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A TRACE ELEMENT STUDY OF THE
CIRCLE MINING DISTRICT, ALASKA

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By James C. Barker, Alaska Field Operations Center
Fairbanks, Alaska

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UNITED STATES DEPARTMENT OF INTERIOR

Cecil D. Andrus, Secretary

BUREAU OF MINES

CONTENTS

Abstract	1
Introduction	2
Acknowledgments	3
Location and Accessibility	4
History	5
Physiography	6
General Geology and Mineralization	7
Description of Boulder Creek	8
Description of Bedrock Creek	10
Description of Deadwood Creek	10
Other Heavy Mineral Occurrences	12
Sampling Program	13
Conclusions	16
References	33
Appendix A -- Pan and sluice concentrate analyses	35
Appendix B -- Sediment sample analyses	57

ILLUSTRATIONS

<u>Figure</u>	<u>Page</u>
1. Index map	3
2. Map of the study area.	4
3. Stream sediment and rock sample sites	9
4. Pan and sluice box sample sites	14
5. Histogram portrayal of concentrate sample results.	15
6. Tin concentrations by sample site	18
7. Tungsten concentrations by sample site	19
8. Lead and molybdenum concentrations by sample site.	20
9. Beryllium and boron concentrations by sample site.	21
10. Lanthanum and cerium concentrations by sample site	22
11. Yttrium and columbium concentrations by sample site.	23
12. Tin concentrations by the "recovery factor method"	31
13. Tungsten concentrations by the "recovery factor method"	32

TABLES

<u>Number</u>		
1.	Boulder creek sluice box concentrates	11
2.	Tin and tungsten sample concentrates and recovery factors	24

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by

James C. Barker 1/

ABSTRACT

The Circle Mining District including the Birch Creek area has been known for years for its tin (cassiterite) and tungsten (wolframite and scheelite) minerals occurring in gold placer concentrates. In 1975 significant quantities of placer cassiterite and scheelite were also found by placer miners on upper Boulder Creek. Although no lode source for these placer minerals could be found, unweathered pieces of cassiterite were seen with fragments of vein quartz and schist attached.

The occurrence on Boulder Creek is located in the Birch Creek Schist near the contact of the Circle Hot Springs intrusive. Examination of the sluice box concentrates indicated 63 percent cassiterite and 0.2 percent scheelite.

Further work by the Bureau of Mines consisted of pan concentrate and limited stream sediment sampling of various creeks in the district and examination of numerous outcrops. Concentrate analyses plots were made of ten elements occurring in heavy mineral samples. As a result, a zone of tin and tungsten mineralization was defined.

INTRODUCTION

This report presents the results of a study by the Bureau of Mines of trace elements in stream valleys of the Circle Mining District in east central Alaska. This district is an old gold placer mining area known to contain tin and tungsten mineralization.

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The purpose of the investigation was to obtain a better picture of the distribution and extent of tin and tungsten mineralization.

ACKNOWLEDGMENTS

Acknowledgment is made to Mr. William Hawkins who holds claims on Boulder Creek and brought his discovery of cassiterite to the Bureau's attention and to the many other placer miners who made the sampling possible.

The particular assistance of Mr. Mitch Henning and Mr. Gil Eakins, geologists for the Alaska Division of Geological and Geophysical Surveys who assisted with field examinations and helicopter support, is also acknowledged.

LOCATION AND ACCESSIBILITY

Central, located 125 road miles northeast of Fairbanks, is the main distribution center for the district. The community has a permanent population of approximately 50 people and offers highway services, supplies, and a post office. In addition, the resort at Circle Hot Springs, nine miles to the east of Central, provides lodging and meals on a year round basis, figure 1.

The majority of the mining activity is located between $65^{\circ} 20'$ and $65^{\circ} 35'$ north latitude and between $144^{\circ} 10'$ and $145^{\circ} 45'$ west longitude about 80 miles south of the Arctic Circle, figure 2. The area is served by scheduled air service from Fairbanks and by various air taxi operators to the airstrips at Central and Circle Hot Springs. Most freight is now brought over the Steese Highway, which is an improved gravel road from Fairbanks, although historically it was landed at Circle via the Yukon river boats and then transported overland approximately 35 miles. The

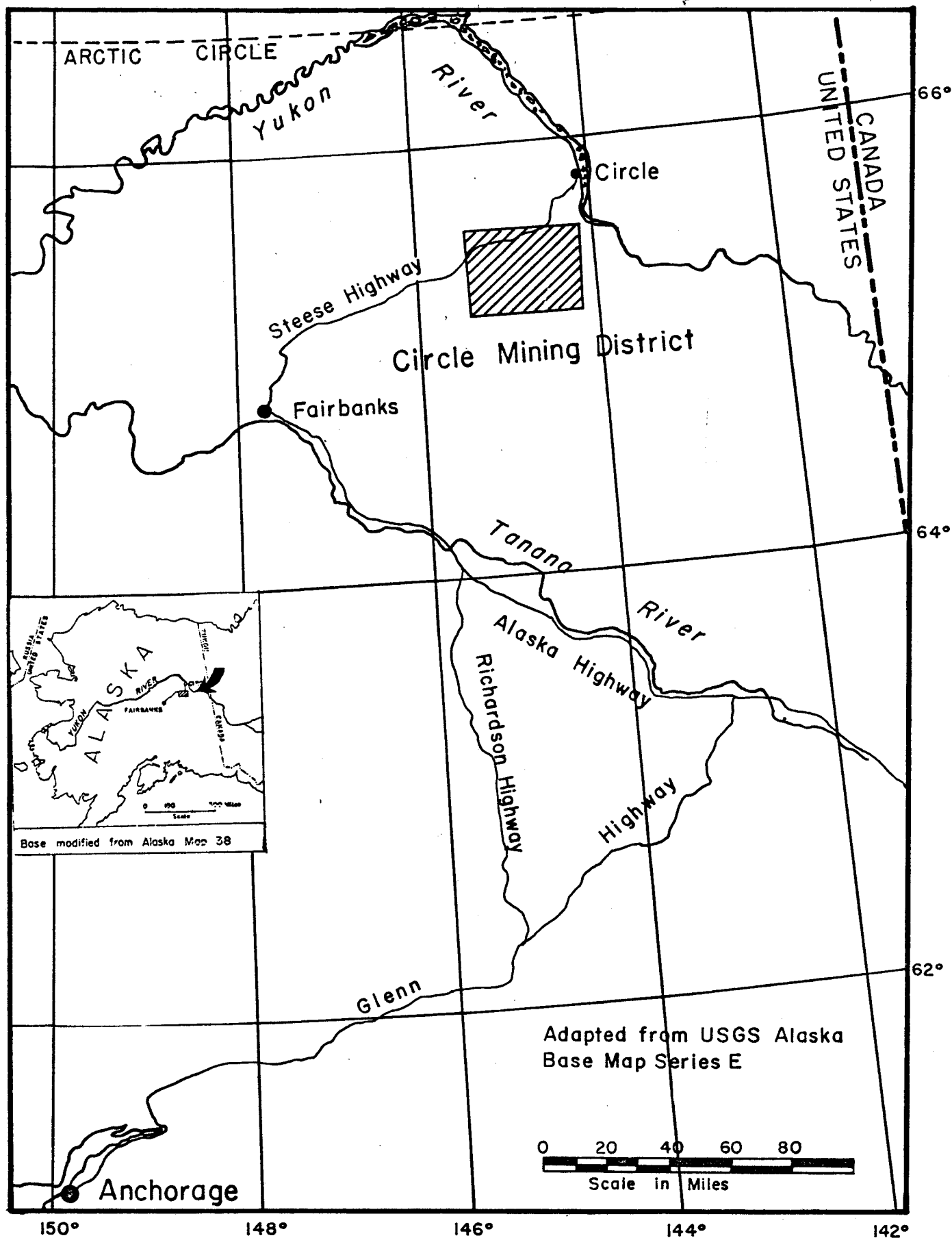


FIGURE 1.- Index map

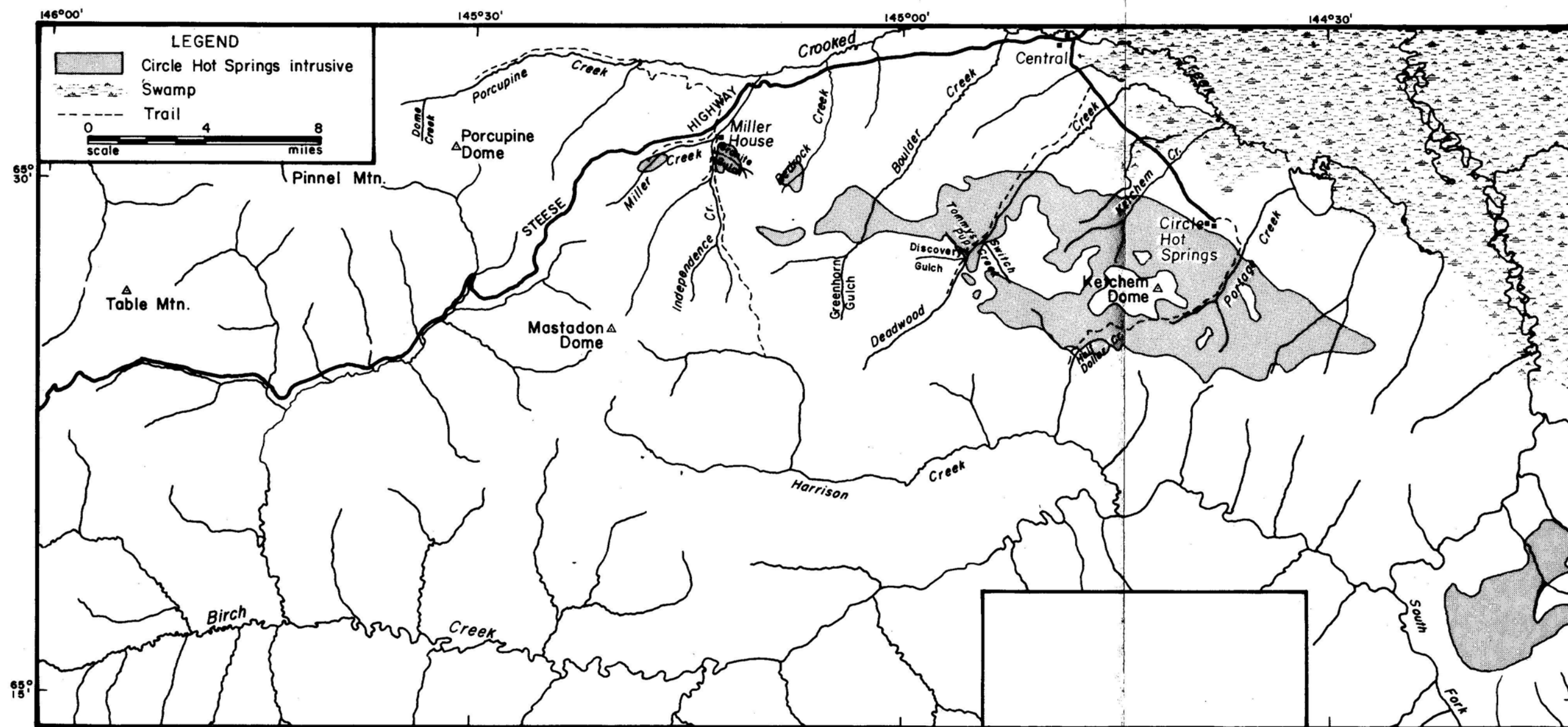


FIGURE 2.- Map of the study area

majority of the placer operations can be reached by light truck over unimproved mine roads from either Miller House or Circle Hot Springs.

HISTORY

Placer mining has been intermittent since gold was first discovered in 1893 in what was originally known as the Birch Creek District (14).^{2/} Since then most of the district has been reasonably prospected for shallow placer gold deposits, and most of the creeks are now under active or patented mining claims. An estimated 277,650 oz. of placer gold and 52,270 oz. of silver byproduct have been recovered from the district through 1970 (1). This past production represents about \$68 million in gold and \$0.38 million in silver at February 1979 prices.

PHYSIOGRAPHY

The Circle Mining District is part of the Tanana-Yukon Uplands physiographic region which is typified by hilly unglaciated terrain and moderately deep narrow valleys. Porcupine Dome at 4,915 feet is the highest elevation in the area with valley floors descending to 1,000 feet. The area is within a zone of discontinuous permafrost. Frozen colluvium and vegetation cover most slopes and valleys with only the higher more resistant ridges exposing bedrock. Excellent examples of solifluction lobes can be found on many hillsides.

Treeline reaches to about 2,500 feet elevation, above which the terrain is generally open tundra. Below the treeline, vegetation is continuous black spruce, alder, willows, and muskeg. Some southerly slopes support stands of birch, aspen, and white spruce.

The climate is typical interior continental. Mean maximum temperature

^{2/} Underlined numbers refer to items in the list of references preceeding the appendixes.

in July is 74°F while the mean minimum in January is -20°F. Precipitation is approximately 10-11 inches per year including about 50 inches of snow (10). Snowfall is generally melted by late May except for the higher shaded slopes.

GENERAL GEOLOGY AND MINERALIZATION

The geology of the Circle Mining District has been described by Prindle and Mertie (14, 12). As of January 1979, a geologic map of the Circle quadrangle had not yet been prepared. Metamorphic bedrock in the area is a quartz mica schist and quartzite known as Birch Creek Schist of Precambrian age. More recently the Birch Creek Schist was thought to include younger Paleozoic units (5). The general cleavage strike of the metamorphic rocks is northwest and dipping moderately to the west. These rocks range from the lower greenschist facies to amphibolite facies in certain localities (19). Some localities of carbonaceous and calcareous members of the Birch Creek Schist are known just to the southeast of the district and are well exposed in the cliffs along Birch Creek. The schist is commonly garnetiferous.

The metamorphic rocks have been intruded by Mesozoic or Tertiary granites that consist principally of a coarse grained to porphyritic biotite granite with abundant feldspar phenocrysts. Mica in the granite near Circle Hot Springs has been dated by potassium-argon at 71 million years (Upper Cretaceous) while a similar age was obtained by whole rock dating with K-Ar and Rb-Sr (17). Greenstone dikes were observed in the vicinity of the south fork of Birch Creek.

Mineralization of the district has generally been accepted to have accompanied the intrusive activity. According to various sources within

the Geological Survey, the placer gold of the Circle District has been derived from random mineralized veins cutting both the intrusive and metamorphic rocks in the Mastodon and Porcupine Dome areas. Gold fineness in the district is quite variable ranging from 702 on Half Dollar Creek to 911 on Boulder Creek with an overall average of 808 (16).

In addition to gold, minor occurrences of sulfides have been found in the placers near Miller House and Portage Creek. Early prospectors also reported a lode occurrence of gold, silver, and tin near Porcupine Dome at the head of Dome Creek. Tin in the form of cassiterite has been found in placer concentrates, particularly from Independence, Deadwood, and Portage Creeks, figure 2. Granitic contacts southeast and west of the Circle intrusive may be part of the same pluton intrusive or sequence. A large regional tin anomaly was indicated by sediment sampling about 55 miles southeast of the district. No information is available on the intervening area. West of the Circle intrusive, anomalous tin and other heavy minerals were found by the Bureau of Mines in the course of ongoing mineral studies of the Mount Prindle and Lime Peak areas.

Uraniferous fluorite and topaz were reported in the placers near Miller House, thus suggesting the possibility of late-stage mineralization of uranium from the granite (20). During the field work for this report, minor radioactive allanite(?) was found associated with a massive quartz zone in a pegmatite granite near Ketchum Creek, figure 2. An analysis of a rock chip sample (Ci-21, figure 3) of a more radioactive portion of the pegmatite showed 300 ppm uranium. Minor amounts of tourmaline were also common in most of the pan concentrate samples.

DESCRIPTION OF BOULDER CREEK

Upper boulder Creek was examined for lode sources of the placer cassiterite; however, vegetation is almost continuous throughout the valley and no in situ mineralization was found, figure 2.

The bedrock is Birch Creek Schist locally grading to a black phyllite. Float rock indicates considerable secondary quartz veining in fractures, possibly as a result of underlying granite. The intrusive near its south contact with the schist is a fine grained biotite granite. Greenhorn Gulch, as upper tributary, is the only portion of the Boulder Creek drainages that has had significant placer mining (12), figure 2.

Minor cassiterite and scheelite were found in occasional quartz and schist cobbles in the creek at and above the granite contact. A sample (Ci-14, figure 3) of fresh granite taken near the contact by the author gave the following geochemical analysis:

Gold	.20	ppm
Tin	20	ppm
Tungsten	22	ppm
Molybdenum	2	ppm

Nelson, West, and Matzko reported as much as 50% allanite in heavy mineral fractions of granite occurring along Boulder Creek (13),

The mining operation on Boulder Creek was suspended in 1975 due to the difficulty of operating a sluice box in gravels with heavy concentrations of cassiterite. This portion of the creek had not been previously mined. Based on production figures given by the placer claimant, it was tentatively estimated that the pay gravels of the creek were yielding in excess of 2 pounds of cassiterite per yard at the mine site. Since no drilling or trenching had been done, it was not possible to estimate reserves. However, any pay streak would be limited to the 200 or 300 feet of width of the alluvial gravels and to a depth of an estimated 4 to 15 feet.

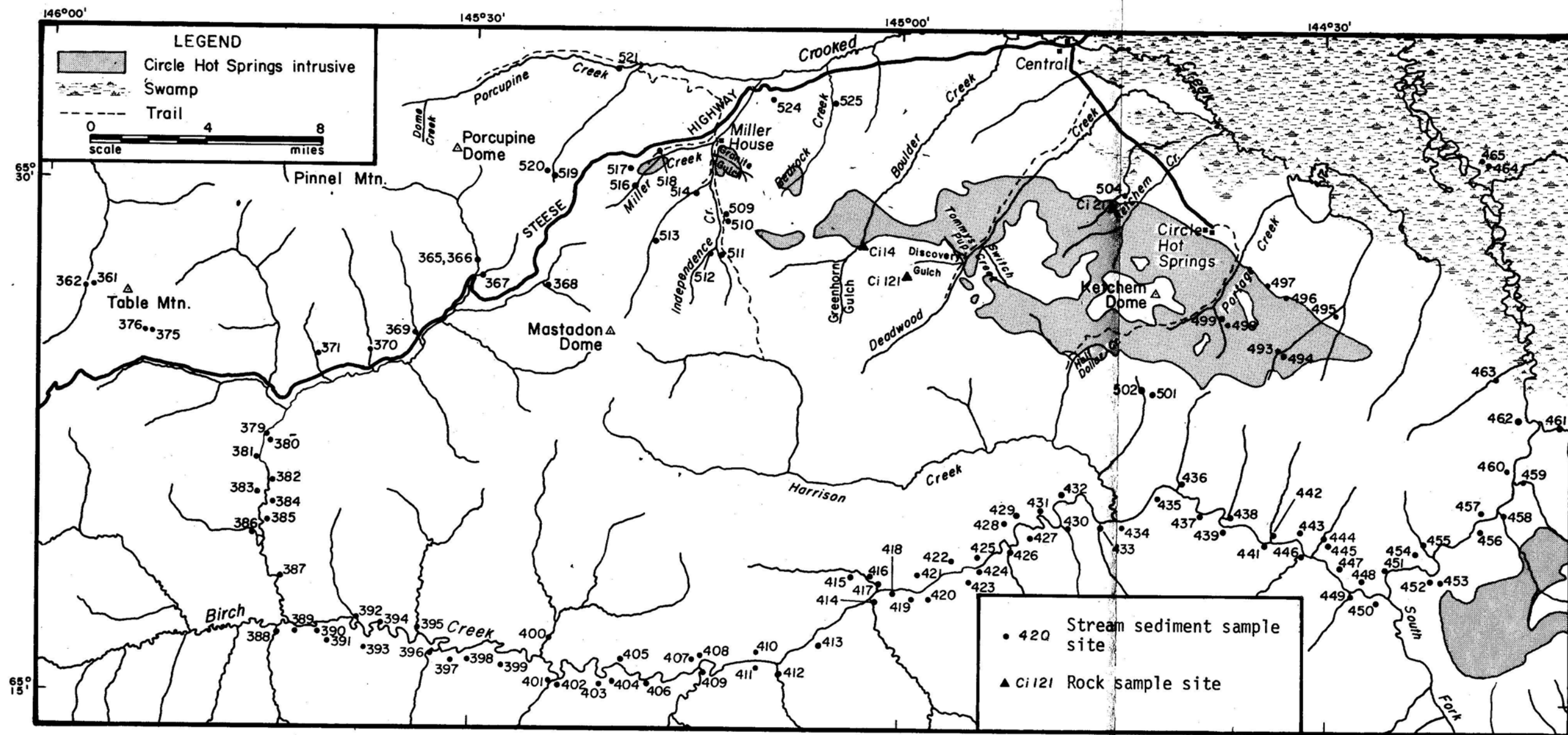


FIGURE 3.- Stream sediment and rock sample sites

Table 1 shows the results of a petrographic examination of a sluice box concentrate sample from Boulder Creek. Cassiterite occurs as fresh unweathered crystals up to 3/8 of an inch long, some of which are attached to gangue rock. Tin is particularly concentrated in the coarser size fractions. The gold is also quite fresh, occurring primarily as thin irregular flakes. The balance of the concentrate consists of rounded nuggets of hematite, magnetite, and scheelite.

DESCRIPTION OF BEDROCK CREEK

Pan samples of the gravels show a significant presence of tin and tungsten. No mining has been attempted on this portion of the creek. Nelson, West, and Matzko reported 10% monazite and 5% topaz in the heavy mineral fraction of granite bedrock (13).

DESCRIPTION OF DEADWOOD CREEK

The extension of the granitic intrusive to the east of Boulder Creek crosses the Deadwood Creek Valley, figure 2. Again, near the south contact on Tommys Pup, cassiterite was found during this study. Johnson reported a nearby locality on Discovery Gulch contained abundant wolframite and cassiterite in the gravels (9). He estimated that the combined concentrate would average 1 to 2 pounds per yard on Discovery Gulch and Deadwood Creek below their confluence point. Small shipments of tungsten concentrates were reported in 1916 when the price was higher (14). A small wolframite vein was reported by early prospectors, but this has never been verified. Two sluice box concentrate sample analyses from a mining operation near Switch Creek each showed approximately 10% tin and 2% tungsten (15). Minor cinnabar has also been reported on Deadwood Creek (7).

Most of the tin and tungsten placer minerals of Deadwood Creek

appear to be derived from the tributaries of Discovery Gulch, Tommys Pup, and Switch Creek, which nearly parallel the south contact of the granite. Examination of the granite near the head of the Gulch revealed numerous fracture sets with quartz and felspar veins. A grab sample (Ci-121, figure 3) of siliceous granite in this area showed 30 ppm tin by semiquantitative emission spectrographic analysis. Burand in a geochemical survey of the area noted anomalous copper, lead, and zinc in stream sediment (2).

OTHER HEAVY MINERAL OCCURRENCES

A placer mining operation on Portage Creek, also in the vicinity of the same intrusive, contains cassiterite (15), figure 2. Nelson, West, and Matzko noted higher concentrations of uranium (40.2 ppb) in water samples from Portage Creek as well as wolframite, sphalerite, scheelite, monazite, and traces of uranothorianite (13). An occurrence of an unidentified yellow-green uranium mineral was also noted in granite bedrock.

Alluvial occurrences of tin and tungsten minerals are also known in the Miller House area. A sample of sluice box concentrate contained greater than 40% tin and .4% tungsten with minor lead and bismuth (see Sample #305B). Significant tin and tungsten values were also found in nearby Granite Gulch. Independence Creek has been reported to contain cassiterite, scheelite, and wolframite in placer concentrates (20).

Half Dollar Creek, a tributary to Harrison Creek, has been reported to contain abundant scheelite and allanite (8, 13).

The gold-tin lode prospect on Porcupine Dome is quite likely related to the same sequence of mineralization which is partly responsible for these minerals being found in the placers of Porcupine Creek (12).

SAMPLING PROGRAM

In 1976-1977, 150 pan concentrate samples were taken using one level full 14-inch pan. Sample locations are shown in figure 4. The panned material (about 40 grams) was screened at 14 mesh with the plus 14 mesh discarded and the minus 14 mesh material separated into plus and minus 2.85 specific gravity fractions in a heavy liquid medium. The minus 2.85 specific gravity portion was then split into magnetic and non-magnetic fractions with a hand magnet. The non-magnetics were weighed and analyzed by semiquantitative emission spectrographic analysis. Samples were analyzed by the Bureau of Mines Reno Metallurgical Research Laboratory and by the Mineral Industry Research Laboratory (MIRL) of the University of Alaska. These are included in appendix A. Pan and sediment samples were taken only from previously unmined gravels to avoid contamination.

Sample map numbers 305B, 292B, 297B, 337B, 359B, and 360B on figure 4 represent samples of sluice box concentrates. These were also analyzed in the manner described above.

Figure 5 shows histograms prepared from sample data of 635 pan concentrate samples. These were taken in various igneous and metamorphic rock areas of central and northeastern Alaska by the Bureau of Mines during the 1977 season and include those samples of the Circle Mining District. These compilations provide representative background and anomalous levels for this type of sampling system. All sample analyses were completed by the University of Alaska MIRL. Mineral concentrations are shown by sample locations in figures 6 through 11.

To reflect more accurately the regional pattern of tin and tungsten background levels, a "recovery factor" of each of these elements was

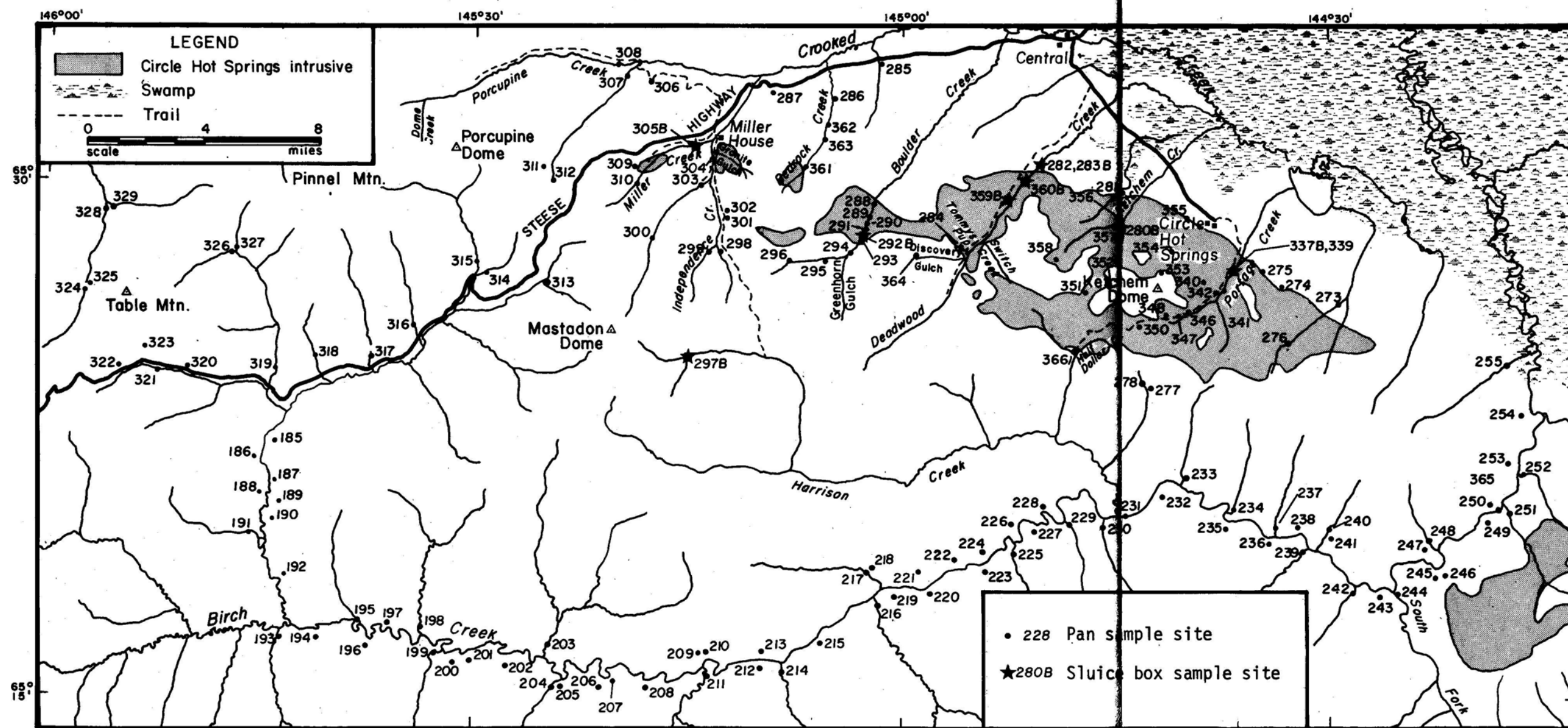


FIGURE 4.-Pan and sluice box sample sites

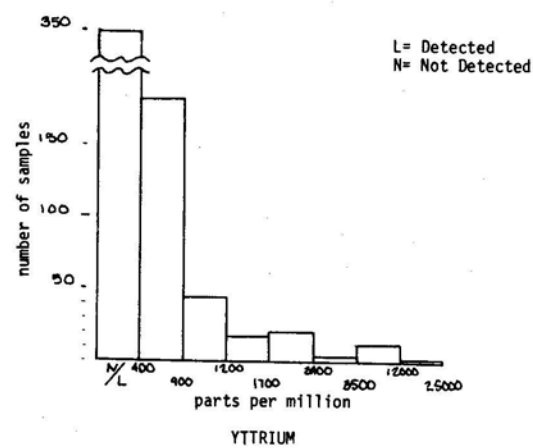
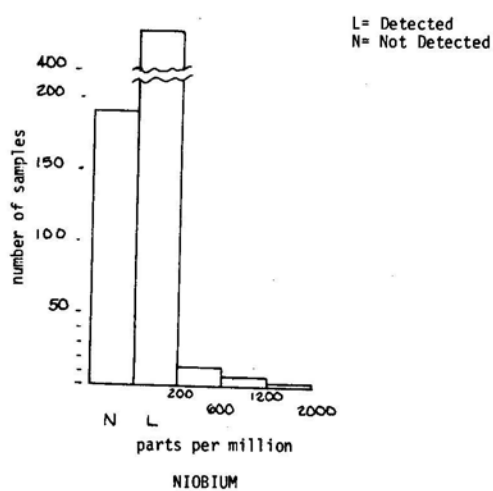
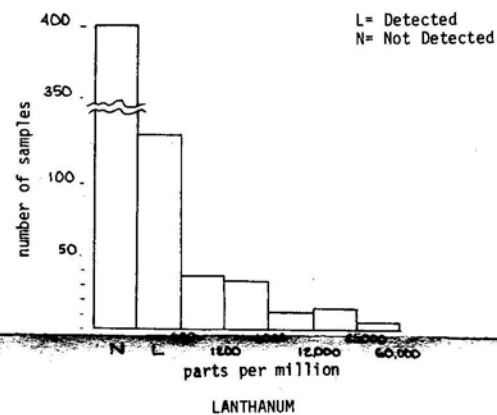
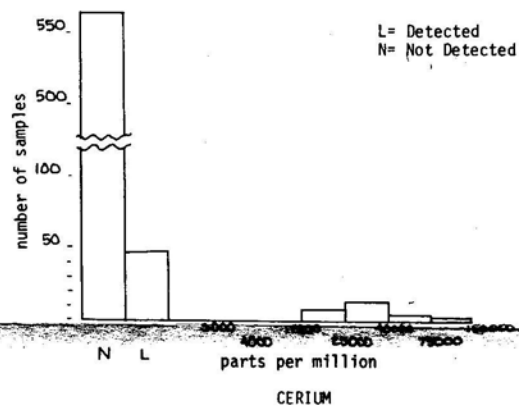
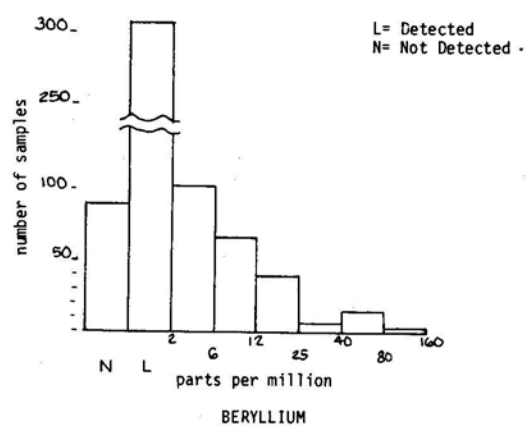
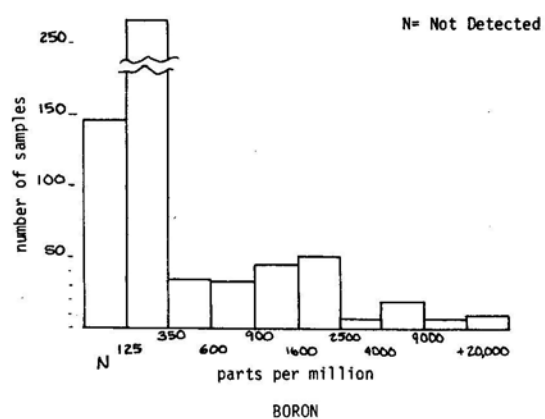
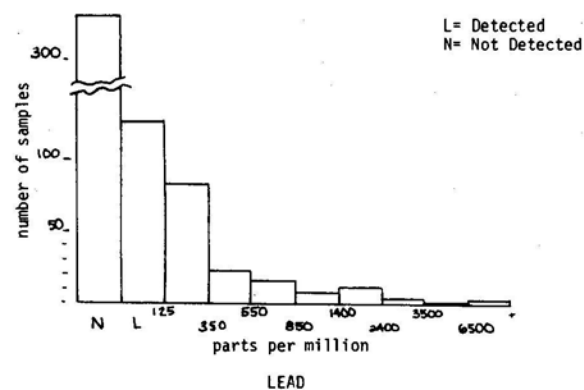
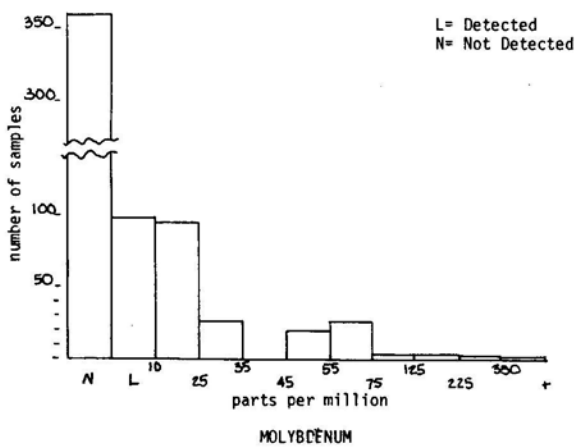
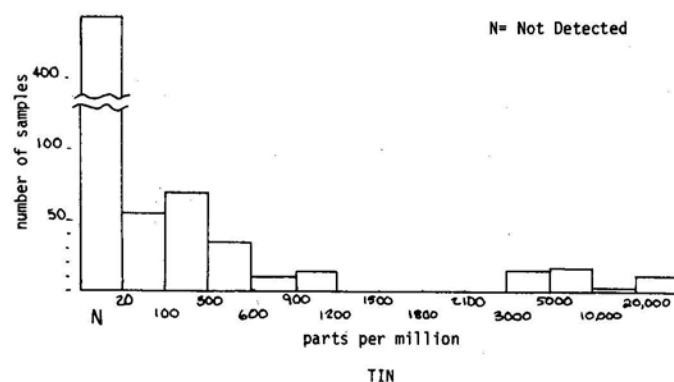
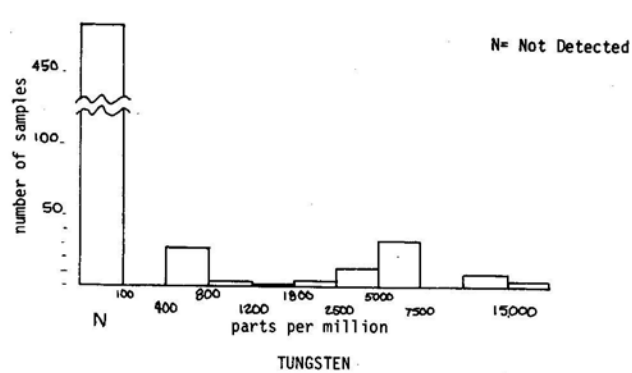


FIGURE 5.-Histogram portrayal of concentrate sample results

calculated. This is possible where a standard size gravel sample is taken and a similar procedure of separation is used. The factor is determined by dividing the parts per million analysis by 100 and then multiplying by the number of grams of non-magnetic concentrate (-2.85 sp. gr.). This procedure eliminates some error that is encountered when comparing sample analyses in ppm. Values in ppm of an element such as tin will vary proportionally to the heavy mineral concentrations of biotite, zircon, garnet, and others. Amounts of these minerals differ considerably from one site to another, particularly in metamorphic/igneous rocks and can mask true background levels of certain trace elements. Tin and tungsten sample concentrates and recovery factors are shown in table 2 and plotted in figures 12 and 13.

One hundred and twenty sediment samples were taken at various sites in the district. The minus 80 mesh fraction was analyzed by semiquantitative spectrographic emission methods. Their locations are shown in figure 3 and their results are included in appendix B. Sediments were not collected in the remainder of the project since that area had been investigated by Burand in 1965 (2).

CONCLUSIONS

Minable deposits of placer tin-tungsten minerals may exist in the Circle mining District. Gold and cassiterite bearing gravels such as those occurring on upper Boulder Creek possibly could be mined using a continuous gravity separation system such as jigging.

A northwest bearing trend of tin mineralization apparently is associated with at least the southern contact of the northern limb of the Circle Hot Springs intrusive. No definable limits to this trend can be predicted without

further work. An anomalous area also is found along the North Fork of Birch Creek. It appears that some amounts of radioactive and tungsten minerals also accompany this mineral trend and indications suggest that some concentrations of uranium minerals may occur in association with the granitic rocks in the district and particularly in the headwaters of Deadwood, Boulder, Portage, and Bedrock Creek near the granite-schist contacts.

Sampling indicates late intrusive minerals such as monazite, cassiterite, scheelite and tourmaline.

Granitic outcrops southeast and west of the Circle intrusive may be part of the same pluton intrusive or sequence. A large regional tin anomaly is indicated by sediment sampling about 55 miles southeast of the district but no information is available on the intervening area. West of the Circle intrusive, anomalous tin and other heavy materials were found by the Bureau of Mines in the Mount Prindle and Lime Peak areas. Tin and tungsten mineralization may be related, in varying degrees, to this northwest to west trending series of granitic intrusions.

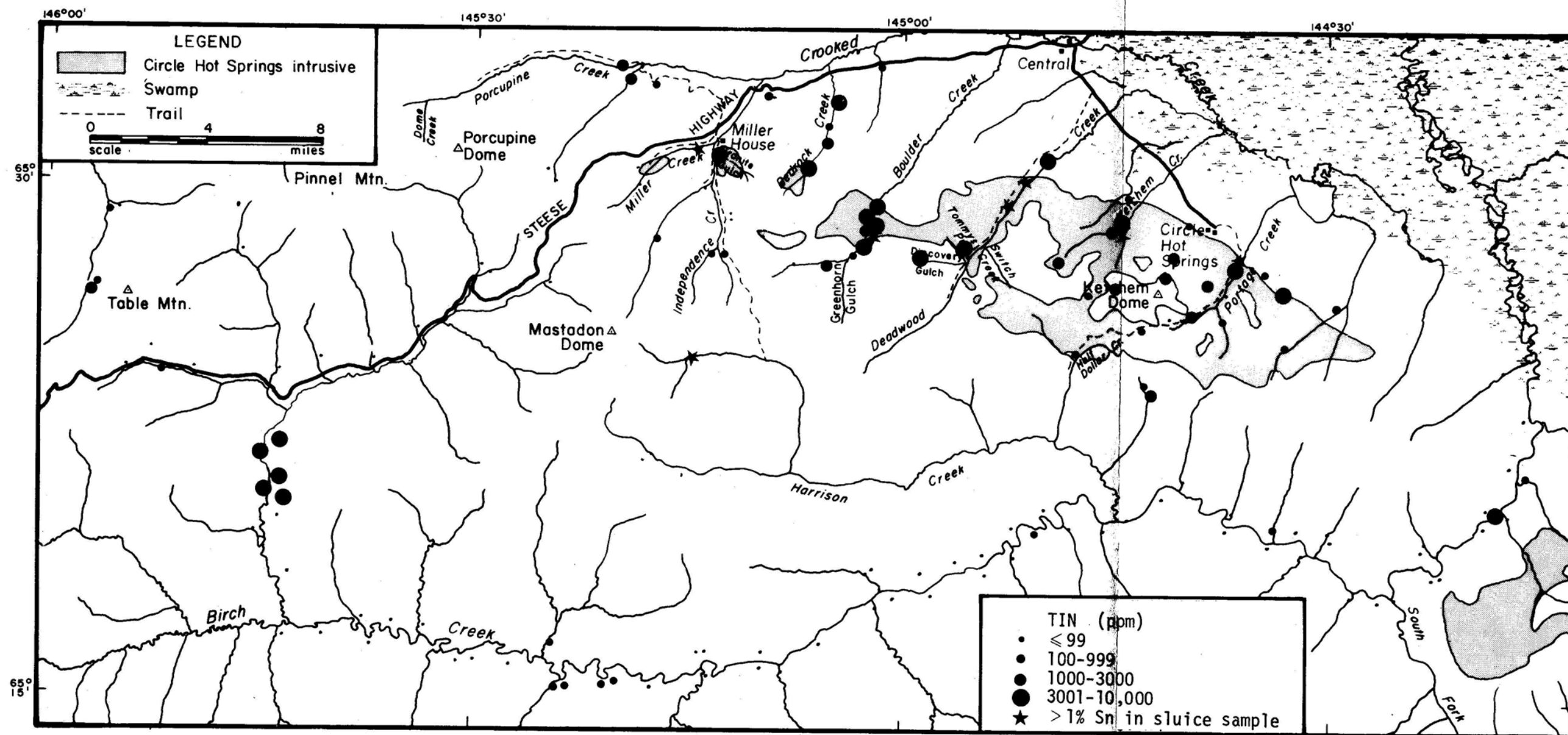


FIGURE 6.- Tin concentrations by sample site

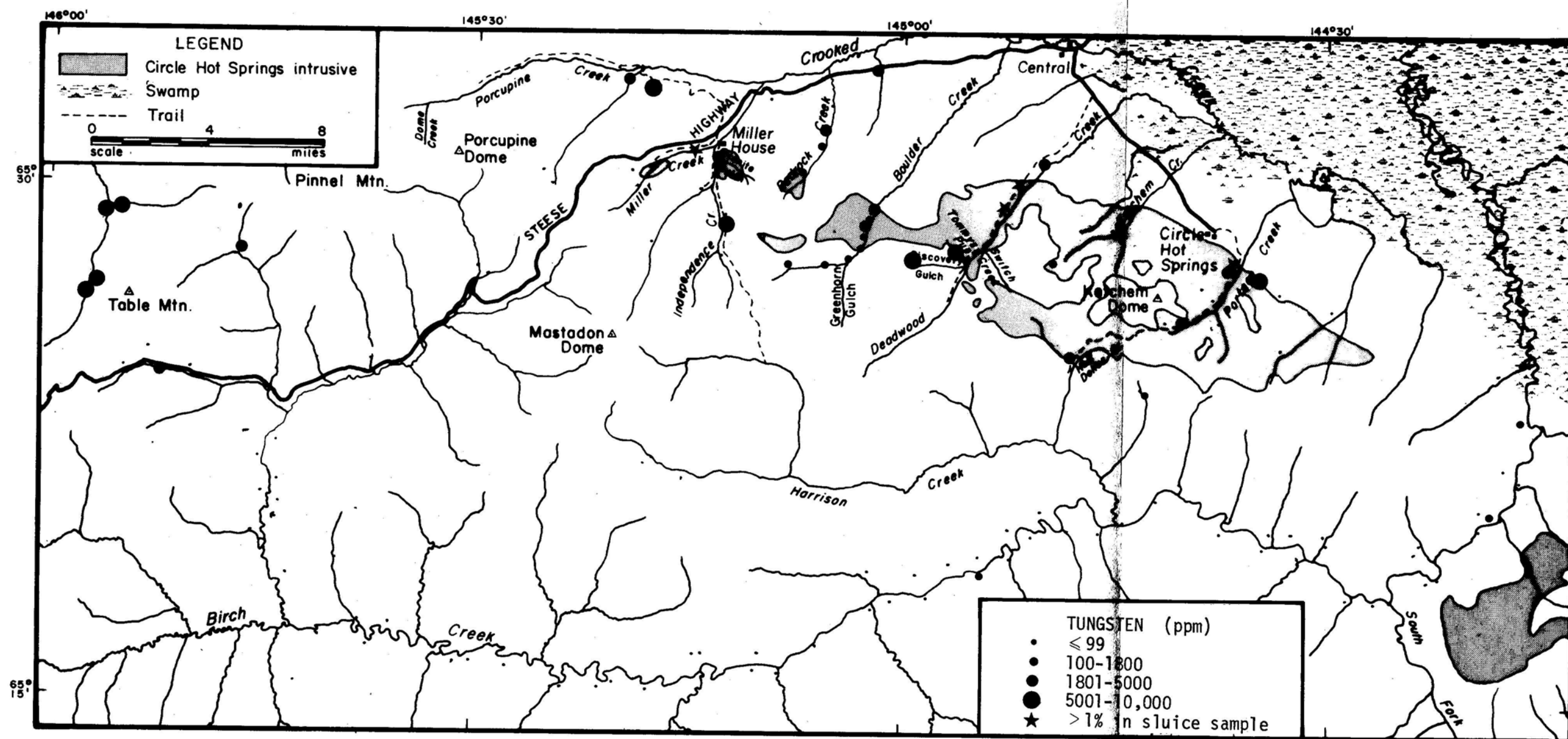


FIGURE 7.- Tungsten concentrations by sample site

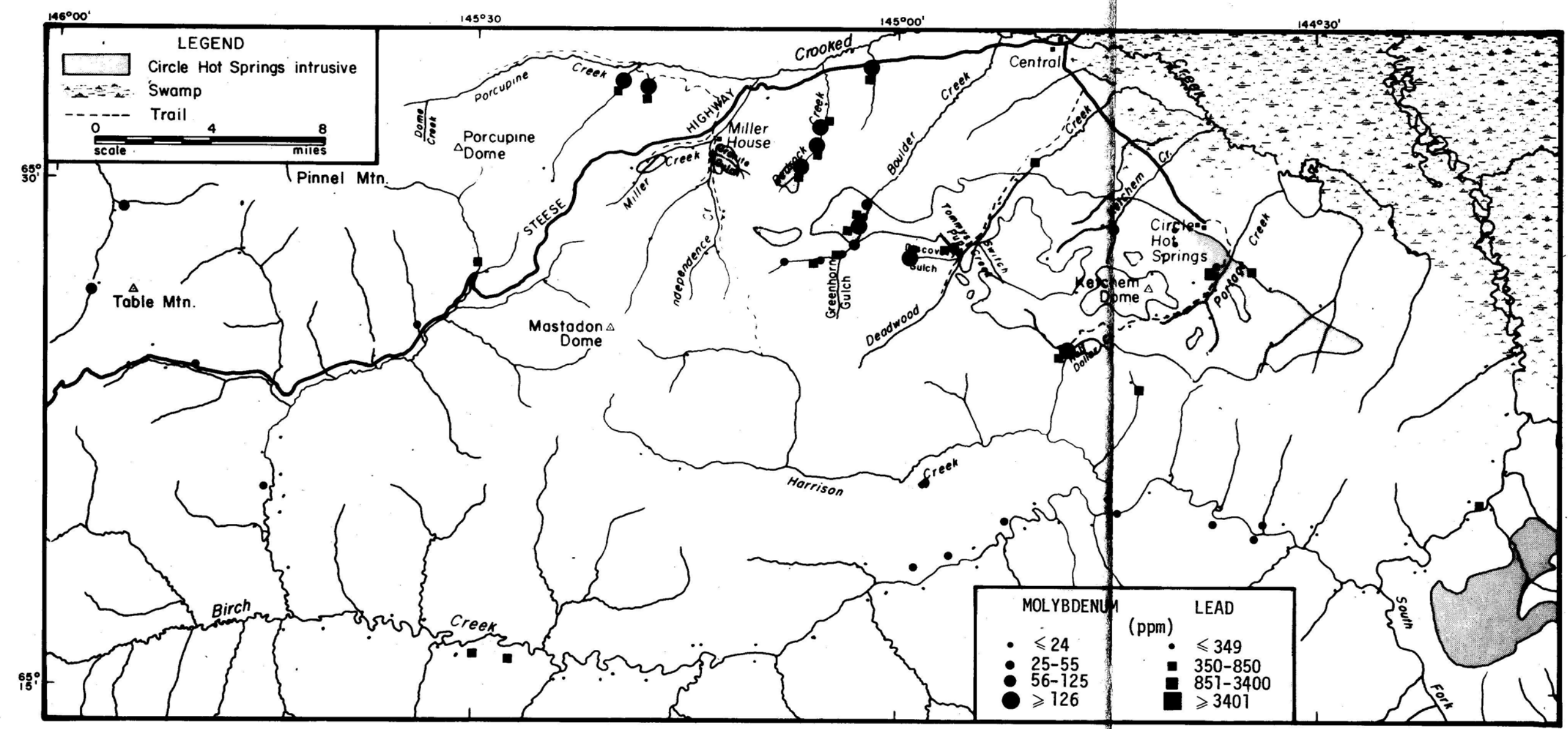


FIGURE 8.- Lead and molybdenum concentrations by sample site

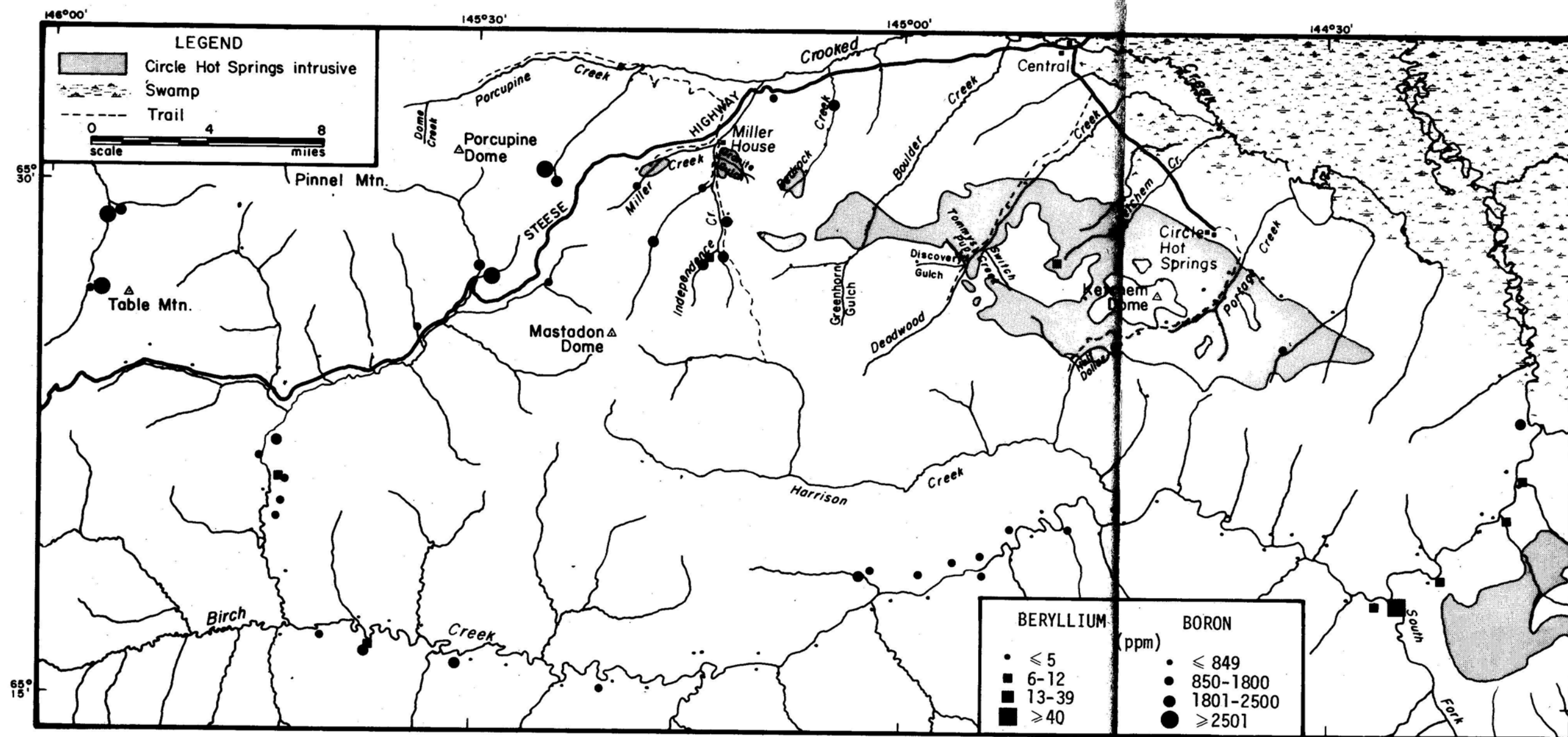


FIGURE 9.- Beryllium and boron concentrations by sample site

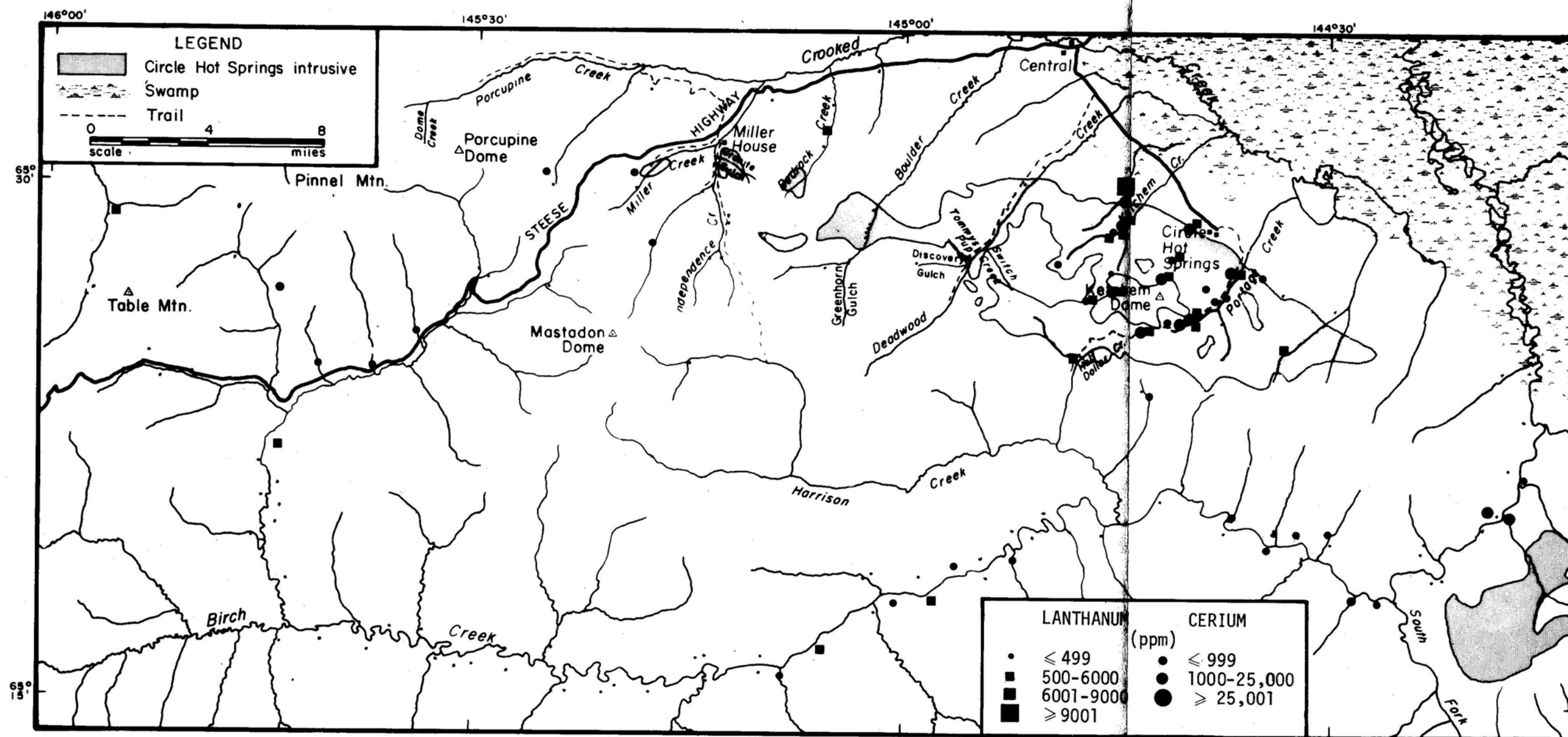


FIGURE 10.- Lanthanum and cerium concentrations by sample site

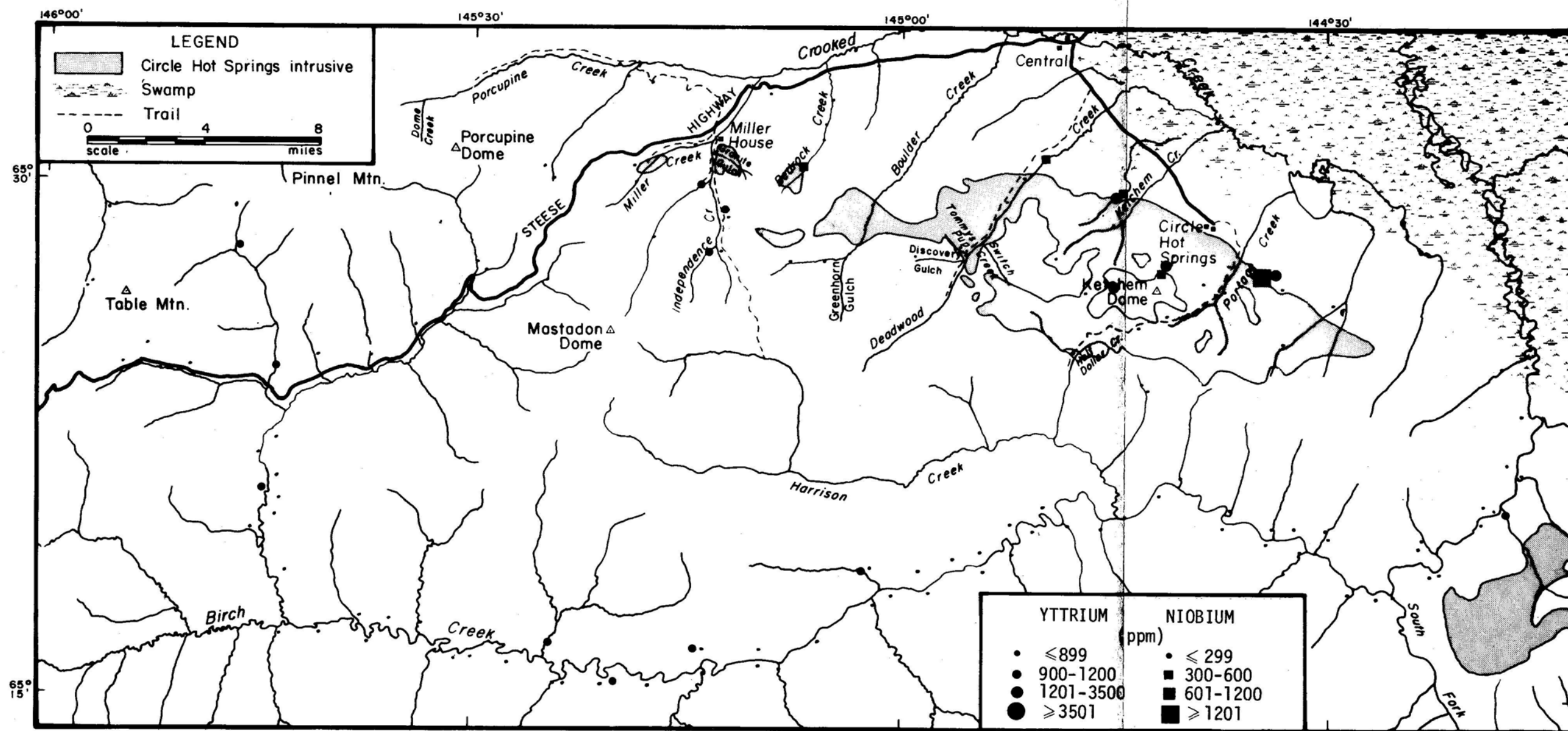


FIGURE 11.- Yttrium and niobium concentrations by sample site

TABLE 2. - Tin and tungsten sample concentrates and recovery factors

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovered (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
185	5,000	7.032	352	N	N
186	5,000	11.934	597	N	N
187	5,000	3,460	173	N	N
188	7,000	16.199	1,134	N	N
189	5,000	2.546	127	N	N
190	N	1.115	N	200	2
191	N	0.951	N	L	L
192	N	1.853	N	L	L
193	N	0.992	N	L	L
194	N	0.447	N	L	L
195	N	2.248	N	L	L
196	N	0.909	N	L	L
197	N	2.635	N	L	L
198	N	4.499	N	L	L
199	N	28.594	N	L	L
200	N	1.140	N	N	N
201	N	1.009	N	N	N
202	N	3.213	N	N	N
203	500	7.016	35	L	L
204	500	6.894	34	L	L
205	500	0.957	5	L	L
206	500	0.719	4	L	L
207	500	0.513	3	L	L
208	70	1.732	1	N	N

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovered (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
209	N	3.567	N	N	N
210	N	3.357	N	N	N
211	N	20.951	N	N	N
212	N	8.159	N	N	N
213	N	3.248	N	N	N
214	N	28.568	N	L	L
215	N	3.356	N	N	N
216	N	28.715	N	N	N
217	N	0.901	N	N	N
218	N	0.652	N	N	N
219	N	0.488	N	N	N
220	N	2.197	N	N	N
221	N	0.449	N	N	N
222	N	1.769	N	N	N
223	N	0.951	N	1,000	10
224	N	2.316	N	N	N
225	N	9.226	N	N	N
226	N	0.953	N	N	N
227	300	1.275	4	N	N
228	N	2.216	N	N	N
229	N	1.024	N	L	L
230	N	2.386	N	L	L
231	N	1.509	N	N	N
232	N	4.394	N	N	N

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovery (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
233	N	6.124	N	N	N
234	30	5.263	2	N	N
235	N	2.388	N	N	N
236	N	12.597	N	N	N
237	300	9.849	30	N	N
238	N	16.936	N	N	N
239	N	40.035	N	N	N
240	N	14.956	N	N	N
241	N	21.714	N	N	N
242	N	51.405	N	L	L
243	N	43.607	N	N	N
244	N	47.486	N	L	L
245	N	30.305	N	L	L
246	N	72.750	N	N	N
247	N	13.587	N	N	N
248	N	10.106	N	N	N
249	N	12.221	N	N	N
250	N	7.516	N	N	N
251	30	20.874	6	N	N
252	300	23.008	69	L	L
253	N	12.922	N	N	N
254	N	3.204	N	1,000	32
255	N	6.134	N	N	N

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovery (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
273	200	5.8	12	N	N
274	5,000	1.8	90	N	N
275	300	4.3	13	7,000	301
276	300	1.8	5	N	N
277	1,000	3.1	31	700	22
278	150	0.8	1	L	L
279	100	0.7	1	L	L
281	500	0.5	3	N	N
283*	230,000	1.906	4,384	3,000	57
284*	G	1.149	G	5,700	65
285*	700	1.02	7	2,000	20
286	5,000	1.0	50	N	N
287	L	0.8	L	N	N
288*	7,500	1.559	117	3,300	51
289*	7,100	0.674	48	770	5
290*	4,000	0.308	12	2,000	6
291*	2,500	1.174	29	820	10
293*	4,400	0.257	11	1,000	3
294*	440	0.542	2	330	2
295*	1,400	0.181	3	600	1
296*	N	0.208	N	680	1
298	200	1.4	3	N	N
299	150	1.2	2	N	N
300	300	3.0	9	L	L

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovery (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
301	50	3.5	2	7,000	245
302	50	15.0	8	N	N
303	20	8.1	2	L	L
304*	G	0.237	G	3,100	7
306*	700	1.178	8	G	G
307*	2,000	1.006	20	2,000	20
308	1,000	3.1	31	N	N
309	50	5.3	3	N	N
310	N	3.5	N	N	N
311	50	3.2	2	N	N
312	N	3.1	N	N	N
313	N	1.0	N	N	N
314	N	0.8	N	N	N
315	N	1.9	N	N	N
316	N	1.6	N	N	N
317	50	13.6	7	N	N
318	N	12.5	N	N	N
319	N	10.9	N	N	N
320	N	74.7	N	N	N
321	100	4.37	4	3,000	131
322	N	27.9	N	N	N
323	N	30.7	N	N	N
324	1,000	3.986	40	7,000	279
325	150	6.257	9	10,000	626

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovery (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
326	N	28.41	N	N	N
327	50	15.76	8	3,000	473
328	150	5.385	8	7,000	377
329	50	2.655	1	20,000	531
339	20,000	Sample by others No conc. wt.	-	N	-
340	2,000	"	-	N	-
341	20	"	-	N	-
342	70	"	-	N	-
346	2,000	"	-	N	-
347	70	"	-	N	-
348	N	"	-	N	-
350	500	"	-	N	-
351	150	"	-	N	-
352	1,500	"	-	N	-
353	1,500	"	-	N	-
354	2,000	"	-	N	-
355	300	"	-	N	-
356	15,000	"	-	500	-
357	2,000	"	-	N	-
358	3,000	"	-	700	-
361*	4,000	1.174	47	600	7
362*	900	0.262	2	2,000	5
363*	3,000	0.340	10	1,000	3
364	30,000	0.145	44	G	G

TABLE 2.- Tin and tungsten sample concentrates and recovery factors, cont.

<u>Sample map no.</u>	<u>Tin (ppm)</u>	<u>Concentrate recovery (grams)</u>	<u>Tin recovery factor</u>	<u>Tungsten (ppm)</u>	<u>Tungsten recovery factor</u>
365*	5,000	2.603	130	1,000	26
366*	900	1.471	13	3,000	44

L - Detected

N - Not detected

i - Interference

G - Greater than detection limits

All analyses by semi-quantitative emission spectographic method
by the University of Alaska except:

- 1) Sample map numbers with an asterisk (*) were analyzed by the Bureau of Mines Reno Metallurgical Lab.
- 2) Sample map numbers 337 to 360 were analyzed by the U. S. Geological Survey.

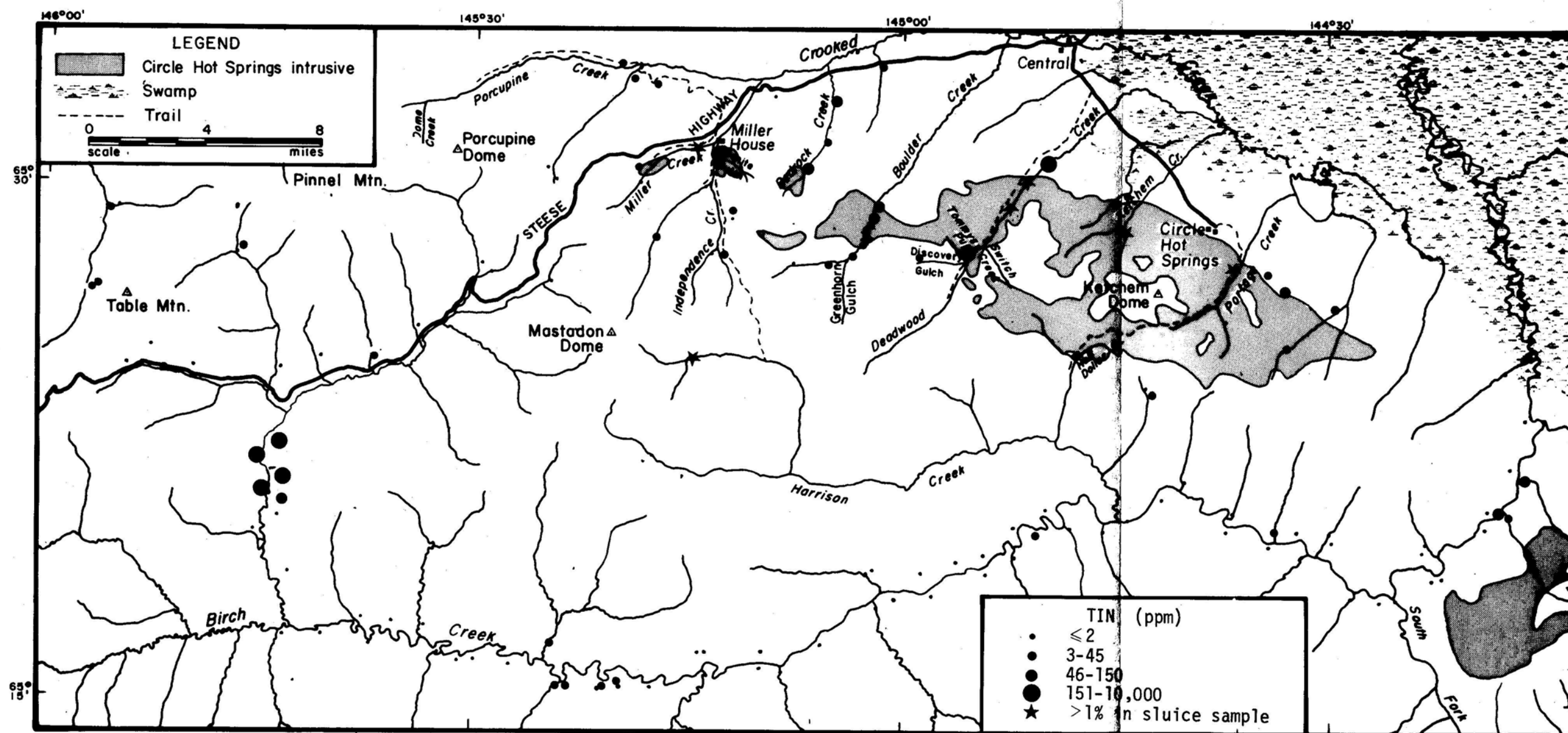


FIGURE 12.- Tin concentrations by the "recovery factor method"

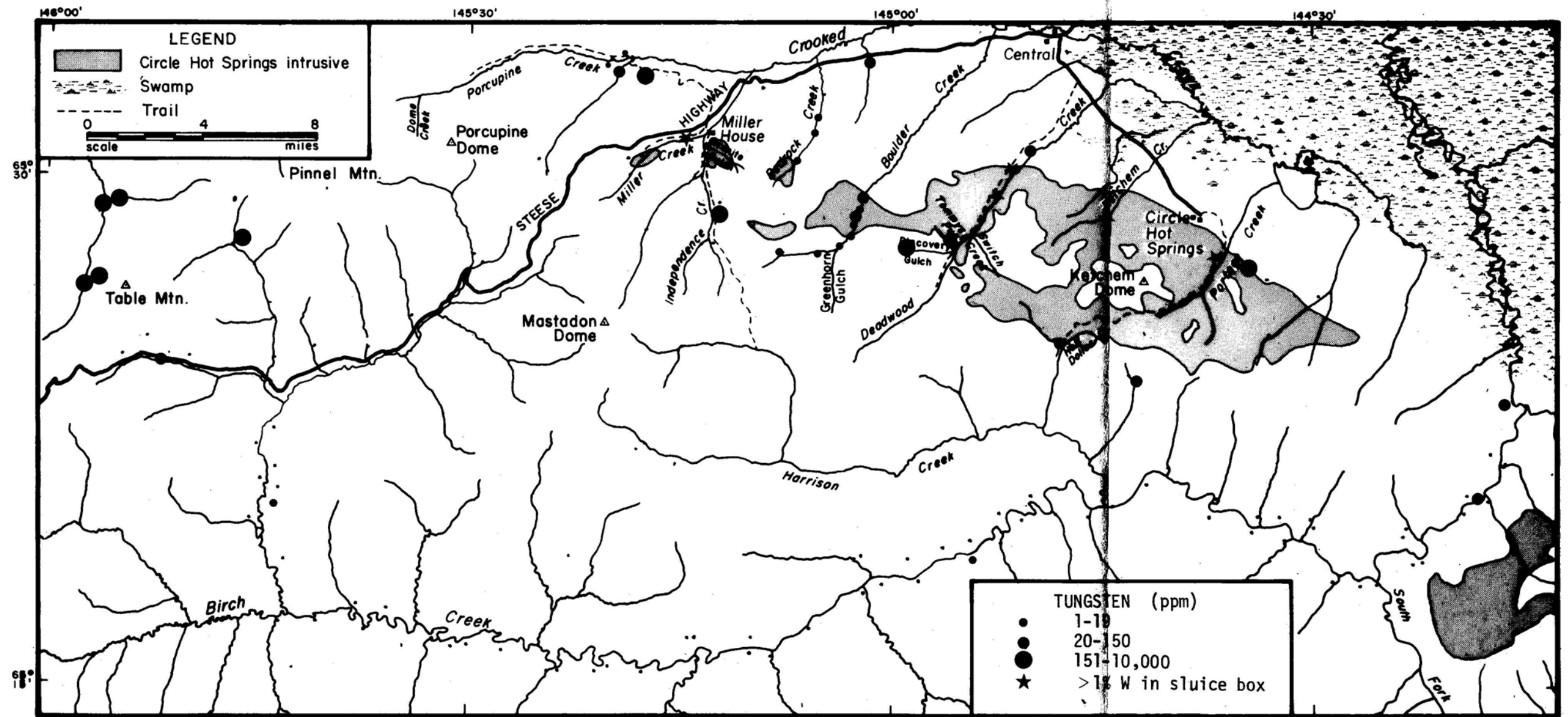


FIGURE 13.- Tungsten concentrations by the "recovery factor method"

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APPENDIX - A

Pan and sluice concentrate analyses (in ppm)

- L - Detected
- N - Not detected
- i - Interference
- G - Greater than detection limits

All analyses by semi-quantitative emission spectrographic method by the University of Alaska except:

- 1) Sample map numbers with an asterisk (*) were analyzed by the Bureau of Mines Reno Metallurgical Lab.
- 2) Sample Map number 337 to 360 were analyzed by the U.S. Geological Survey.

Map No.

36

185

186

187

188

189

190

191

192

Sample No.

BC1241P

BC1243P

BC1245P

BC1247P

BC1249P

BC1300P

BC1331P

BC1333P

Ag		10	2	5	10	10	2	5	L
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		2000	1000	1000	200	1000	1500	300	300
Ba		N	N	N	N	N	N	N	N
Be		S	2	10	2	5	N	N	N
Bi		L	L	L	L	L	N	N	N
Ce		N	N	N	N	N	N	N	N
Co		50	N	50	50	50	50	N	N
Cr		200	20	20	200	100	500	50	L
Cu		200	100	200	500	500	300	15	20
La		5000	N	N	N	N	N	N	N
Mo		N	N	N	50	N	N	N	N
Nb		L	L	L	L	200	N	N	N
Ni		1000	100	200	500	200	300	15	15
Pb		N	N	N	N	N	N	N	N
Pt		N	N	N	N	N	N	N	N
Sb		500	N	N	L	L	N	N	N
Sn		5000	5000	5000	7000	5000	N	N	N
Th									
U									
V		200	100	100	100	100	70	70	70
W		N	N	N	N	N	200	L	L
Y		700	500	500	1000	500	500	N	L
Zn		N	N	N	N	N	N	N	N
Zr		G	1000	500	500	G	G	G	1000

Map No.

37

201 202 203 204 205 206 207 208

Sample No.

BC1358P BC1360P BC1502P BC1506P BC1504P BC1510P BC1508P BC1513P

Ag	3	3	5	2	1	2	2	3
As	N	N	N	N	N	N	N	N
Au	N	N	N	N	N	N	N	N
B	700	700	200	300	500	1000	700	700
Ba	2000	2000	N	N	N	1000	1000	1500
Be	L	L	1	2	5	5	1	N
Bi	L	L	L	L	L	L	L	L
Ce	N	N	N	N	N	N	N	N
Co	100	100	50	50	150	100	100	30
Cr	1000	1000	1000	1000	1000	1000	1000	700
Cu	1000	500	200	500	500	500	5000	15
Ca	N	N	N	N	N	N	N	L
Mo	20	20	20	20	20	20	20	15
Nb	N	N	200	L	200	200	L	N
Ni	300	500	500	500	500	200	2000	150
Pb	500	700	L	20	L	L	L	N
Pt	N	N	N	N	N	N	N	N
Sb	N	N	N	N	N	N	100	N
Sn	N	N	500	500	500	500	500	70
Th								
U								
V	300	300	50	100	50	300	200	300
W	N	N	L	L	L	L	L	N
	N	700	1000	700	500	700	1000	500
Zn	700	700	500	500	1000	1000	1000	700
Zr	G	G	1000	G	G	G	G	G

193

194

195

196

197

198

199

200

Sample No.

BC133SP

BC133BP

BC1341P

BC1343P

BC1345P

BC1347P

BC1349P

BC1354P

Ag		2	5	2	10	L	2	2	3
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		300	1000	300	2000	300	300	70	2000
Ba		N	N	N	N	N	N	N	L
Be		N	N	N	10	N	N	N	L
Bi		N	N	N	N	N	N	N	L
Ce		N	N	N	N	N	N	N	N
Co		20	50	50	20	N	N	N	70
Cr		20	1000	50	1000	50	500	1000	1500
Cu		150	150	150	15	30	20	20	200
La		N	N	N	N	N	N	N	N
Mo		N	N	N	N	N	N	N	20
Nb		N	N	N	L	N	N	N	N
Ni		150	150	150	1500	150	200	300	300
Pb		N	N	L	N	N	N	N	L
Pt		N	N	N	N	N	N	N	N
Sb		N	N	N	N	N	N	N	N
Sn		N	N	N	N	N	N	N	N
Th									
U									
V		70	100	70	500	500	70	500	300
W		L	L	L	L	L	L	L	N
Y		N	N	L	500	L	500	500	50
Zn		N	N	N	N	N	N	N	700
Zr		G	G	G	G	G	1000	200	G

Map No.

39

209 210 211 212 213 214 215 216

Sample No.

BC1517P BC1519P BC1514P BC1527P BC1529P BC1531P BC1533P BC1535P

Ag	5	5	5	5	3	5	3	5
As	L	N	N	N	N	N	N	3000
Au	N	N	N	N	N	N	N	N
B	700	500	150	200	500	70	700	70
Ba	1500	1500	N	1500	2000	N	3000	N
Be	N	N	L	L	L	L	L	1.5
Bi	N	L	L	L	L	L	L	L
Ce	N	N	N	N	N	L	N	L
Co	50	50	L	L	70	L	70	L
Cr	700	150	500	1500	1500	700	500	500
Cu	150	100	20	100	300	5	150	100
Ca	N	N	N	N	N	N	500	N
Mo	20	15	N	N	15	N	N	N
Nb	N	N	N	N	N	N	N	N
Ni	300	70	70	150	150	70	150	2
Pb	70	50	N	N	N	N	50	L
Pt	N	N	N	N	N	N	N	N
Sb	L	L	N	N	N	L	L	N
Sn	N	N	N	N	N	N	N	N
Th								
U								
V	700	700	L	500	500	300	300	L
W	N	N	N	N	N	L	N	N
	1000	500	500	500	700	700	500	500
Zn	1000	700	700	N	700	N	700	1500
Zr	G	G	G	1000	G	700	G	L

Map No.

217

218

219

220

221

222

223

224

40

Sample No.

BC1540P

BC1538P

BC1543P

BC1546P

BC1549P

BC1551P

BC1553P

BC1556P

Ag		5	5	7	3	3	3	3	5
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		2000	1500	70	700	1500	1000	1500	1500
Ba		1500	L	N	L	N	N	N	N
Be		N	L	I	L	I	N	L	N
Bi		L	L	L	N	N	N	N	N
Ce		L	N	N	N	N	L	N	N
Co		100	100	L	L	50	70	70	50
Cr		1000	1500	1500	150	1500	1000	700	1000
Cu		200	300	150	150	150	200	200	150
La		N	N	N	1000	N	L	N	N
Mo		N	15	15	N	30	50	10	15
Nb		N	N	N	N	N	N	N	N
Ni		300	300	300	15	700	300	300	200
Pb		70	70	N	50	150	150	300	N
Pt		N	N	N	N	N	N	N	N
Sb		L	N	N	N	L	N	N	L
Sn		N	N	N	N	N	N	N	N
Th									
U									
V		700	300	300	500	300	300	300	500
W		N	N	N	N	N	N	1000	N
Y		1000	500	700	500	N	700	N	N
Zn		1500	500	700	700	1500	1500	1500	1500
Zr		G	G	700	G	G	G	G	G

• Sample No.

BC1558P BC1560P BC1563P BC1520P BC1522P BC1525P BC1566P BC1568P

	BC1560P	BC1563P	BC1565P	BC1567P	BC1568P	BC1569P	BC1570P	BC1571P	BC1572P
Ag	5	3	5	3	3	5	7	5	
As	N	N	N	N	1000	N	N	N	
Au	N	N	N	N	N	N	N	N	
B	150	1000	700	300	1500	300	200	150	
Ba	1500	N	N	2000	1500	L	N	N	
Be	1	1	N	L	1.5	1	1	1	
Bi	N	N	L	L	L	N	N	N	
Ce	L	N	N	N	N	N	N	N	
Co	L	70	70	50	50	50	L	N	
Cr	1500	1000	1500	700	700	1000	1000	700	
Cu	70	300	100	300	150	150	70	10	
Fe	10	N	N	N	N	N	L	L	
Mo	N	50	10	N	N	15	30	10	
Nb	200	N	N	N	N	N	N	N	
Ni	N	300	300	300	150	150	100	70	
Pb	N	70	300	100	300	L	N	N	
Pt	N	N	N	N	N	N	N	N	
Sb	N	N	L	N	L	N	N	N	
Sn	N	300	N	N	N	N	N	N	
Th									
U									
V	300	200	300	500	500	700	300	L	
W	N	N	N	N	L	L	N	N	
Zn	700	N	N	N	N	N	N	N	
Zr	1500	1500	1500	1000	700	N	150	1500	
	G	G	G	G	G	G	1000	300	

233 234 235 236 237 238 239 240

Sample No.

BC1570P BC1573P BC1575P BC1579P BC1581P BC1583P BC1585P BC1590P

Ag		5	5	7	5	7	7	3	5
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		200	300	300	100	150	100	70	150
Ba		1500	1500	N	N	1500	N	1500	1500
Be		1	1	1	1	1	1	L	1.5
Bi		N	N	N	N	N	N	N	N
Ce		N	L	N	L	L	L	N	L
Co		30	70	N	30	50	30	N	N
Cr		1000	1500	1000	3000	1500	1000	1500	1500
Cu		150	150	20	10	150	70	15	100
La		N	L	N	N	N	N	L	N
Mo		15	10	30	30	30	10	N	L
Nb		N	N	N	N	N	N	L	L
Ni		100	200	50	300	200	200	150	100
Pb		N	20	N	N	20	N	N	N
Pt		N	N	N	N	N	N	N	N
Sb		N	N	L	L	N	N	N	N
Sn		N	30	N	N	300	N	N	N
Th									
U									
V		500	300	200	200	200	200	200	700
W		N	N	N	N	N	N	N	N
Y		N	N	N	700	N	N	N	N
Zn		1500	1500	1500	1500	1500	1500	N	N
Zr		300	G	G	L	L	L	300	L

Map No.

43

241

242

243

244

245

246

247

248

Sample No.

BC1588P

BC1593P

BC1597P

BC1598P

BC1602P

BC1604P

BC1606P

BC1608P

Ag

5

7

7

10

15

15

15

10

As

N

N

N

N

N

N

N

N

Au

N

N

N

N

N

N

N

N

B

150

200

200

200

150

100

150

150

Ba

N

N

N

N

N

N

N

N

Be

1

L

7

70

N

10

3

L

Bi

N

N

N

N

N

N

N

N

Ce

N

L

L

N

N

N

N

N

Co

N

30

50

30

30

N

N

N

Cr

1500

2000

2000

2000

2000

1500

1500

1500

Cu

15

70

70

15

20

15

70

15

Fe

L

N

N

150

N

N

L

N

Mo

N

N

L

L

L

N

N

L

Nb

L

L

L

L

L

L

L

L

Ni

100

150

150

150

150

150

150

100

Pb

N

N

N

N

N

N

N

N

Pt

N

N

N

N

N

N

N

N

Sb

N

L

L

N

N

L

N

L

Sn

N

N

N

N

N

N

N

N

Th

U

V

500

200

700

700

1000

300

200

700

W

N

L

N

L

L

N

N

N

Zn

N

L

N

N

L

L

N

N

Zr

L

500

N

L

N

L

N

L

Map No.

249

250

251

252

253

254

255

44

273

Sample No.

BC1610P

BC1612P

BC1614P

BC1617P

BC1619P

BC1622P

BC1624P

CI 211P

Ag		10	15	20	10	10	3	5	15
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		300	300	200	200	300	2000	300	500
Ba		N	N	1500	N	N	L	L	N
Be		1.5	N	7	10	3	L	N	L
Bi		N	N	N	N	N	L	150	L
Ce		N	5000	5000	L	N	N	N	N
Co		L	70	L	L	N	N	N	10
Cr		2000	2000	2000	1500	1500	1000	1500	200
Cu		15	150	50	50	70	200	150	100
La		N	N	N	N	N	N	N	L
Mo		15	L	L	L	L	20	15	N
Nb		L	L	L	L	N	N	N	L
Ni		100	300	150	150	150	50	150	100
Pb		N	N	N	N	N	N	N	L
Pt		N	N	N	N	N	N	N	N
Sb		L	N	L	L	L	N	L	N
Sn		N	N	30	300	N	N	N	200
Th									
U									
V		700	300	200	700	200	L	300	300
W		N	N	N	N	N	1000	N	N
Y		500	500	1000	L	L	N	N	N
Zn		1500	L	1500	2000	L	300	300	1500
Zr		G	G	G	L	L	1000	200	L

274 275 276 277 278 279 280*_B 281

Sample No.

Ci 221P Ci 229P Ci 255P Ci 240P Ci 243P Ci 251P Ci 023AB Ci 258P

Ag	3	5	5	15	3	3	i	5
As	L	L	N	1000	N	N	N	N
Au	N	N	N	N	N	N	N	N
B	700	700	1000	500	300	500	N	100
Ba	N	L	N	N	L	L	N	N
Be	L	N	L	N	N	L	N	5
Bi	L	N	N	L	N	L	N	N
Ce	N	L	N	L	N	N	-	7000
Co	20	50	10	50	10	10	50	10
Cr	1000	1000	500	1500	500	500	550	300
Cu	300	200	200	300	70	150	N	150
Ca	N	N	1000	N	L	L	490	50000
Mo	L	20	10	20	N	N	90	10
Nb	L	1500	L	L	L	200	N	500
Ni	150	150	150	300	100	150	130	150
Pb	300	700	100	500	100	50	250	200
Pt	N	N	N	N	N	N	i	N
Sb	N	N	N	N	N	N	710	N
Sn	5000	300	300	1000	150	100	G	500
Th								
U								
V	500	700	500	1500	700	500	90	500
W	N	7000	N	700	L	L	G	N
	L	1500	700	L	700	500	630	2000
Zn	N	N	1500	N	500	N	1300	700
Zr	G	G	G	L	G	G	4000	G

Map No.

282*^B 283* 284* 285* 286 287 288* 289*⁴⁶

Sample No.

Ci133P(76) Ci131P Ci025P Ci127P Ci261P Ci263P Ci013P Ci011P

Ag	i	i	70	i	3	3	i	120
As	L	200	N	1000	N	N	N	N
Au	N	L	N	N	N	N	N	N
B	N	N	140	600	2000	1000	270	230
Ba	N	N	N	200	N	L	N	N
Be	N	N	N	N	5	5	N	N
Bi	N	800	N	5000	N	L	N	N
Ce	-	-	-	-	N	N	-	-
Co	N	N	60	200	30	30	60	50
Cr	N	N	100	60	500	300	250	160
Cu	-	2000	50	2000	150	150	70	90
La	N	L	N	300	L	L	N	N
Mo	N	N	70	500	10	10	70	50
Nb	-	600	N	200	200	200	N	N
Ni	N	200	160	100	300	150	360	340
Pb	N	400	650	800	200	100	320	480
Pt	N	N	i	i	N	N	i	i
Sb	-	8000	680	8000	N	N	1600	1700
Sn	100,000	230,000	G	700	5000	L	7500	7100
Th								
U								
V	N	N	90	1000	500	500	110	70
W	2000	3000	5700	2000	N	N	3300	770
Y	100	300	190	700	700	N	300	230
Zn	30	50	420	400	N	L	740	480
Zr	N	100	3000	6000	L	1000	6800	4100

Map No.

290* 291* 292*B 293* 294* 295* 296* 297*B⁴⁷

Sample No.

C135P(76) C100P C109B C108P C107P C106P C105P C132B

Ag	i	50	N	60	50	70	N	i
As	600	N	N	N	N	N	N	100
Au	L	N	N	N	N	N	N	L
B	500	280	N	220	400	200	600	100
Ba	40	N	N	N	N	N	N	100
Be	N	N	N	N	N	N	N	N
Bi	2000	N	N	N	N	450	N	900
Ce	-	-	-	-	-	-	-	-
Co	300	N	N	90	N	L	N	N
Cr	300	110	110	140	140	410	210	N
Cu	2000	50	N	100	50	70	N	2000
Ca	N	N	N	250	N	N	N	N
Mo	200	40	20	60	30	40	40	N
Nb	200	N	N	N	N	N	N	200
Ni	90	210	60	250	290	270	190	100
Pb	400	250	90	250	520	460	220	400
Pt	i	i	N	i	i	i	i	N
Sb	8000	1200	N	940	1600	1100	1000	8000
Sn	4000	2500	G	4400	440	1400	N	10,000
Th								
U								
V	40	50	90	150	90	N	60	N
W	2000	820	210	1000	330	600	680	600
	N	230	100	250	260	120	250	N
Zn	200	520	50	280	290	790	230	L
Zr	10,000	6800	390	2800	6800	1800	6900	100

Map No.

298

299

300

301

302

303

304*

305*B

Sample No.

C1268P

C1267P

C1272P

C1247P

C1248P

C1273P

C103P

C104B

Ag		10	50	1000	3	15	10	90	N
As		N	L	3000	N	N	L	2300	9000
Au		L	50	G	N	N	N	N	L
B		2000	2000	2000	2000	150	1000	390	N
Ba		N	L	N	N	2000	N	N	N
Be		L	10	L	L	L	N	N	N
Bi		N	L	N	L	N	L	N	1000
Ce		N	N	L	N	N	N	-	-
Co		70	50	100	70	50	10	N	N
Cr		300	1500	700	700	700	300	N	N
Cu		200	300	1500	200	300	1000	60	N
La		N	N	L	N	N	N	N	N
Mo		N	N	10	20	10	N	50	200
Nb		N	N	N	L	L	N	N	100
Ni		200	300	300	200	100	150	150	N
Pb		100	100	150	50	L	50	180	3000
Pt		N	N	N	N	N	N	N	N
Sb		N	L	N	N	N	N	690	2000
Sn		200	150	300	50	50	20	G	G
Th									
U									
V		700	2000	700	500	500	500	N	N
W		N	N	L	7000	N	L	3100	G
Y		N	1000	700	L	1000	1000	610	N
Zn		L	L	L	1500	L	N	710	N
Zr		G	G	G	L	L	G	760	L

Map No.

49

306* 307* 308 309 310 311 312 313

Sample No.

C123P C125P C1244P C1215P C1217P C1235P C1231P C1220P

Ag	i	i	3	10	3	15	3	2
As	900	700	N	N	L	3000	N	N
Au	N	N	N	N	N	N	N	N
B	300	400	1500	700	1000	10000	2000	1500
Ba	100	L	N	L	L	3000	L	L
Be	N	N	N	L	L	N	L	L
Bi	5000	3000	N	L	L	N	L	L
Ce	-	-	N	L	N	L	N	N
Co	200	N	30	20	20	100	50	50
Cr	L	N	300	1500	300	1500	1000	500
Cu	2000	2000	300	500	150	700	500	300
Ca	200	200	N	N	L	N	N	L
Mo	400	300	N	10	L	20	20	L
Nb	200	200	200	L	L	L	L	L
Ni	90	100	150	300	100	300	300	200
Pb	700	500	100	150	70	300	70	200
Pt	i	i	N	N	N	N	N	N
Sb	8000	8000	N	N	N	1000	N	N
Sn	700	2000	1000	50	N	50	N	N
Th								
U								
V	60	N	700	500	200	1500	500	300
W	G	2000	N	N	N	N	N	N
	100	80	N	500	500	700	L	L
Zn	100	100	L	N	1000	N	N	1000
Zr	10,000	5000	G	G	G	G	G	1000

Map No.

50

314

315

316

317

318

319

320

321

Sample No.

C:227P

C:225P

C:208P

C:207P

C:205P

C:446P

C:444P

C:442P

Ag		2	5	20	15	10	10	7	2
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		5000	2000	1500	300	300	150	150	50
Ba		L	L	3000	L	L	N	N	1000
Be		L	N	N	L	L	N	L	1
Bi		L	L	N	L	L	N	N	50
Ce		N	N	L	L	L	N	N	N
Co		20	50	50	50	20	30	N	N
Cr		500	700	5000	3000	2000	1500	2000	200
Cu		150	500	500	300	50	200	300	15
La		N	N	N	N	N	N	N	L
Mo		10	L	30	20	10	20	50	N
Nb		L	L	L	L	L	N	N	L
Ni		300	200	1000	500	L	200	500	L
Pb		N	500	N	N	N	N	N	N
Pt		N	N	N	N	N	N	N	N
Sb		N	500	1000	N	N	N	N	N
Sn		N	N	N	50	N	N	N	100
Th									
U									
V		500	500	500	300	300	500	150	200
W		N	N	N	N	N	N	N	3000
Y		L	500	700	700	700	1000	L	L
Zn		N	N	N	N	N	500	1000	N
Zr		G	G	G	L	L	G	L	G

Map No.

51

322 323 324 325 326 327 328 329

Sample No.

Ci440p Ci203p Ci133p Ci135p Ci144p Ci142p Ci140p Ci138p

Ag	7	10	3	10	3	3	10	10
As	N	N	N	N	N	N	N	3000
Au	N	N	N	N	N	N	N	N
B	70	150	1500	3000	150	100	3000	2000
Ba	N	L	N	1000	N	N	1000	1000
Be	N	L	N	2	2	L	N	N
Bi	L	L	N	N	L	L	N	N
Ce	N	N	N	N	N	N	N	N
Co	N	20	30	70	N	N	70	50
Cr	200	3000	2000	700	1000	500	1000	500
Cu	150	150	200	1000	100	100	300	150
Fe	N	N	L	N	N	N	N	5000
Mo	N	10	70	L	L	L	L	70
Nb	L	L	L	L	N	N	L	L
Ni	150	300	300	L	150	200	150	50
Pb	N	N	N	150	N	N	70	150
Pt	N	N	N	N	N	N	N	50
Sb	N	N	N	N	N	N	N	N
Sn	N	N	1000	150	N	50	150	50
Th								
U								
V	300	300	1000	500	200	300	500	500
W	N	N	7000	10,000	N	3000	7000	20,000
	N	700	700	300	L	1000	500	700
Zn	L	N	L	700	500	500	700	N
Zr	200	G	G	G	L	G	G	G

Map No.

52

337B 339 340 341 342 346 347 348

Sample No.

3646B 3648p 3649p 3650p 3651p 3654p 3652p 3656p

		3646B	3648p	3649p	3650p	3651p	3654p	3652p	3656p
Ag		20	3	N	N	N	N	N	N
As		3600	5000	N	N	N	N	N	N
Au		100	N	N	N	N	N	N	N
B		N	N	70	200	N	50	100	50
Ba		200	150	300	200	300	500	300	700
Be		5	3	N	N	N	3	3	2
Bi		500	N	N	N	N	N	N	N
Ce		700	3000	500	300	500	3000	1500	300
Co		N	30	15	30	20	20	30	30
Cr		70	100	100	150	150	150	150	150
Cu		15	20	30	15	15	15	20	50
La		700	2000	300	100	300	2000	1000	150
Mo		300	30	N	N	N	N	N	N
Nb		300	150	50	20	30	150	50	20
Ni		10	50	30	50	20	20	50	50
Pb		3000	1500	30	30	30	70	70	70
Pt		N	N	N	N	N	N	N	N
Sb		N	N	N	N	N	N	N	N
Sn		G	20,000	2000	20	70	2000	70	N
Th		N	N	N	N	N	L	N	N
U		N	N	N	N	N	N	N	N
V		100	150	150	200	200	200	300	200
W		10,000	3000	N	N	N	N	300	N
Y		300	500	70	150	70	500	200	70
Zn		N	N	N	N	N	N	N	N
Zr		150	200	150	200	100	300	300	150

Map No.

350 351 352 353 354 355 356 357

Sample No.

3653p 3668p 3667p 3662p 3661p 3660p 3663p 3664p

		3653p	3668p	3667p	3662p	3661p	3660p	3663p	3664p
Ag		N	N	N	N	N	N	7	N
As		N	N	N	N	N	N	N	N
Au		N	N	N	N	N	N	N	N
B		50	50	N	N	N	300	N	200
Ba		300	500	100	100	200	50	150	300
Be		3	3	5	3	3	5	7	7
Bi		N	N	N	N	N	N	N	N
Ce		2000	700	5000	7000	300	3000	7000	700
Co		15	30	N	N	N	N	N	15
Cr		100	150	50	20	50	150	70	100
Cu		7	15	15	20	15	15	15	30
Ca		1500	500	3000	5000	1500	2000	5000	500
Mo		N	N	N	N	N	N	N	N
Nb		70	30	300	500	300	300	300	150
Ni		15	50	15	10	15	20	30	30
Pb		100	100	70	100	70	70	150	30
Pt		N	N	N	N	N	N	N	N
Sb		N	N	N	N	N	N	N	N
Sn		100	150	1500	1500	2000	300	15000	2000
Th		500	N	700	700	N	N	N	N
U		N	—	—	—	—	—	—	—
V		150	200	200	100	100	200	100	150
W		N	N	N	N	N	N	500	N
		200	70	1500	1500	700	500	700	200
Zn		N	N	N	N	N	N	N	N
Zr		500	200	3000	700	1500	300	300	300

Map No.

358 359B 360B 361* 362* 363* 364* 365*

Sample No.

3665p 3672B 3673B Ci-MH-1102p Ci-MH-112.1p Ci-MH-1131p Ci-117p Ci-114p

	3665p	3672B	3673B	Ci-MH-1102p	Ci-MH-112.1p	Ci-MH-1131p	Ci-117p	Ci-114p
Ag	N	50	700	i	i	i	i	i
As	N	N	N	300	600	1000	700	1000
Au	N	300	3000	N	N	N	N	i
B	200	N	N	200	200	800	300	200
Ba	500	30	20	100	60	100	60	60
Be	7	100	5	N	N	N	N	N
Bi	N	20	30	2000	3000	2000	3000	800
Ce	500	300	N	-	-	-	-	-
Co	30	15	15	N	N	N	200	N
Cr	100	20	30	N	1000	N	90	N
Cu	70	50	20	2000	2000	1000	2000	8000
La	300	70	70	200	600	N	300	200
Mo	N	N	N	200	300	200	300	L
Nb	100	70	150	400	N	200	N	L
Ni	70	15	20	80	N	N	100	300
Pb	70	300	50	400	500	400	500	700
Pt	N	N	N	i	i	i	i	i
Sb	N	N	N	8000	8000	5000	8000	20,000
Sn	3000	100,000	100,000	4000	900	3000	30,000	5000
Th	N	N	N					
U	-	-	-					
V	150	70	70	N	70	N	200	200
W	700	20,000	20,000	600	2000	1000	G	1000
Y	200	30	20	N	200	800	100	N
Zn	N	N	N	400	700	500	500	200
Zr	300	70	30	300	5000	900	2000	1000

Sample No.

C1129p BE2266

Ag	i	5						
As	500	N						
Au	N	N						
B	100	150						
Ba	N	2000						
Be	N	N						
Bi	3000	N						
Ce	-	N						
Co	300	30						
Cr	200	5000						
Cu	2000	100						
Fe	600	1000						
Mo	300	N						
Nb	200	L						
Ni	80	70						
Pb	400	70						
Pt	i	N						
Sb	8000	500						
Sn	900	N						
Th								
U								
V	70	300						
W	3000	N						
X	200	N						
Zn	500	700						
Zr	7000	N						

APPENDIX - B

Stream sediment analyses (in ppm)

- L - Detected
- N - Not detected
- i - Interference
- G - Greater than detection limits

All analyses by semi-quantitative emission spectrographic method by the University of Alaska except:

- 1) Sample map numbers with an asterisk (*) were analyzed by the Bureau of Mines Reno Metallurgical Lab.
- 2) Sample Map number 337 to 360 were analyzed by the U. S. Geological Survey.

57

364

C: 141

ci 143

[illegible]

[illegible]

Map No.	406	407	408	409	410	411	412	413	62 414
Sample No.	BC1512	BC1516	BC1518	BC1515	BC1528	BC1526	BC1530	BC1532	BC1534
Fe %	1.5	2	5	5	1.5	1.5	1.5	1.5	2
Mg %	1	3	3	2	3	3	2	2	3
Ca %	2	2	5	2	5	5	2	2	3
Na %	G	G	G	G	G	G	G	G	G
K %	—	—	—	—	—	—	—	—	—
Ti %	.15	.5	G	.2	1	.5	.5	G	1
Mn	200	1000	1000	1000	1000	500	1000	1000	1000
Ag	L	L	L	L	L	L	L	L	L
As	N	N	N	N	N	N	N	N	N
Au	N	N	N	N	N	N	N	N	N
B	100	150	100	200	200	100	100	100	150
Ba	N	N	N	N	N	N	N	N	N
Be	L	L	L	L	2	L	N	N	N
Bi	L	L	L	L	L	L	2	2	2
Cd	N	N	N	N	N	N	N	N	N
Co	N	L	L	L	N	L	N	N	L
Cr	300	1000	1000	1000	1000	1000	500	500	500
Cu	1	5	20	2	15	L	10	10	15
Ga	L	1	1	.5	3	1	L	.5	1
La	L	N	N	N	N	N	N	N	N
Li	N	N	N	N	N	N	N	N	N
Mo	L	N	N	N	N	N	N	N	N
Nb	N	N	N	N	N	N	N	N	N
Ni	300	500	300	300	500	700	200	200	200
Pb	N	N	L	N	N	L	N	N	N
Sd	N	N	N	N	N	N	N	N	N
Tb	N	N	N	N	N	N	N	N	N
U	N	N	N	N	N	N	N	N	N
V	—	—	—	—	—	—	—	—	—
W	N	N	N	N	N	N	N	N	N
Xe	N	N	N	N	N	N	N	N	N
Y	N	N	N	N	N	N	N	N	N
Zn	L	100	200	100	100	200	50	100	100
	N	N	N	N	N	N	N	N	N
	L	L	L	L	500	5000	200	500	500

414

415

416

417

418

419

420

421

477

173

Sample No. BC 1539 BC 1537 BC 1541 BC 1542 BC 1544 BC 1545 BC 1548 BC 1550 BC 1554

[illegible]

[illegible]

Map No.	460	461	462	463	464	465	466	467
Sample No.	BC1618	BC1620	BC1621	BC1623	BC1625	BC1626	UP34	UP35
Fe%	10	7.5	10	3.5	3.5	5		
Mg%	3	3.5	1	1	1	1		
Ca%	3	7.5	3.5	3.5	3.5	5		
Na%	6	6	6	6	1.6	6		
K%	-	-	-	-	-	-		
Ti%	0.7	6	1.0	6	0.5	0.5		
Mn	1000	1000	1500	1000	1000	1000		
Ag	3	2	2	1	2	2		
As	N	N	N	N	N	N		
Au	N	N	N	N	N	N		
B	500	200	500	100	50	100		
Ba	L	L	L	N	N	N		
Be	2	L	5	1.5	L	L		
Bi	N	50	20	20	20	20		
Cd	N	N	N	N	N	N		
Co	N	N	N	N	N	N		
Cr	500	1000	1000	1000	1000	500		
Cu	200	2	5	1	1	5		
Ga	2	1.5	2	1	L	0.5		
La	N	N	N	N	N	N		
Li	N	N	N	N	N	N		
Mo	N	N	N	N	N	N		
Nb	N	N	N	N	N	N		
Ni	500	100	200	350	500	200		
P	L	L	L	L	L	L		
Pb	200	L	L	50	50	L		
Pd	N	N	N	N	N	N		
Pt	N	N	N	N	N	N		
Sb	N	N	N	N	N	N		
Sc	N	N	N	N	N	N		
Se	-	-	-	-	-	-		
Sn	N	N	N	N	N	N		
Sr	N	N	N	N	N	N		
Ta	N	N	N	N	N	N		
Te	N	N	N	N	N	N		
V	150	200	500	200	100	200		
W	L	L	N	N	L	N		
Y	N	N	N	N	N	N		
Zn	N	L	L	L	N	N		
Zr	N	6	1000	1000	1000	500		
Th								
U								

Map No.	463	487	488	489	490	491	492	493
Sample No.	UP33	UP8	UP11	UP10	UP305	UP307	UP309	C-253
Fe%								5
Mg%								3
Ca%								7
Na%								6
K%								-
Ti%								6
Mn								3000
Ag								L
As								N
Au								N
B								100
Ba								N
Be								3
Bi								N
Cd								N
Co								150
Cr								5
Cu								1
Ga								N
La								N
Li								N
Mo								N
Nb								N
Ni								70
P								N
Pb								N
Pd								N
Pt								N
Sb								N
Sc								N
Se								-
Sn								N
Sr								N
Ta								N
Te								N
V								200
W								N
Y								N
Zn								N
Zr								N
Th								
U								

Map No.	494	495	496	497	498	499	520	521
Sample No.	C: 254	C: 210	C: 222	C: 230	C: 252	C: 250	C: 130	C: 241
Fe%	5	5	7	5	5	7		5
Mg%	3	5	5	3	5	5		3
Ca%	5	10	5	5	5	7		5
Na%	6	6	6	6	6	6		6
K%	-	-	-	-	-	-		-
Ti%	0.7	6	6	1	1	6		6
Mn	5000	5000	5000	2000	3000	5000		5200
Ag	L	2	L	L	L	2		L
As	N	N	N	N	N	N		N
Au	N	N	N	N	N	N		N
B	100	100	150	100	70	150		70
Ba	N	N	N	N	N	N		N
Be	2	2	L	L	L	5		L
Bi	N	L	L	L	N	N		L
Cd	N	N	N	N	N	N		N
Co	N	N	N	N	N	N		N
Cr	300	2000	2000	2000	200	2000		2000
Cu	30	30	100	50	100	50		100
Ga	2	5	2	0.5	1	5		1
La	N	N	N	N	N	N		N
Li	N	N	N	N	N	N		N
Mo	N	N	N	N	N	N		N
Nb	N	N	N	N	N	N		N
Ni	300	300	500	500	300	300		300
P	N	L	L	L	N	L		L
Pb	N	N	N	N	N	100		N
Pd	N	N	N	N	N	N		N
Pt	N	N	N	N	N	N		N
Sb	N	N	N	N	N	N		N
Sc	N	N	N	N	N	N		N
Se	-	-	-	-	-	-		-
Sn	N	N	N	N	N	N		70
Sr	N	N	N	N	N	N		N
Ta	N	N	N	N	N	N		N
Te	N	N	N	N	N	N		N
V	200	200	500	500	200	700		500
W	N	L	N	N	N	N		N
Y	N	N	N	N	N	N		N
Zn	N	N	N	N	N	700		N
Zr	N	L	N	L	N	N		N
Th								
U								

Map No.	SD2	SD3	SD4	SD5	SD6	SD7	SD8	SD9
Sample No.	C1242	VOID	C1257	C1026	C1117	C1012	C1015	C1249
Fe%	5		10					7
Mg%	5		3					3
Ca%	10		7					5
Na%	G		G					G
K%	-		-					-
Ti%	G		1					G
Mn	3000		G					3000
Ag	L		2 2					2
As	N		N					N
Au	N		N					N
B	SD		20					70
Ba	L		N					N
Be	5		10					L
Bi	L		N					L
Cd	N		N					N
Co	N		N					N
Cr	2000		SD					2000
Cu	30		SD					1SD
Ga	5		5					2
La	N		N					N
Li	N		N					N
Mo	N		N					N
Nb	N		N					N
Ni	300		300					300
P	L		1SD					L
Pb	N		N					N
Pd	N		N					N
Pt	N		N					N
Sb	N		N					N
Sc	N		N					N
Se	-		-					-
Sn	N		N					N
Sr	N		N					N
Ta	N		N					N
Te	N		N					N
V	700		1SD					700
W	N		N					N
Y	N		N					N
Zn	N		N					N
Zr	L		L					N
Th								
U								

Map No.	510	511	512	513	514	515	516	517
Sample No.	Ci 246	Ci 269	Ci 266	Ci 270	Ci 271	Ci 02	Ci 216	Ci 214
Fe%	7	10	10	10	10		10	10
Mg%	3	3	5	3	3		3	7
Ca%	5	5	2	2	7		2	5
Na%	6	6	6	6	6		6	6
K%	-	-	-	-	-		-	-
Ti%	1	1	6	1	1		0.7	6
Mn	3000	3000	3000	3000	3000		5200	5200
Ag	L	2	2	2	2		L	2
As	N	N	N	N	N		N	N
Au	N	N	N	N	N		N	N
B	70	100	200	100	100		200	300
Ba	N	N	N	N	N		N	N
Be	L	2	L	L	L		L	L
Bi	L	L	L	L	L		L	L
Cd	N	N	N	N	N		N	N
Co	N	L	L	L	L		L	L
Cr	2000	2000	1500	1000	2000		2000	2000
Cu	100	70	50	100	100		70	100
Ga	1.5	1	2	2	2		1	5
La	N	N	N	N	N		N	N
Li	N	N	N	N	N		N	N
Mo	N	N	N	N	N		N	N
Nb	N	N	N	N	N		N	N
Ni	500	300	1000	500	700		500	500
P	L	L	2500	L	N		500	1000
Pb	N	N	N	N	N		N	N
Pd	N	N	N	N	N		N	N
Pt	N	N	N	N	N		N	N
Sb	N	N	N	N	N		N	N
Sc	N	N	N	N	N		N	N
Se	-	-	-	-	-		-	-
Sn	N	N	N	N	N		N	N
Sr	N	N	N	N	N		N	N
Ta	N	N	N	N	N		N	N
Te	N	N	N	N	N		N	N
V	500	500	200	200	500		250	200
W	N	N	N	N	N		L	L
Y	N	N	N	N	N		N	N
Zn	N	N	N	N	N		N	N
Zr	L	L	L	N	N		L	L
Th								
U								

Map No.	518	519	520	521	522	523	524	525
Sample No.	C. 218	C. 232	C. 236	C. 245	C. 124	C. 122	C. 262	C. 260
Fe%	2	10	2	5			5	5
Mg%	3	5	3	3			3	3
Ca%	2	5	3	1			1.5	1
Na%	6	6	6	6			6	6
K%	-	-	-	-			-	-
Ti%	1	6	1	1			1	0.1
Mn	2000	3000	2000	2000			3000	2000
Ag	L	2	L	L			2	L
As	N	N	N	N			N	N
Au	N	N	N	N			N	N
B	100	200	200	200			100	200
Ba	N	N	N	N			N	N
Be	L	2	L	L			L	2
Bi	L	L	L	L			L	L
Cd	N	N	N	N			N	N
Co	N	N	N	N			N	N
Cr	500	2000	1000	2000			1000	1000
Cu	50	150	70	50			50	50
Ga	5	5	2	0.5			L	0.5
La	N	N	N	N			N	N
Li	N	N	N	N			N	N
Mo	N	N	N	N			N	N
Nb	N	N	N	N			N	N
Ni	100	500	300	500			300	500
P	L	L	L	L			N	N
Pb	N	L	L	L			N	N
Pd	N	N	N	N			N	N
Pt	N	N	N	N			N	N
Sb	N	N	N	N			N	N
Sc	N	N	N	N			N	N
Se	-	-	-	-			-	-
Sn	N	N	N	N			N	N
Sr	N	N	N	N			N	N
Ta	N	N	N	N			N	N
Te	N	N	N	N			N	N
V	500	200	200	150			150	100
W	N	N	N	N			N	N
Y	N	N	N	N			N	N
Zn	N	N	N	N			N	N
Zr	N	L	N	L			L	L
Th								
U								

Map No.	526	527	528	529	530	531		
Sample No.	C1126	KD1636	KD1635	KD1632	KD1629	KD1627		
Fe%		2	10	0.5	2	1		
Mg%		5	1	2	1	3.5		
Ca%		10	3.5	5	3.5	7.5		
Na%		7	1.6	1.6	1.6	4		
K%		-	-	-	-	-		
Ti%		6	0.05	0.1	0.1	1.0		
Mn		1500	200	520	520	3500		
Ag		2	4	2	1	1.5		
As		N	N	N	N	N		
Au		N	N	N	N	N		
B		150	35	150	75	100		
Ba		N	N	N	N	N		
Be		2	1	2	1	1		
Bi		2	N	N	N	2		
Cd		N	N	N	N	N		
Co		2	N	N	N	52		
Cr		520	20	52	20	1000		
Cu		150	15	52	20	100		
Ga		1.5	2	2	2	1.5		
La		N	N	N	N	N		
Li		N	N	N	N	N		
Mo		N	N	N	N	N		
Nb		N	N	N	N	N		
Ni		N	N	N	N	N		
P		200	10	52	52	150		
Pb		1000	1000	1000	1000	1000		
Pd		N	N	N	N	N		
Pt		N	N	N	N	N		
Sb		N	N	N	N	N		
Sc		N	N	N	N	N		
Se		-	-	-	-	-		
Sn		N	N	N	N	N		
Sr		N	N	N	N	N		
Ta		N	N	N	N	N		
Te		N	N	N	N	N		
V		350	35	35	2	2.2		
W		N	N	N	N	2		
Y		N	N	N	N	N		
Zn		N	N	N	N	N		
Zr		52	2	N	N	52		
Th								
U								