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INTRODUCTION

Analytical data for 132 rock samples and 79 stream sediment samples from the Livengood quadrangle are given in tables 1 and 2, and the bedrock type or predominant rock types in the stream drainage are noted. The sample sites are shown on plate 1. The samples were collected as time permitted during the course of geologic mapping in the Livengood quadrangle, and as a part of geological and geochemical investigations in the Fairbanks district, a portion of which is within this quadrangle. These samples do not constitute a systematic and thorough geochemical sampling coverage of the quadrangle. Most of the samples are random grab samples, but some were selected because of obvious metal enrichment and are representative of only a small vein or mineralized zone. Several other reports that include geochemical sample analyses from parts of this quadrangle are listed under references.

The granitic rock bodies and the hornfels associated with them are shown on plate 1. The reader is referred to the geologic map of the Livengood quadrangle (Chapman, Weber, and Taber, 1971) for more complete geological information.

A detailed interpretation of the data is not made in this preliminary report, but all of the analytical values are given. Some anomalous and probably-anomalous values are indicated, and the data may be useful as a guide to geochemical sampling in this quadrangle or in geologically-similar areas. The more outstanding and the clearly anomalous amounts of some of the elements are discussed briefly in the following sections. The values for threshold of anomalous amounts, shown in table 3, have been selected by the authors as reasonable interpretations based on various published analytical values and experience with other Alaskan geochemical samples. Other interpretations may be made, and the reader is referred to Mason (1966), and Parker (1967) for data on amounts of the elements in the earth's crust and various types of rocks.

Undue economic significance should not be attached to apparently-anomalous values without confirming them by means of a systematic sampling program in the area, or rock unit, of interest. Some of the elements do not have primary economic interest, but may be useful as pathfinder elements or the analytical values may serve to establish characteristic geochemical suites for certain rock units.

BEDROCK SAMPLES

Granitic rocks, chiefly monzonite and quartz monzonite, were sampled at Tolovana Hot Springs Dome, Cache, Sawtooth, Wolverine, and Elephant Mountains, and near Troublesome Creek just north of Sawtooth Mountain. Visible sulfide minerals are rarely found in these rocks. Thirty-six samples were analyzed, and 18 of them contain an anomalous amount of one or more of the elements listed in table 3. Weakly anomalous amounts (0.4 ppm) of silver are found in 5 samples (sites 80, 81, 86, 106, 107), all in the Quail Creek-Troublesome Creek area, from dikes or probable dikes that appear to be genetically related to the Wolverine and Sawtooth Mountains plutons. Tin (15-30 ppm) occurs in 3 samples (sites 107, 115, 116) taken in the Troublesome-Willow Creek area, and 70 ppm tin with 20 ppm beryllium are present in a dike (site 19) just outside of the Cache Mountain pluton; one may infer that tin enrichment accompanied a late stage of the granitic intrusion. Lanthanum (100-200 ppm) is found in 4 samples (sites 65, 67, 69, 101) from the granitic plutons or their associated dikes. Either these possibly-anomalous amounts of lanthanum are associated, locally at least, with the granitic rocks in weakly-mineralized areas, or such amounts of this element are normal in the monzonitic rocks. No evidence of a mineralized zone was seen in the vicinity of the one anomalous molybdenum (70 ppm) sample (site 11) at Cache Mountain, and anomalous metal enrichment in and around this pluton is believed to be rare and very local.

Hornfelses, which are peripheral to the granitic bodies, have no visible sulfide minerals except in a few places where small to moderate amounts of very fine-grained pyrite are disseminated in the rock. Twenty-four samples of hornfels were analyzed, and 17 of them contain anomalous amounts of one or more of the elements shown in table 3. Anomalous amounts of copper (150-700 ppm) are present in 14 samples, which is in contrast to the low (≤30 ppm) copper content of the granitic rocks. Eight samples (sites 6, 12, 16, 64, 73, 97, 100, 117) have anomalous amounts of one or more of the following elements:--silver (0.4 to 0.8 ppm), beryllium (30 ppm), tin (15 and 20 ppm), lead (70 and 150 ppm), and lanthanum (100 and 300 ppm). The samples that contain anomalous amounts of metals are from rocks that are very close to a contact with the granitic plutons, and in a few cases are also close to small dikes that probably are genetically related to the plutonic rocks.

The lower Paleozoic mafic and ultramafic rocks are represented by 25 samples, 14 of which show anomalous amounts of one or more of the metals shown in table 3. The average amounts of chromium and nickel are higher than in the other groups of rocks, as would be expected. In 8 of the samples chromium ranges from > 500 to 3,000 ppm, and nickel from 300 to 1,500 ppm, which may be interpreted as anomalous. Copper is not abundant in these samples, and only 2 samples (sites 60, 84) are possibly weakly anomalous (200 and 300 ppm). The values for chromium and copper are similar to those given by Foster (1969, p. 4) for 14 samples of serpentinite from rocks in this unit, but the nickel values are considerably lower than the 2,100 to 5,000 ppm that he reports. Anomalous amounts of lead, 70 and 100 ppm, occur in 2 samples (sites 82, 83) taken along Troublesome Creek near Sawtooth Mountain, and 1.5 ppm silver also is present in the sample from site 82. The lead and silver enrichment are probably related to the later granitic intrusion.

The 30 samples of the Triassic and Permian intrusive and extrusive rocks are chiefly from diabase, diorite, or basalt, and 17 of the samples include anomalous amounts of one or more of the elements listed in table 3. These rocks show a characteristically higher background value for copper, and 12 of them have an anomalous or possibly anomalous amount (150-15,000 ppm). Only 2 copper values are outstanding: 15,000 ppm in a very thin green-stained mineralized shear zone, which is too small to have economic significance, that cuts diabase and basalt in a borrow pit near Isom Creek (site 127); and 7,000 ppm from a tuff-shale-diabase outcrop along upper Hess Creek (site 46) that has no apparent economic significance. The sample from the shear zone also contains anomalous amounts of gold (1.4 ppm), silver (17 ppm), and tin (10 ppm). Nickel and chromium are generally lower in the Triassic and Permian rock unit than in the lower Paleozoic mafic rocks, and few, if any, of the samples show amounts that seem to be anomalous.

There are several anomalous amounts of metals among the 17 samples that are grouped as miscellaneous rock types. Samples from sites 32 and 33 show 300-500 ppm arsenic, 15 ppm molybdenum, and 300 ppm antimony. These samples are from a crushed and sheared shale with abundant yellow, yellow green, white and reddish stains and powdery coatings, and this isolated bluff exposure on Lost Creek north of Noodor Dome is possibly part of a fault zone that could be a favorable host for mineralizing solutions. The metal enrichment in the samples from sites 109, 110, 111, and 112 in the Troublesome Creek-Hunter Creek area, which show anomalous silver (0.5 ppm), molybdenum (7 and 50 ppm) and zinc (500 and 700 ppm), is probably related to veins in fractured or sheared zones.

STREAM SEDIMENT SAMPLES

Most of the anomalous and apparently-anomalous values in the stream sediment samples can be correlated with known mineral deposits or with types of rocks that characteristically have large amounts of certain elements. The geologic map of the Livengood quadrangle (Chapman, Weber, and Taber, 1971) shows the distribution of all rock units and will be helpful in interpreting the analytical values.

The anomalous values are largely grouped in the Pedro Dome-Fairbanks Creek area in the southeastern corner of the quadrangle and in the Amy Dome-Money Knob area at Livengood in the center of the quadrangle. These are the major areas of bedrock and placer mineral deposits, known chiefly for gold, in the quadrangle. Eight samples from the Pedro Dome-Fairbanks Creek area, a part of the Fairbanks mining district, show anomalous amounts of one or more of the following elements:--arsenic 100-240 ppm, silver 1 ppm, molybdenum 15 ppm, lead 50-100 ppm, antimony 8-55 ppm, and tungsten 30-100 ppm. All of these metals are directly or closely associated with the gold deposits in the Fairbanks district. Nine samples from the Amy Dome-Money Knob area contain anomalous amounts of one or more of the following elements:--arsenic 160-1,200 ppm, chromium 700- >1,000 ppm, copper 100-150 ppm, molybdenum 10 ppm, nickel 150-300 ppm, lead 50 ppm, and antimony 15 ppm. The apparently-anomalous amounts of chromium, nickel, and possibly copper are due to their characteristic abundance in the mafic and ultramafic rocks that are common in the area. Arsenic, molybdenum, lead, and antimony are associated with the gold-bearing lode deposits that are the apparent source for the surrounding gold placer deposits.

There are no lode or placer deposits known around Tolovana Hot Springs Dome. The 4 samples from streams that drain the quartz monzonite and surrounding hornfels show 100-500 ppm lanthanum, which are apparently anomalous concentrations, but may be characteristic of this igneous body. Anomalous amounts of beryllium (7 ppm) and tungsten (300 ppm), present in 2 samples (sites 263, 264), are probably indicative of small, localized concentrations near the margin of the pluton. A sample from Uncle Sam Creek (site 265), about 20 miles southwest of Tolovana Hot Springs Dome, contains 150 ppm lanthanum. The presence of lanthanum, plus several exposures of hornfels and spotted slate along Uncle Sam Creek indicate that the Tolovana Hot Springs Dome quartz monzonite pluton extends southwestward, under a thin cover of hornfels and surficial deposits, into this area. Apparently-anomalous amounts of beryllium (10 ppm) and lanthanum (100 ppm) from Buckeye Creek (site 271), which drains the contact zone of the Sawtooth Mountain granitic pluton, suggest that these 2 elements may be characteristically associated with this pluton, also.

Isolated anomalies occur at 4 other sites. One on Cushman Creek, at mile 20 on the Elliott Highway (site 223), shows 120 ppm arsenic and 35 ppm antimony; this probably is derived from a few small, localized pods of stibnite-arsenopyrite in the schist in this small drainage basin. No deposits are known in the area, and another sample (site 224) from this creek does not confirm the anomalous values. A second sample, at site 258 on a small creek 10 miles west of Livengood, contains 15 ppm antimony; however, a sample at site 257 about 0.8 mile downstream does not show an antimony anomaly. This occurrence also can probably be attributed to some small, isolated pods of stibnite in the chert and argillite bedrock. At a third site (233) on Lost Creek 10 miles north of Noodor Dome the sample shows 500 ppm zinc, and this anomaly is believed to be related to a mineralized shear zone that is exposed in the bluff on the west side of the creek. The fourth locality, site 277 on Twentymile Creek near Maypole Hill, shows 700 ppm chromium and 150 ppm nickel; these apparently-anomalous amounts are interpreted as characteristic of the mafic intrusive and extrusive rocks that underlie a large part of this drainage basin.

SUMMARY

The three centers of known mineral deposits in the Livengood quadrangle, Pedro Dome-Fairbanks Creek, Amy Dome-Money Knob, and Sawtooth-Wolverine Mountains areas, can be identified from the distribution of anomalous values of some of the more common metals of economic interest. These areas are more obvious also because of the greater density of samples. The small amount of sampling in and near the Cache Mountain and Tolovana Hot Springs Dome granitic plutons reveals some contact-zone metal enrichment but no outstanding anomalies.

The apparently-anomalous amounts of chromium, nickel, and, in part, copper are due to the characteristic abundance of these elements in mafic and ultramafic rocks. Apparently-anomalous amounts of lanthanum seem to be characteristic of the granitic rocks. Anomalous amounts of silver that are not associated with granitic rocks or vein deposits probably should be evaluated as part of the characteristic "geochemical signature" of parts of the mafic-basaltic rock unit in the northern part of the quadrangle.

The modest anomalies in bedrock and stream sediment samples from Lost Creek north of Noodor Dome are derived from a sheared and mineralized zone in shale, and this zone may be interpreted as part of an east-northeast trending fault zone. No other exposures are known in either direction from Lost Creek along this presumed trend, but surficial and vegetal cover is widespread in this area of low relief. Some sampling might be justified along this possible fault zone, which could be a favorable locus for mineral deposits.

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Table 1.--Semiquantitative spectrographic and other analyses of 132 rock samples from the Livengood quadrangle

Field collectors: R. M. Chapman (Ch), B. Taber (Tb), and F. R. Weber (Wr).

Analysts: E. F. Cooley, K. J. Curry, G. Day, M. DeValliere, C. L. Forn, J. G. Frisken, D. J. Grimes, W. W. Janes, J. B. McHugh, A. L. Meier, R. L. Miller, D. Murrey, H. M. Nakagawa, M. S. Rickard, and R. B. Tripp.

Analyses, unless noted, are semiquantitative spectrographic and are reported in the series 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0, 1.5, and so on or by the following symbols: N = not detected; L = detected but below limit of determination; -- = not looked for; > = greater than; < = less than; A = determined by atomic absorption; C = determined by field method chemical test. In all samples Cd is <50 ppm.

	Map No.	Field No.	Ag	As	Au 1/	B	Ba	Be	Bi	Co	Cr	Cu	Ga	La	Mo	Mn	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Fe	Mg	Ca	Ti
GRANITIC (FELSIC) ROCKS																																
Quartz monzonite	4	67ACh-272	A<.2	N	<.02	L	100	3	N	7	L	L	--	50	N	150	L	L	20	N	5	N	N	L	N	30	N	70	.7	.07	.2	.07
Quartz monzonite	5	67ACh-270	A<.2	N	<.02	30	150	3	N	L	L	7	--	70	N	300	L	5	20	N	5	N	L	15	N	50	N	70	1.5	.15	.3	.15
Quartz monzonite	10	62ATb-327	A<.2	N	<.02	L	150	2	N	5	L	7	--	30	N	200	L	5	20	N	5	N	N	L	N	20	L	70	1.5	.15	.2	.15
Quartz monzonite	11	69ACh-160	A<.2	N	<.02	L	150	5	N	N	L	L	--	70	70	1000	10	5	30	N	L	N	N	10	N	20	N	100	2	.3	.1	.1
Quartz monzonite	13	69ACh-159	A<.2	N	<.02	L	200	5	N	N	5	L	--	N	N	200	10	5	20	N	L	N	N	15	N	20	N	100	2	.3	.5	.1
Quartz monzonite	14	69ACh-162	A<.2	N	<.02	N	100	7	N	N	L	L	--	50	N	150	10	5	50	N	L	N	N	L	N	10	N	100	1.5	.2	.15	.05
Quartz monzonite	17	69ACh-158	A<.2	N	<.02	20	150	5	N	N	N	L	--	N	N	300	10	5	70	N	L	N	N	L	N	70	N	100	1.5	.2	.3	.05
Rhyodacite(?)	19	69ACh-156	A<.2	N	<.02	200	700	20	L	N	5	5	--	N	N	700	50	5	N	N	L	70	200	L	N	15	N	30	1	.3	.15	.03
Quartz monzonite	63	62ATb-124	N	N	<.02	70	700	1	N	15	150	30	--	L	L	1000	15	100	15	N	15	N	L	300	N	20	L	150	10	2	.5	.7
Quartz monzonite	65	69ACh-242	A<.2	N	<.02	10	1500	2	N	15	20	L	--	100	N	1000	30	10	30	N	15	N	700	200	N	30	N	150	10	2	5	.7
Monzonite or quartz monzonite	67	69ACh-99	A<.4	N	<.02	10	1500	3	N	30	150	30	--	100	N	1000	10	30	50	N	15	N	500	150	N	20	L	100	7	3	2	.5
Monzonite dike	69	69ACh-103	A<.4	300	.04	15	150	2	N	10	100	30	--	150	N	70	30	20	30	N	10	N	100	150	N	20	N	500	3	.07	.07	.5
Monzonite or quartz monzonite	70	69ACh-100	A<.4	N	<.02	20	1500	1.5	N	30	150	30	--	20	N	500	L	30	50	N	15	N	300	100	N	15	N	100	3	2	1.5	.3
Monzonite	71	69ACh-101	A<.4	N	<.02	30	1500	1.5	N	50	300	50	--	20	L	700	10	100	50	N	15	N	500	200	N	15	L	70	10	3	3	.5
Monzonite dike	72	69ACh-90	A<.4	N	<.02	15	1500	5	N	20	20	10	--	30	L	1000	15	10	70	N	15	N	700	70	N	20	L	200	5	1.5	1.5	.5
Dioritic(?) dike	74	69ACh-86	A<.4	N	<.02	10	2000	2	N	30	200	5	--	50	L	1000	15	50	30	N	20	L	700	150	N	30	L	200	10	3	1.5	.5
Quartz monzonite	77	69ACh-83	A<.4	N	<.02	15	1000	5	N	15	20	7	--	70	N	700	20	5	50	N	5	N	500	30	N	15	N	200	3	1	1	.3
Quartz monzonite	79	69AWr-247	L	700	<.02	150	700	1.5	N	L	70	15	--	L	N	100	L	70	70	L	L	N	300	70	N	10	2000	70	1.5	.2	.2	.2
Monzonite dike	80	69ACh-39	A0.4	N	<.02	10	200	3	N	50	300	20	--	20	L	1500	15	20	30	N	30	N	500	200	N	20	L	150	7	5	3	.5
Dacite(?) dike	81	69ACh-70	A0.4	N	<.02	20	500	3	N	30	150	20	--	20	L	1500	10	20	30	N	20	N	700	200	N	20	L	100	7	3	3	.5
Monzonite(?) dike	85	69ACh-25	A<.4	N	<.02	30	1500	3	N	20	50	10	--	20	N	700	15	30	20	N	5	N	300	50	N	10	200	200	5	.5	.07	.5
Monzonite(?) dike	86	69ACh-32	A0.4	N	<.02	15	1500	3	N	50	150	30	--	50	L	1500	10	50	30	N	30	N	700	200	N	30	L	150	10	3	2	.5
Monzonite or quartz monzonite	91	69ACh-12	A<.4	N	<.02	50	1500	3	N	30	70	10	--	70	L	700	10	15	30	N	15	N	700	150	N	30	L	70	7	1.5	2	.5
Monzonite or quartz monzonite	92	69ACh-13	A<.4	N	<.02	70	1500	3	N	50	70	30	--	50	L	1000	10	30	30	N	20	N	700	200	N	20	L	150	10	3	3	.7
Monzonite or quartz monzonite	95	69AWr-165B	N	N	<.02	30	300	1.5	N	L	70	15	--	L	N	70	L	30	N	N	7	N	L	150	N	15	N	300	2	.3	.07	.5
Monzonite or quartz monzonite	96	69ACh-3	A<.4	N	<.02	70	1500	5	N	30	30	30	--	50	L	700	10	20	30	N	15	L	700	150	N	30	L	70	7	1.5	2	.7
Monzonite or quartz monzonite	98	69ACh-2	A<.4	N	<.02	100	1500	3	N	30	70	30	--	50	L	1000	10	30	50	N	15	L	500	150	N	20	L	200	7	2	2	.5
Quartz monzonite	101	69ACh-5	A<.4	N	<.02	70	700	3	N	10	10	7	--	200	L	700	15	10	50	N	L	L	300	30	N	20	N	300	5	1	1.5	.5
Quartz monzonite	103	69ACh-9	A<.4	N	<.02	30	700	3	N	10	L	15	--	70	L	150	15	15	10	N	L	N	700	30	L	30	N	300	3	1	2	.5
Diorite(?)	106	69ACh-38	A0.4	N	<.02	10	3000	1	N	30	L	30	--	30	L	1000	15	N	L	N	20	N	100	150	N	70	L	500	15	3	1.5	>1.0
Diorite(?)	107	69ACh-41	A0.4	N	<.02	30	2000	3	N	30	300	5	--	30	L	1500	15	100	20	N	30	30	700	300	N	20	L	150	10	5	5	.7
Quartz monzonite or granite	108	69ACh-42	A<.4	N	<.02	30	700	5	N	20	L	100	--	L	N	300	15	20	70	N	L	L	200	20	N	10	700	200	2	.7	.7	.3
Granite pegmatite	113	69AWr-342A	N	N	<.02	N	L	N	N	N	L	10	--	N	N	70	L	7	N	N	N	N	L	10	N	20	N	70	.3	.1	.05	.03
Granite pegmatite	114	69AWr-342B	N	N	<.02	20	200	5	N	N	L	5	--	N	N	30	L	5	150	N	N	N	L	L	N	L	N	70	.2	.05	.1	.005
Muscovite granite	115	69ACh-151	A<.4	N	<.02	20	150	5	N	L	L	L	--	L	N	70	10	7	70	N	L	15	100	15	N	15	N	50	1	.2	.7	.07
Granite pegmatite	116	70AWr-205A	N	N	N.02	10	50	15	N	N	L	7	--	N	N	30	N	L	10	N	L	15	N	L	N	L	N	10	.5	.05	.1	.005
HORNFELS ASSOCIATED WITH GRANITIC PLUTONS	1	67ACh-268	A<.2	N	<.02	150	300	1	N	7	30	10	--	L	N	150	L	30	L	N	7	N	L	70	N	10	N	200	2	1	.15	.3
	2	70AWr-165	N	N	N.02	200	700	1.5	N	5	150	500	--	50	N	100	N	15	30	N	30	N	150	150	N	50	N	100	1.5	1	L	.3
	3	67ACh-271	A<.2	N	<.02	20	L	L	N	7	L	10	--	L	N	300	L	10	L	N	5	N	L	15	N	10	N	200	2	.7	.3	.2
	6	68ACh-366	A<.2	N	<.02	150	150	30	N	L	L	L	--	L	N	700	10	5	30	N	5	15	150	L	N	20	N	N	.5	.1	.3	.03
	7	68ACh-367	A<.2	N	<.02	10	150	1	N	5	20	7	--	L	N	300	L	7	L	N	7	N	N	20	N	10	N	200	2	.7	.1	.3
	9	68ACh-369	A<.2	N	<.02	L	200	L	N	70	500	300	--	20	N	1000	L	300	30	N	30	N	200	300	N	10	200	70	5	5	5	.7
	12	69ACh-161	A<.2	N	<.02	50	700	2	N	10	150	10	--	100	N	1000	20	30	70	N	20	N	N	200	N	30	L	150	10	1.5	.05	.5
	15	69ACh-163	A<.2	N	<.02	N	150	2	N	7	20	20	--	N	N	1000	L	20	N	N	L	N	150	20	N	20	N	300	5	1	1.5	.1
	16	69ACh-177	A<.2	N	<.02	N	150	2	N	7	50	10	--	300	N	200	10	10	N	N	5	N	200	50	N	30	N	200	5	1	.5	.2
	18	69ACh-157	A<.2	N	<.02	30	200	1.5	N	N	20	L	--	N	N	200	10	10	N	N	5	N	N	30	N	10	N	200	2	.5	.1	.2
	62	62ATb-110	N	N	<.02	30	300	L	N	5	50	50	--	L	N	1500	L	30	10	N	7	N	N	70	N	10	L	50	3	2	.15	.3
	64	62ATb-137	0.5	N	<.02	100	1500	1	N	30	150	70	--	30	L	3000	15	100	150	N	15	N	L	300	N	15	L	100	3	1.5	.1	.7
	68	69ACh-98	A<.4	N	<.02	70	1500	L	N	30	150	50	--	N	L	200	10	150	10	N	15	N	100	300	N	15	L	100	7	1.5	.1	.5
	73	69ACh-91	A0.8	N	<.02	L	1500	1	N	50	150	30	--	50	N	1000	10	30	50	N	20	N	500	200	N	15	L	100	10	5	2	.5
	75	69ACh-88	A<.4	N	<.02	150	1500	1.5	N	30	70	50	--	L	N	1000	15	70	20	N	20	N	L	150	N	30	L	300	5	1.5	.1	.5
	76	69ACh-85	A<.4	N	<.02	50	1500	L	N	30	200	30	--	L	L	700	15	150	20	N	30	N	300	300	N	15	200	150	10	3	1	.5
	78	69ACh-84	A<.4	N	<.02	70	700	2	N	50	200	5	--	30	L	700	15	150	30	N	30	N	150	300	N	30	200	150	10	3	.7	.7
	93	69ACh-14	A<.4	N	<.02	30	1500	2	N	70	700	70	--	70	N	70	15	200	15	N	30	L	150	500	N	30	N	300	7	1.5	.3	1
	94	69ACh-16	A<.4	N	<.02	100	500	2	N	30	150	50	--	20	L	200	15	150	20	N	20	N	100	300	N	20	200	150	5	2	.7	.7
	97	69ACh-1	A0.4	N	<.02	100	700	1.5	N	30	150	30	--	20	L	200	10	100	L	N	20	N	L	200	N	30	L	200	7	1.5	.3	.7
	99	69AWr-158E	N	N	<.02	L	150	L	N	15	150	30	--	N	L	500	10	70	N	N	10	N	150	150	N	20	L	70	3	1	2	.3
	100	69ACh-4	A0.4	N	<.02	100	700	2	N	30	150	70	--	30	L	200	10	100	30	N	20	N	100	300	N	30	300	200	5	2	.15	.7
	102	69AWr-159A	N	N	<.02	L	700	2	N	30	150	150	--	20	L	300	10	50	10	N	15	L	300	150	N	10	L	70	5	1.5	2	.3
	117	70AWr-205H	N	N	N.02	>2000	L	5	N	5	30	20	--	20	N	700	N	10	L	N	15	20	N	70	N	10	300	200	2	1.5	.07	.3
LOWER PALEOZOIC MAFIC AND ULTRAMAFIC ROCKS																																
Diabase	21	69ACh-183	A<.2	N	<.02	10	>5000	N	N	30	200	100	--	--	N	2000	20	100	N	N	30	N	300	300	N	30	N	50	20	5	2	>1.0
Basalt or andesite(?)	22	69ACh-181	A<.2	N	<.02	10	200	L	N	70	2000	70	--	--	N	2000	10	500	N	N	50	N	150	150	N	10	N	30	20	7	7	.5
Basalt or diabase	24	70AWr-173	N	N	N.02	20	70	L	N	70	150	100	--	N	N	700	N	70	10	N	30	N	150	200	N	20	300	70	2	2	7	.5
Diabase or diorite	25	68ACh-351	A<.2	N	<.02	L	100	L	N	15	70	30	--	70	N	700	L	30	N	N	20	N	N	300	N	10	N	50	3	3	5	.3
Serpentinite	26	68ACh-350	A<.2	N	<.02	50	L	N	N	100	1500	5	--	N	N	300	L	1500	N	N	5	N	N	20	N	N	N	N	3	7	L	.01
Diabase or diorite	27	68ACh-352	A<.2	N	<.02	L	200	1	N	20	20	30	--	70	N	700	L	10	L	N	20	N	150	150	N	30	N	150	5	2	7	>1.0
Diabase or diorite	28	70AWr-176E	N	N	N.02	10	2000	1.5	N	N	L	7	--	70	L	50	70	L	10	N	L	N	100	L	N	70	N	700	.7	.15	L	.1
Diabase or diorite	29	70AWr-179D	N	N	N.02	10	70	L	N	20	500	70	--	L	N	1000	15	150	30	N	20	N	300	150	N	10	300	100	2	3	7	.5
Basalt	30	68ACh-356	A<.2	N	<.02	L	700	1	N	70	300	50	--	70	N	700	10	200	L	N	15	N	1500	150	N	15	N	150	7	5	7	>1.0
Diabase or diorite	36	68ACh-328	A<.2	N	<.02	10	1500	1.5	N	50	150	70	--	N	N	500	10	150	N	N	15	N	300	300	N	10	N	70	5	3	5	1
Diabase or diorite	37	68ACh-329	A<.2	N	<.02	10	2000	1	N	30	L	70	--	70	N	700	10	10	L	N	10	N	700	150	N	15	N	70	7	2	5	>1.0
Basalt	39	62ACh-17	<1	<500	--	50	20	2	<10	50	>500	7	<5	<50	<1	700	--	1000	<10	<100	7	<10	<20	30	<50	<5	200	<20	3	10	1	.01
Diorite	40	62ACh-18	<1	<500	--	10	100	5	<10	50	50	100	20	<50	2	1500	--	50	20	<100	30	<10	300	200	<50	30	200	70	7	2	7	.5
Basaltic dike	56	70ACh-241	A<.2	N	<.02	N	20	N	N	N	30	L	--	L	N	700	L	7	N	N	L	N	700	15	N	15	N	70	1.5	1	20	.2
Diorite or diabase	57	63ACh-20	<1	<500	--	<10	>5000	<2	<10	70	500	10	20	<50	<2	1500	--	100	<10	<200	70	<10	300	300	<100	15	<100	20	10	>5	10	.5
Basalt	58	63ACh-21	<1	<500	--	<10	200	<2	<10	30	20	100	30	<50	<2	2000	--	15	<10	<200	50	<10	100	300	<100	20	<100	100	7	5	15	.7
Serpentinite	59	63ACh-22	<1	<500	--	50	<100	<2	<10	100	>1000	50	<5	<50	<2	1000	--	>1000	<10	<200	10	<10	<100	50	<100	<5	<100	<20	5	>5	.05	.005
Diorite or diabase	60	60ACh-219A	<1	C<10	--	<10	150	<1	<10	30	30	200	<20	<50	5	1000	<50	15	<10	C<1	70	<10	700	500	<50	20	C25	50	>10	5	--	.5
Serpentinite	61	60ACh-219B	<1	C<10	--	<10	10	<1	<10	100	700	5	<20	<50	<5	700	<50	1500	<10	C1	<10	<10	10	<10	<50	10	C25	<10	7	>5	--	.002
Basaltic dike	82	62ATb-244B	1.5	N	<.02	20	1500	2	N	20	70	20	--	30	L	1500	15	30	100	50	20	N	700	150	N	20	L	100	10	5	3	.7
Basaltic dike	83	62ATb-244G	L	N	<.02	N	500	1.5	N	30	150	70	--	30	L	700	15	50	70	N	15	N	300	150	N	15	L	70	7	3	3	.3
Serpentinite	84	62ATb-245	L	N	<.02	L	700	L	N	50	70	300	--	L	5	1500	15	100	L	N	30	N	500	300	N	30	200	100	15	3	5	>1.0
Basaltic dike	88	69AWr-181D	N	N	<.02	L	L	N	N	70	1500	7	--	N	N	1500	L	300	N	N	L	N	5	20	N	L	N	L	3	7	10	.015
Diorite or diabase	89	69AWr-182C-1	N	N	<.02	10	L	N	N	150	3000	50	--	N	L	1000	10	1500	N	N	15	N	L	100	N	10	N	L	7	7	.15	.3
Basaltic dike	90	69AWr-182C-2	N	N	<.02	L	L	N	N	100	2000	15	--	N	L	1000	10	1500	N	N	10	N	150	50	N	L	N	L	5	7	5	.15
TRIASSIC AND PERMIAN MAFIC INTRUSIVE AND EXTRUSIVE ROCKS																																
Diabase	34	69ACh-201	A<.2	N	<.02	30	200	N	N	50	150	200	--	50	N	2000	20	100	N	N	30	N	200	500	N	[illegible]	N	100	20	3	10	>1.0
Diabase	35	69ACh-198	A<.2	N	<.02	20	1000	N	N	50	30	300	--	--	N	2000	10	100	N	N	50	N	300	500	N	30	N	100	20	5	7	1
Diabase	42	69ACh-142	A0.4	N	<.02	15	700	L	N	70	70	150	--	N	L	1000	10	100	N	N	30	N	300	300	N	30	L	100	15	3	5	1
Diabase	43	69ACh-139	A<.4	N	<.02	15	300	L	N	70	10	L	--	N	L	1500	10	30	N	N	30	N	200	700	N	30	L	100	20	5	5	1
Diabase	44	69ACh-140	A<.4	N	<.02	10	300	L	N	50	150	200	--	N	L	1000	10	70	N	N	30	N	200	300	N	30	L	70	15	3	5	1
Basaltic volcanic	45	69AWr-319D	N	N	<.02	30	700	L	N	L	15	30	--	N	N	1000	10	20	N	N	10	N	L	30	N	15	N	70	3	.7	.7	.2
Tuff(?)	46	69AWr-319F	1.0	N	<.02	10	1500	1.5	N	30	70	7000	--	L	N	700	10	50	N	N	15	N	100	100	N	10	N	200	3	1.5	.7	.5
Diabase	47	69ACh-141	A<.4	N	<.02	15	700	N	N	50	150	150	--	N	L	1000	10	100	N	N	30	N	150	300	N	20	L	70	15	3	5	.7
Basalt	48	69ACh-143	A0.8	N	<.02	15	300	N	N	30	L	100	--	N	N	1000	10	15	N	N	20	N	L	300	N	15	N	70	10	2	1	.5
Basalt or diabase	49	69ACh-145	A0.4	N	<.02	10	3000	N	N	70	150	150	--	N	L	1500	10	100	N	N	30	N	150	300	N	20	L	70	10	5	2	.7
Basalt	50	69ACh-146	A0.4	N	<.02	15	500	L	N	30	20	30	--	N	L	1000	15	50	N	N	30	N	L	300	N	20	L	100	10	3	2	[illegible]
Diabase	51	69ACh-147	A<.4	N	<.02	15	700	N	N	70	500	50	--	N	L	1000	15	100	N	N	30	N	150	300	N	15	L	70	10	5	3	.7
Diabase	52	69ACh-135	A<.4	N	<.02	10	300	N	N	50	15	150	--	N	L	1500	10	50	N	N	30	N	150	300	N	20	L	70	15	3	5	.7
Basalt	53	69AWr-326	N	N	<.02	50	100	L	N	50	150	200	--	N	L	1000	10	70	N	N	30	N	L	200	N	20	N	70	10	1.5	7	1
Diabase or diorite	54	69ACh-109	A<.4	N	<.02	15	1500	L	N	70	70	70	--	N	L	1500	10	50	L	N	30	N	300	500	N	30	L	100	15	3	5	>1.0
Diabase, pyritic	118	70ACh-232	A<.2	N	<.02	L	50	L	N	50	20	70	--	N	5	1500	10	70	L	N	30	N	150	300	N	30	N	150	15	2	5	.7
Diorite or diabase	119	69AWr-292	N	N	<.02	10	300	N	N	30	150	50	--	N	L	700	10	70	N	N	30	N	300	200	N	10	N	30	5	3	3	.5
Diorite or diabase	120	69ACh-133	A0.4	N	<.02	10	150	N	N	70	700	5	--	N	L	1500	10	150	N	N	30	N	100	300	N	20	300	70	15	7	5	.7
Diorite or diabase	121	69ACh-131	A<.4	N	<.02	15	150	L	N	50	L	L	--	N	L	1500	10	L	N	N	30	N	100	300	N	30	L	70	20	3	3	>1.0
Clay, weathered quartz diorite(?)	122	70ACh-226	A<.2	N	<.02	15	1000	2	N	15	30	30	--	100	L	700	15	20	L	N	30	N	100	200	N	70	N	300	7	.7	.15	.3
Weathered quartz diorite	123	70ACh-227	A<.2	N	<.02	L	2000	1	N	N	L	30	--	30	N	1500	10	5	N	N	15	N	L	70	N	30	N	300	3	.3	.15	.3
Weathered quartz diorite	124	70ACh-228	A<.2	N	<.02	10	1500	3	N	L	L	20	--	100	L	1000	15	7	10	N	20	N	L	30	N	70	N	300	5	.3	.15	.3
Basalt, sheared	125	70ACh-219	A<.2	N	<.02	15	200	L	N	70	20	150	--	L	5	1500	15	50	10	N	30	N	300	300	N	30	N	150	15	3	2	1
Diabase	126	69ACh-134	A<.4	N	<.02	10	300	L	N	70	10	300	--	N	L	1500	10	20	N	N	30	N	150	300	N	50	L	100	20	2	3	>1.0
Green-stained diabase	127	70ACh-216	A17.0	N	1.4	L	>5000	N	N	20	30	15000	--	N	5	700	L	50	15	N	10	10	150	500	N	15	300	70	5	.7	.7	.2
Yellow-coated tuff or chert(?)	128	70ACh-206A	A<.2	N	<.02	30	2000	L	N	N	10	10	--	N	N	100	L	7	N	N	5	N	150	15	N	10	N	100	.7	.1	L	.15
Greenstone and slate contact	129	69AWr-306A	N	N	<.02	L	150	L	N	N	20	10	--	20	N	5000	L	10	N	N	7	N	300	30	N	30	N	30	3	1	20	.1
Diabase or diorite	130	69ACh-124	A<.4	N	<.02	10	150	N	N	70	300	100	--	N	L	1000	10	70	N	N	30	N	300	300	N	20	L	70	15	5	5	.7
Basalt	131	69ACh-126	A<.4	N	<.02	10	300	N	N	50	15	100	--	N	L	1000	10	15	N	N	30	N	100	500	N	15	L	50	15	3	1.5	.5
Diabase or diorite	132	69ACh-121	A0.4	N	<.02	10	150	N	N	50	100	70	--	N	L	1000	10	70	N	N	30	N	200	300	N	20	L	70	15	3	3	1
MISCELLANEOUS ROCKS																																
Yellow-coated limestone	8	68ACh-291	A<.2	N	<.02	N	100	N	N	N	10	L	--	N	N	50	N	7	N	N	N	N	300	15	N	L	N	15	.3	1	>20	.07
Shale	20	69AWr-358	N	N	<.02	30	1500	L	N	30	50	70	--	N	L	700	15	50	N	N	20	N	150	200	N	15	N	70	7	3	.5	.7
Shale	23	68AWr-91B	1.5	N	--	20	5000	1.5	N	5	100	70	--	L	5	5000	15	150	L	N	15	L	500	300	N	30	200	50	>20	3	.5	.2
Gritty quartzite	31	70AWr-193A	N	N	N.02	50	200	1	N	7	20	15	--	100	N	150	N	15	L	N	7	N	N	30	N	20	N	300	.7	.2	.07	.2
Yellow-stained crushed shale	32	68ACh-338	A<.2	500	<.02	200	>5000	1.5	N	10	70	50	--	30	N	70	L	50	L	N	15	N	200	700	N	30	L	150	7	.5	.1	.3
Yellow coating on soft shale	33	68ACh-339	A<.2	300	.02	150	3000	1	N	L	30	15	--	20	15	30	L	10	30	300	5	N	150	100	N	15	N	100	10	.3	.15	.2
Limestone	38	57ACh-388	--	--	--	--	--	--	--	--	--	C10	--	--	--	--	--	--	C<20	C<1	--	--	--	--	--	--	C<20	--	--	--	--	--
Limestone/dolomite	41	62ACh-6	<1	<500	--	<10	20	3	<10	<5	10	5	<5	<50	<1	200	--	5	<10	<100	<5	<10	150	15	<50	<5	100	<20	.2	7	20	.01
Pyritic chert	55	70ACh-239	A<.2	N	<.02	15	200	L	N	L	30	30	--	L	N	1500	10	7	L	N	10	N	L	70	N	10	N	70	3	.7	.07	.5
Quartz and chert	66	67AWr-108	N	N	--	L	150	L	N	L	L	L	--	N	N	15	N	5	N	N	N	N	100	15	N	15	N	N	.1	L	1.5	.007
Sulfide-bearing quartzite	87	69AWr-180B	N	N	<.02	30	200	L	N	N	15	10	--	L	N	70	L	30	N	N	5	N	L	100	N	10	N	70	1	.3	L	.3
Shale	104	69AWr-155	N	300	<.02	150	100	3	N	20	50	70	--	50	L	1000	10	30	L	N	15	N	L	70	N	20	L	70	10	1	L	.3
Iron-stained quartz	105	69AWr-174	N	N	<.02	15	L	1.5	N	N	L	50	--	N	L	150	L	50	N	N	N	N	L	15	N	10	N	L	3	.05	L	.03
Iron-stained chert	109	69AWr-209	N	L	<.02	15	300	N	N	L	20	30	--	N	7	70	L	30	10	N	N	N	L	20	N	L	N	L	2	.15	.05	.02
Calcareous breccia	110	69AWr-344A	0.5	N	<.02	10	200	N	N	N	30	7	--	N	L	700	L	15	L	N	N	N	300	30	N	L	N	20	.7	.3	15	.05
Calcareous breccia	111	69AWr-344B	L	L	<.02	20	300	L	N	5	30	15	--	N	5	700	10	30	L	N	L	N	300	50	N	L	500	20	5	.3	15	.07
Calcareous breccia	112	69AWr-344C	N	N	<.02	30	700	L	N	150	20	70	--	L	50	>5000	15	100	15	N	5	N	300	70	N	70	700	30	5	1	2	.07
Lower limits of spectrographic determination			.5	200	.02	10	5	1	10	5	5	5	20	20	5	10	10	2	10	100	5	10	50	10	50	10	200	20	.05	.02	.05	.001

1/ Atomic absorption

Table 2.--Semiquantitative spectrographic and other analyses of 79 stream sediment samples from the Livengood quadrangle

Field collectors: R. M. Chapman (Ch), D. W. Hinckley (Hw), B. Taber (Tb), and F. R. Weber (Wr).

Analysts: M. J. Bright, E. F. Cooley, K. J. Curry, M. DeValliere, J. G. Frisken, D. J. Grimes, R. T. Hopkins, Jr., W. W. Janes, W. L. Jones, K. W. Leong, J. B. McHugh, H. H. Mehnert, R. L. Miller, E. Mosier, D. G. Murrey, H. M. Nakagawa, U. Oda, and J. G. Viets.

Analyses, unless noted, are semiquantitative spectrographic and are reported in the series 0.1, 0.15, 0.2, 0.3, 0.5, 0.7, 1.0, 1.5, and so on, or by the following symbols: N = not detected; L = detected but below limit of determination, -- = not looked for; > = greater than; < = less than, A = determined by atomic absorption; C = determined by field method chemical test. In all samples Cd is <50 ppm.

Predominant rock types in drainage area	Map No.	Field No.	Ag	As	Au 1/	B	Ba	Be	Bi	Co	Cr	Cu	Ga	La	Mo	Mn	Nb	Ni	Pb	Sb	Sc	Sn	Sr	V	W	Y	Zn	Zr	Fe	Mg	Ca	Ti
Metamorphic rocks; schist	200	60ACh-58	<5	C<10	--	50	700	<5	<10	10	150	20	20	<50	<5	500	--	20	15	C2	15	<10	300	100	--	15	C50	300	2.0	.7	1.5	.3
Metamorphic rocks; schist	201	65ACh-53	<1	C10	--	70	500	<2	<30	10	50	10	15	20	<1	1000	--	10	<10	C2	15	<20	100	100	<200	20	C75	500	5.0	1.5	1.0	.7
Metamorphic rocks; schist	202	57ACh-418	<5	<1000	--	30	200	<5	<10	7	70	15	15	<50	<5	2000	--	10	10	C1	15	<10	70	70	--	30	C50	150	2.0	.5	.7	.3
Metamorphic rocks; schist	203	57ACh-417	<5	<1000	--	50	300	<5	<10	7	50	15	10	<50	<5	500	--	10	<10	C1	10	<10	70	70	--	15	C50	150	1.5	.3	.2	.3
Metamorphic rocks; schist	204	57ACh-416	<5	<1000	--	15	200	<5	<10	7	30	15	5	<50	<5	300	--	10	<10	C1	10	<10	50	30	--	<10	C50	100	1.5	.2	.07	.2
Metamorphic rocks; schist	205	57ACh-415	<5	<1000	--	20	200	<5	<10	15	50	20	7	<50	<5	1000	--	15	<10	C1	10	<10	<50	70	--	15	C20	70	2.0	.5	.15	.2
Schist; placer and lode gold	206	60ACh-9	<5	C30	--	50	700	<5	<10	10	150	10	10	<50	<5	500	--	20	10	C4	15	<10	200	70	C<20	20	C50	300	2.0	.5	.7	.7
Schist; placer and lode gold	207	60ACh-8	<5	C100	--	50	700	<5	<10	10	150	15	10	<50	<5	500	--	20	10	C4	10	<10	200	70	C<20	20	C50	300	2.0	.5	.5	.5
Schist; placer and lode gold	208	60ACh-7	--	C60	--	--	--	--	--	--	--	--	--	--	C4	--	--	--	--	C3	--	--	--	--	C<20	--	C50	--	--	--	--	--
Schist; placer and lode gold	209	60ACh-6	<1	C20	--	100	700	<1	<10	15	100	50	<20	70	<5	1000	<50	20	15	C2	15	<10	100	100	C<20	20	C50	300	5.0	1.5	--	.7
Schist; placer and lode gold	210	58ACh-337	<5	<1000	--	10	200	<5	<10	<5	70	10	<5	<50	<5	200	--	7	10	C3	<10	<10	50	50	--	<10	C50	150	1.0	.1	.05	.15
Schist; placer and lode gold	211	58ACh-336	1	<1000	--	70	1500	1	<10	15	100	50	<20	50	<5	1500	<50	50	70	C5	15	<10	150	100	<100	30	C<25	300	5.0	1.5	--	.7
Schist	212	58ACh-335	<5	<1000	--	20	500	<5	<10	5	100	15	10	<50	<5	300	--	15	10	C1	<10	<10	150	70	--	10	C25	100	1.5	.3	.3	.2
Schist; placer and lode gold	213	60ACh-5	<5	C240	--	70	1000	<5	<10	7	150	15	15	<50	<5	700	--	15	70	C55	10	<10	200	100	C<20	20	C75	300	2.0	.5	1.0	.5
Schist; placer and lode gold	214	60ACh-4	<1	C240	--	70	700	1	<10	15	50	50	<20	50	5	1000	<50	20	50	C8	10	<10	50	70	C<20	20	C100	200	3.0	1.5	--	.7
Schist; placer and lode gold	215	60ACh-3	1	C240	--	100	1500	1	<10	20	150	70	<20	50	15	2000	<50	50	100	C20	20	<10	150	100	C30	30	C100	300	7.0	3.0	--	1.0
Granitic rocks, schist; placer and lode gold	216	56ACh-218	<5	C150	--	30	200	<5	<10	5	50	10	5	<50	<5	200	--	10	15	C6	<10	<10	70	50	C<20	10	C75	100	1.0	.15	.07	.2
Granitic rocks, schist; placer and lode gold	217	56ACh-217	<1	C60	--	100	700	1	<10	10	100	50	<20	50	<5	1000	<50	50	20	C6	15	<10	150	70	C<20	20	C75	200	5.0	1.5	--	.7
Granitic rocks, schist; placer and lode gold	218	56ACh-216	<5	C80	--	20	700	<5	<10	5	70	10	7	<50	<5	500	--	10	<10	C10	10	<10	150	50	C<20	10	C50	200	1.0	.5	.5	.3
Granitic rocks, schist; placer and lode gold	219	56ACh-215	<1	C60	--	100	2000	1	<10	15	70	30	<20	50	15	1000	<50	30	30	C3	20	<10	300	100	100	30	C50	500	5.0	1.5	--	1.0
Granitic rocks, schist; placer and lode gold	220	56ACh-219	<5	C20	--	50	500	<5	<10	5	70	10	10	<50	<5	200	--	10	15	C3	<10	<10	100	70	C<20	15	C50	200	1.5	.3	.2	.3
Schist	221	56ACh-220	<5	C10	--	20	300	<5	<10	5	100	15	7	<50	<5	150	--	15	<10	C2	<10	<10	150	50	C<20	10	C50	150	1.5	.2	.3	.2
Schist and phyllite	222	56ACh-223	<5	C10	--	30	200	<5	<10	<5	30	7	<5	<50	<5	150	--	7	<10	C2	<10	<10	70	30	--	10	C25	150	.7	.1	.07	.2
Schist and phyllite	223	56ACh-222	<5	C120	--	50	300	<5	<10	7	50	10	7	<50	<5	700	--	15	15	C35	<10	<10	100	70	--	15	C50	200	1.5	.2	.2	.3
Schist and phyllite	224	60ACh-17	<5	C10	--	15	700	<5	<10	15	150	15	10	<50	<5	1000	--	20	<10	C<1	10	<10	200	100	--	15	C50	300	2.0	.5	.5	.5
Phyllite, quartzite	225	57ACh-393	<5	<1000	--	30	300	<5	<10	<5	70	10	<5	<50	<5	500	--	10	<10	<200	<10	<10	100	30	--	10	<200	50	.7	.1	.2	.15
Phyllite, quartzite	226	60ACh-16	<1	C10	--	100	1500	1	<10	15	100	30	<20	50	<5	1000	<50	20	10	C<1	15	<10	150	100	<100	20	C50	200	3.0	2.0	--	.7
Quartzite, slate, argillite	227	60ACh-15	<5	C10	--	30	1000	<5	<10	7	200	20	15	<50	<5	500	--	20	10	C1	15	<10	300	100	--	20	C50	300	2.0	.5	1.0	.3
Quartzite, slate, argillite	228	57ACh-392	<5	<1000	--	30	700	<5	<10	7	70	15	10	<50	<5	500	--	15	10	<200	10	<10	150	70	--	15	<200	200	1.0	.3	.5	.2
Limestone, argillite	229	63ACh-59	<1	C10	--	100	1500	<2	<10	20	150	15	15	70	<2	700	--	50	<10	C3	15	<10	200	150	<100	30	C50	500	3.0	1.0	2.0	.7
Mafic rocks, quartzite	230	60ACh-14	<5	C10	--	30	1000	<5	<10	10	200	15	10	<50	<5	500	--	20	10	C1	15	<10	300	150	--	15	C50	300	2.0	.5	1.5	.5
Shale, graywacke	231	60ACh-13	<5	C10	--	50	1000	<5	<10	7	200	20	10	<50	<5	500	--	15	<10	C2	15	<10	300	100	--	20	C75	200	2.0	.7	1.0	.3
Schist, phyllite	232	68AWr-49	N	N	L(.02)	50	300	L	N	10	30	L	--	20	N	500	10	20	10	N	7	N	L	50	N	10	N	300	2.0	.5	.15	.7
Shale, quartzite; fault zone(?)	233	68ACh-340	A<.2	N	L(.02)	70	5000	1	N	15	100	30	--	30	N	200	15	70	15	N	15	N	L	200	N	20	500	200	3.0	.7	.7	.3
Argillite, mafic rocks	234	68ACh-245	A<.2	N	L(.02)	50	1500	1	N	20	70	30	--	30	N	1000	10	30	10	N	15	N	100	150	N	20	N	300	3.0	.7	.7	.3
Chert, slate, mafic rocks	235	68ACh-243	A<.2	N	L(.02)	150	700	1	N	30	150	15	--	70	N	700	20	30	L	N	20	N	L	150	N	30	N	300	5.0	1.0	.7	.7
Chert, argillite, limestone	236	68ACh-238	A<.2	N	L(.02)	30	300	L	N	10	20	10	--	20	N	200	L	15	L	N	7	N	L	100	N	L	N	100	3.0	.5	.5	.2
Graywacke, shale, chert, mafic rocks	237	62ACh-203	<1	C<10	--	50	700	2	<10	30	200	70	10	50	2	1000	--	100	10	C<1	10	<20	<100	150	<200	15	C50	200	5.0	1.5	1.5	.7
Graywacke, shale, mafic rocks	238	58ACh-43	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	C150	--	C1	--	--	--	--	--	--	C25	--	--	--	--	--
Graywacke, shale	239	58ACh-289	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	C25	--	C1	--	--	--	--	--	--	C25	--	--	--	--	--
Graywacke, mafic rocks, limestone	240	58ACh-42	<1	<1000	--	50	1500	<1	<10	20	700	100	<20	50	<5	5000	<50	200	10	C4	15	<10	150	150	<100	30	C25	300	5.0	5.0	--	.7
Graywacke, shale, limestone	241	62ACh-204	<1	C160	--	70	1000	3	<10	15	150	30	15	50	2	700	--	70	15	C<1	10	<20	200	200	<200	20	C50	300	5.0	.7	1.5	.7
Graywacke, limestone, mafic rocks, and placer gold	242	58ACh-290	<1	1500	--	100	2000	1	<10	20	1000	150	<20	50	10	1000	<50	200	50	C15	15	<10	200	200	<100	50	C25	300	5.0	5.0	--	.5
Graywacke, limestone, mafic rocks, and placer gold	243	62ACh-5	<1	C300	--	70	1000	2	<10	20	>1000	30	15	50	3	700	--	200	15	C<1	10	<20	150	150	<200	20	C75	300	5.0	2.0	.7	.3
Graywacke, limestone, mafic rocks, and placer gold	244	62ACh-1	<1	C1200	--	100	1500	3	<10	15	300	30	15	70	5	700	--	150	20	C2	10	<20	200	150	<200	30	C100	500	5.0	1.5	1.5	.3
Graywacke, limestone, mafic rocks, and placer gold	245	58ACh-292	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	C50	--	C6	--	--	--	--	--	--	C25	--	--	--	--	--
Graywacke, limestone, mafic rocks, and placer gold	246	58ACh-291	<1	<1000	--	50	1000	1	<10	10	200	70	<20	50	5	700	<50	50	10	C4	15	<10	100	150	<100	20	C50	200	3.0	1.0	--	.5
Limestone, chert, mafic rocks, and placer gold	247	64ACh-28	<1	C50	--	30	700	<1	<10	20	500	20	10	<50	<2	2000	--	300	20	C7	7	<10	--	200	<50	<10	C25	150	5.0	5.0	.7	.5
Limestone, chert, mafic rocks, and placer gold	248	62ATb-29A	<1	C10	--	30	1000	2	<10	15	500	30	15	<50	2	1000	--	100	15	C<1	10	<20	200	100	<200	15	C50	200	5.0	2.0	5.0	.3
Limestone, chert, mafic rocks, and placer gold	249	63ACh-13	<1	C30	--	70	1000	<2	<10	30	700	20	20	50	<2	2000	--	100	10	C4	15	<10	200	150	<100	30	C50	300	5.0	1.5	3.0	1.0
Mafic rocks, chert, limestone	250	63ACh-17	<1	C20	--	50	500	<2	<10	50	>1000	30	15	50	<2	1000	--	300	<10	C6	20	<10	100	150	<100	20	C50	200	5.0	3.0	2.0	.7
Chert, limestone	251	62ACh-9	<1	C10	--	30	1000	2	<10	10	100	15	7	<50	<2	700	--	20	10	C<1	7	<20	150	150	<200	15	C50	300	3.0	.7	3.0	.5
Chert, argillite, limestone	252	62ACh-26	<1	C10	--	30	1000	2	<10	15	150	20	10	50	2	500	--	30	10	C<1	10	<20	200	100	<200	20	C50	300	5.0	1.0	3.0	.5
Mafic rocks, chert, argillite	253	60ACh-10	--	C20	--	--	--	--	--	--	C500	C20	--	--	--	--	--	C100	C<25	C1	--	--	--	--	--	--	C75	--	--	--	--	--
Mafic rocks, chert, argillite	254	60ACh-11	<5	C10	--	30	1000	<5	<10	10	500	20	7	<50	<5	300	--	50	<10	C2	10	<10	200	100	--	15	C75	300	2.0	.7	.5	.5
Mafic rocks, chert, argillite	255	60ACh-12	<5	C10	--	50	1000	<5	<10	10	500	20	7	<50	<5	500	--	50	<10	C2	15	<10	200	150	--	20	C50	300	2.0	.7	1.0	.3
Chert, argillite	256	62ACh-113	<1	C<10	--	30	1000	2	<10	15	100	20	10	70	2	700	--	30	10	C<1	10	<20	150	150	<200	15	C50	300	5.0	1.0	1.5	.5
Chert, argillite, limestone	257	62ACh-111	<1	C<10	--	30	1000	2	<10	15	100	20	15	<50	2	700	--	30	10	C<1	10	<20	150	150	<200	15	C50	200	5.0	1.0	2.0	.5
Chert, argillite	258	64ACh-37	<1	C<10	--	30	700	<1	<10	10	50	10	7	<50	<2	500	--	20	10	C15	7	<10	--	200	<50	<10	C25	200	2.0	1.0	1.0	.5
Mafic rocks, chert, shale	259	62ACh-183	<1	C<10	--	50	1000	2	<10	15	150	20	10	<50	3	500	--	70	10	C<1	10	<20	100	150	<200	15	C50	200	3.0	1.0	1.0	.5
Graywacke, shale, quartzite	260	62ACh-31	<1	C<10	--	70	1000	2	<10	50	100	70	10	50	3	1000	--	50	10	C<1	7	<20	100	150	<200	30	C125	150	5.0	.7	1.0	.3
Graywacke, shale	261	62ACh-47	<1	C<10	--	50	1000	5	<10	15	150	30	15	100	2	2000	--	20	10	C<1	15	<20	300	200	<200	30	C50	1000	5.0	1.0	5.0	>1.0
Granitic rocks, slate, hornfels	262	62ACh-56	<1	C80	--	50	1000	3	<10	20	100	70	15	100	2	1500	--	50	30	C<1	10	<20	500	150	<200	20	C75	70	5.0	1.0	3.0	.7
Granitic rocks, slate, hornfels	263	62ACh-59	<1	C40	--	70	2000	3	<10	15	150	70	20	300	2	>5000	--	50	30	C1.5	10	<20	500	100	300	20	C75	500	5.0	1.0	2.0	.7
Granitic rocks, slate, hornfels	264	62ACh-64	<1	C<10	--	20	700	7	<10	15	70	20	15	500	<2	1000	--	10	15	C<1	15	<20	500	100	<200	50	C50	>1000	5.0	1.5	3.0	1.0
Graywacke, shale	265	62ACh-85	<1	C<10	--	50	500	2	<10	10	100	10	7	150	<2	500	--	30	10	C<1	7	<20	100	100	<200	10	C50	200	3.0	.7	1.0	.3
Quartzite, slate, limestone, mafic rocks	266	62ACh-99	<1	C<10	--	30	1000	2	<10	15	100	15	10	50	<2	700	--	30	15	C<1	10	<20	200	100	<200	15	C50	200	3.0	1.0	3.0	.3
Quartzite, slate, limestone, mafic rocks	267	62ACh-105	<1	C<10	--	30	1000	2	<10	15	150	10	15	50	<2	500	--	30	10	C<1	10	<20	200	100	<200	15	C50	300	3.0	1.0	2.0	.5
Graywacke, shale	268	63ACh-51	<1	C10	--	100	1000	<2	<10	15	200	20	15	70	<2	700	--	70	<10	C2	20	<10	200	150	<100	30	C50	300	3.0	1.0	2.0	.7
Graywacke, shale	269	57AHw-37B	<2	C40	--	70	1500	<2	<10	20	200	20	--	<50	<10	1500	--	70	10	C3	20	<10	300	200	--	20	C80	200	>5.0	1.5	--	.3
Graywacke, shale	270	62ACh-114	<1	C10	--	30	1500	3	<10	15	150	20	15	70	2	700	--	50	15	C<1	10	<20	200	150	<200	15	C50	700	5.0	1.0	2.0	.3
Graywacke, shale, granitic rocks	271	62ACh-126	<1	C80	--	50	1000	10	<10	50	100	30	15	100	2	1500	--	20	20	C2	20	<20	300	200	<200	30	C50	>1000	7.0	2.0	5.0	1.0
Graywacke, shale, granitic rocks	272	62ACh-125	<1	C10	--	50	1000	3	<10	50	100	20	10	50	<2	2000	--	70	10	C<1	10	<20	150	150	<200	20	C75	300	5.0	.7	1.0	.5
Graywacke, shale	273	62ACh-148	<1	C<10	--	50	1000	2	<10	20	150	30	15	70	<2	1000	--	70	10	C<1	10	<20	100	150	<200	20	C75	300	5.0	1.0	1.0	.5
Graywacke, shale, granitic rocks, hornfels	274	62ACh-168	<1	C20	--	100	1500	3	<10	15	200	50	20	50	2	700	--	70	30	C<1	15	<20	200	200	<200	20	C100	200	5.0	1.5	2.0	.7
Graywacke, shale, hornfels, granitic rocks	275	62ACh-169	<1	C80	--	70	1500	2	<10	15	300	50	15	70	2	1000	--	50	30	C1	15	<20	200	150	<200	20	C75	200	5.0	1.0	2.0	.7
Graywacke, shale, hornfels, granitic rocks	276	62ACh-163	<1	C40	--	100	1000	3	<10	50	150	50	15	50	2	2000	--	100	20	C<1	15	<20	150	150	<200	20	C100	300	7.0	1.0	2.0	.7
Mafic rocks, chert, argillite	277	70ACh-306	N	N	L(.02)	15	700	L	N	30	700	50	--	L	L	1500	15	150	<10	N	30	N	150	300	N	20	N	300	7.0	3.0	3.0	.7
Mafic rocks	278	70ACh-249	N	N	L(.02)	50	500	1.5	N	15	150	15	--	30	L	700	15	70	10	N	15	N	150	150	N	30	N	200	3.0	1.5	1.5	.5
Lower limits of spectrographic determination			.5	200	.02	10	5	1	10	5	5	5	20	20	5	10	10	2	10	100	5	10	50	10	50	10	200	20	.05	.02	.05	.001

1/ Atomic absorption

TABLE 3

Probable threshold anomalous amounts in parts per million for some elements of economic or geochemical interest

[Values are arbitrarily selected, based in part on figures given by Mason (1966) and Parker (1967) for crustal average and several common types of rocks.]

Element	Bedrock	Stream sediment
Ag	0.4	0.4
As	1/	100.
Au	0.1	--
Be	10.	7.
Cr	700.	700.
Cu	150.	100.
La	100.	100.
Mo	7.	10.
Ni	300.	150.
Pb	70.	50.
Sb	1/	8.
Sn	10.	--
W	1/	20.
Zn	500.	200.

1/ Value omitted; analytical method is not sensitive enough to show possible anomalies in the lower range.

GEOCHEMICAL ANALYSES OF BEDROCK AND STREAM SEDIMENT SAMPLES FROM THE LIVENGOOD QUADRANGLE, ALASKA

By Robert M. Chapman and Florence R. Weber

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