1	1	2	3
218	244718	2	2	1	15	40	5	75	0.2	1	1	2	3
219	244719	4	2	1	15	45	5	70	0.2	1	1	2	2
220	244720	2	5	1	25	45	5	70	0.2	1	1	<2	2
221	244721	2	2	1	20	55	5	75	0.2	1	1	<2	3
222	244722	2	2	1	25	65	5	75	0.2	1	1	<2	3
223	244723	6	90	1	15	45	5	65	0.2	1	1	<2	3
224	244724	2	3	1	25	45	5	75	0.2	1	1	<2	3
225	244725	2	90	1	15	60	5	80	0.2	1	1	<2	3
226	244726	2	2	1	20	45	5	70	0.2	1	1	2	4
227	244727	2	2	1	15	40	5	65	0.2	1	1	<2	3
228	244728	3	2	1	10	45	5	75	0.2	1	1	<2	3
229	244729	2	2	1	20	50	5	90	0.2	1	1	2	3
230	244730	2	2	1	10	55	5	80	0.2	1	1	<2	2
231	244731	2	80	1	15	40	5	80	0.2	1	1	2	3
233	244733	2	2	1	10	55	5	75	0.2	1	1	<2	2
234	244734	2	2	1	15	50	5	75	0.2	1	1	<2	4
235	244735	2	2	1	10	55	5	80	0.2	1	1	2	2
236	244736	2	5	1	25	75	5	80	0.2	1	1	2	3
237	244737	2	2	1	20	60	5	80	0.2	1	1	2	3
238	244738	10	3	1	35	80	5	95	0.2	1	1	<2	3
239	244739	2	2	1	15	40	5	80	0.2	1	1	2	3
240	244740	2	2	1	35	80	5	85	0.2	1	1	2	3
241	244741	2	3	1	35	75	5	105	0.2	1	1	<2	3
242	244742	2	2	1	20	45	5	75	0.2	1	1	<2	3
243	244743	2	2	1	15	40	5	75	0.2	1	1	<2	4
244	244744	2	2	1	10	35	5	70	0.2	1	1	<2	3