UNITED STATES DEPARTMENT OF THE INTERIOR

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EXPERIMENTAL RESULTS OF ATOMIC ABSORPTION ANALYSES FOR INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

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Experimental results of atomic absorption analyses for indium and thallium in 803 nonmagnetic concentrates from Alaska

by William C. Overstreet, George L. Crenshaw, Arthur E. Hubert, Sam Rosenblum and Ricke J. Smith

Abstract

The development in the U.S. Geological Survey of rapid methods for the determination by atomic absorption spectrophotometry of indium and thallium at limits of detection as low as 0.2 ppm each in geologic materials affords great advantages over spectrographic methods in studies concerned with values at or near the crustal abundances of these elements. Experimental application of the technique to the analysis of 803 nonmagnetic concentrates from Alaska showed specific disadvantages owing to the insolubility of cassiterite--one of the major sources for indium in concentrates--under the conditions of dissolution used in the preparation of samples for analysis by atomic absorption. Where nonmagnetic concentrates are used as a geochemical sample medium, and an exploration program is based on the interpretation of multi-element data, little purpose is served by independent analyses for indium and thallium.

Introduction

Background

The development during the early 1970's by A. E. Hubert and H. W. Lakin (1972), U.S. Geological Survey, of rapid methods for the determination by atomic absorption spectrophotometry of indium and thallium in geologic materials was followed by experimental applications of the technique to a diverse array of sample materials. The purpose of these experiments was to define the limitations of the new method in geochemical exploration. One of the sets of samples so analyzed was the 803 nonmagnetic concentrates discussed below.

The background of these nonmagnetic concentrates has been reviewed elsewhere (Hamilton and others, 1974), but a brief account is appropriate here.

Between 1895 and 1953 about 5,000 heavy-mineral concentrates were collected, mainly through panning, in Alaska by geologists of the U.S. Geological Survey and placed in storage for reference. These concentrates came to be known as the Alaskan Placer Concentrate File. Prior to 1944, little chemical work was done on these samples owing to a lack of rapid and inexpensive methods of analysis, and mineralogical examinations tended toward cursory inspection for gold, platinum, and cassiterite. Two exceptions are the mineralogical studies made by Waters (1934), and the investigations of the chemical characteristics of Alaskan placer gold undertaken by Mertie (1940). Beginning in 1944 when the Alaskan Trace Elements Program was initiated by the U.S. Geological Survey with funding from the U.S. Atomic Energy Commission to search for radioactive minerals in Alaska, the file of placer concentrates was examined radiometrically, and the sources of radioactive concentrates became starting points for field work aimed at locating radioactive deposits in Alaska. This program contributed immensely to the number of concentrates in the file. All concentrates added to the file were examined for radioactive minerals by J. J. Matzko, U.S. Geological Survey, and an extensive literature appeared about them (Bates and Wedow, 1953). A recent summary of this program and of work done by State agencies and other entities was made by Eakins (1969).

The collecting of heavy-mineral concentrates declined as a field procedure after 1953 with a few notable exceptions such as the work of Sheth (1971) at Nome. Few samples have been added to the Alaskan Placer Concentrate File since that date. Factors contributing to the decline included: (1) closure of most of the placer mines, (2) a decline in the study of metallic mineral deposits, and (3) most importantly, the growing use of silt and clay as the preferred geochemical sample medium rather than coarser-grained material like sand-sized heavy-mineral concentrates.

Geochemical prospecting for deposits of metallic minerals was introduced into Alaska by the U.S. Geological Survey in 1951 by C. L. Sainsbury (1957) and expanded in the late 1950's by R. M. Chapman and H. T. Shacklette (1960), following the development in the Survey of rapid and inexpensive analytical methods for minor elements (Lakin and others, 1952; Myers and others, 1956, 1961; Ward and others, 1963, 1969). These rapid methods were applied in analyses of alluvial silt and clay, which are more readily and cheaply collected than concentrates. Perhaps it was this emphasis on the taking of samples of silt and clay as the preferred sample medium that prompted the papers by Mertie (1954) and Theobald (1957) on the use of the gold pan to collect concentrates for geological exploration.

Considerable advantage is gained under certain geologic conditions by the use of sand-sized concentrates, instead of or together with, silt and clay, as the geochemical sample medium (Hawkes and Webb, 1962, p. 278). An advantage of sand-sized panned concentrates was shown during 1968 in Alaska by a study near a tin-bearing granite on the Seward Peninsula (Sainsbury and others, 1970). This survey demonstrated that geochemical exploration based on analyses of silt and clay from stream sediments may fail to disclose deposits containing heavy resistant minerals such as cassiterite, as well as minerals containing antimony, arsenic, gold, lead, silver, and zinc. Analyses of sand-sized concentrates panned from alluvial gravel at the same sites where the silt and clay were sampled readily yielded data which helped identify the bedrock sources of tin and other metals.

Further tests of the use of concentrates as a geochemical sample medium in subarctic and arctic environments through analysis of splits of samples in the Alaskan Placer Concentrate File were begun in 1970 by C. L. Sainsbury and others. The first samples to be studied were 1,069 nonmagnetic concentrates analyzed by semiquantitative spectrographic methods for 45 elements (Hamilton and others, 1974). From this group of samples, 803 nonmagnetic concentrates weighing 1 g or more each were split and analyzed for indium and thallium.

Purpose and scope

The purpose of the present work is to evaluate a newly developed method of analysis for indium and thallium (Hubert and Lakin, 1972) where the method is applied to nonmagnetic separates from panned concentrates. Inasmuch as the analytical method was designed for use in geochemical exploration, and nonmagnetic concentrates are a suitable sample medium for geochemical exploration, it is necessary that the method should be tested on the medium. The scope of the report is restricted to the presentation and evaluation of the results of the analyses of the 803 nonmagnetic concentrates from Alaska.

The method of Hubert and Lakin (1972) is useful in detail in the refining of the zonal arrangement of elements around sulfide deposits by adding indium and thallium, which have geologically definitive chemical characteristics, to the suite of elements that can be determined by the semiquantitative spectrographic methods of analysis used in geochemical exploration. Extension of the use of the method to concentrates of heavy resistant minerals to provide a tool for regional reconnaissance geochemical exploration was attempted using the 803 nonmagnetic concentrates from Alaska. The results were not wholly successful. It was found that much of the indium and thallium in these concentrates is in minerals that resist dissolution by the present analytical method. From the data presented, it seems unlikely that extensive analytical research is needed to overcome this constraint because where a regional reconnaissance exploration program is based on the interpretation of multielement data, independent analyses for indium and thallium are not needed.

Acknowledgment

The help of William R. Marsh, U.S. Geological Survey, in separating the nonmagnetic fraction from the concentrates and in preparing the material for analysis is gratefully acknowledged.

Nonmagnetic concentrates

Source

The 803 nonmagnetic concentrates are from stream and beach deposits, or are from crushed rock, at various places in the areas covered by 38 of the 1:250,000-scale quadrangle maps of Alaska (fig. 1). Detailed descriptions

Figure 1. Map of Alaska showing generalized outlines of areas represented by analyzed concentrates.

of the source for each concentrate, as recorded in the Alaskan Placer Concentrate File, are given in table 1, where it can be seen that most of the samples

Table 1.--NEAR HERE

are concentrates panned from stream sediments. The sample numbers used in table 1 are the file numbers in the records of the Alaskan Placer Concentrate File.

A number of localities are the sources for half-a-dozen or more samples. This is caused by repetitive sampling of the same general site by successive geologists over the years, and by the fact that the actual localities, though somewhat different on the ground, are plotted at the same positions on the 1:250,000-scale quadrangles. Early samples, particularly, are exactly located only where they were taken at an active mine, the location of which was still recognized after the quadrangle maps were made.

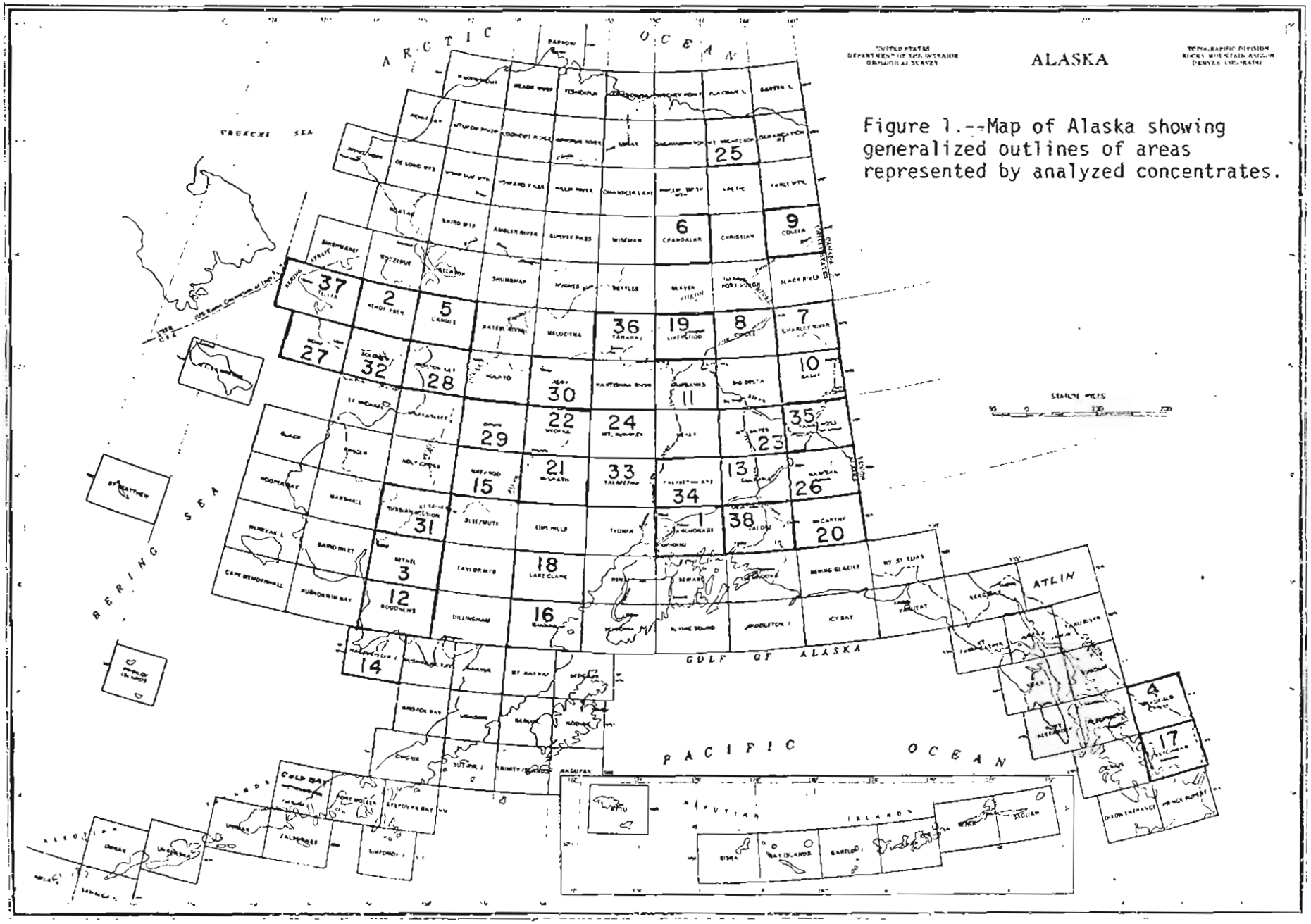

Figure 1.--Map of Alaska showing generalized outlines of areas represented by analyzed concentrates.

EXPLANATION

2

Index of 1:250,000-scale topographic maps of Alaska covering areas of analyzed concentrates:

1. Anchorage
2. Bendeleben
3. Bethel
4. Bradfield Canal
5. Candle
6. Chandalar
7. Charley River
8. Circle
9. Coleen
10. Eagle
11. Fairbanks
12. Goodnews
13. Gulkana
14. Hagemeister Island
15. Iditarod
16. Iliamna
17. Ketchikan
18. Lake Clark
19. Livengood
20. McCarthy
21. McGrath
22. Medfra
23. Mt. Hayes
24. Mt. McKinley
25. Mt. Michelson
26. Nabesna
27. Nome
28. Norton Bay
29. Ophir
30. Ruby
31. Russian Mission
32. Solomon
33. Talkeetna
34. Talkeetna Mountains
35. Tanacross
36. Tanana
37. Teller
38. Valdez

Figure 1.--Map of Alaska showing generalized outlines of areas represented by analyzed concentrates.

TABLE 1.--LOCATIONS AND DESCRIPTIONS OF 803 NONMAGNETIC CONCENTRATES FROM ALASKA

SAMPLE CODE:

PSC = PANNED STREAM (OR BEACH) CONCENTRATE

SSC = SLUICE BOX (OR DREDGE) CONCENTRATE

CRC = CRUSHED ROCK CONCENTRATE

B = FINER THAN 20 MESH, DENSITY 2.87 - 3.3

M = FINER THAN 20 MESH, DENSITY GREATER THAN 3.3

P = COARSER THAN 20 MESH, DENSITY GREATER THAN 2.87

U = FINER THAN 20 MESH, DENSITY GREATER THAN 2.87

ABBREVIATIONS USED UNDER LOCATION:

BR(S)	BRANCH(ES)	HW(S)	HEADWATERS(S)	NO.	NUMBER	USTR	UPSTREAM
BTW	BETWEEN	HWY	HIGHWAY	PT	POINT	W	WEST
CO.	COMPANY	IS	ISLAND	R	RIVER	YDS	YARDS
CONC	CONCENTRATE	JCT	JUNCTION	RD	ROAD	1ST	FIRST
CR(S)	CREEK(S)	L	LEFT	RT	RIGHT	2ND	SECOND
DSTR	DOWNSTREAM	MI	MILE(S)	S	SOUTH	3RD	THIRD
E	EAST	MID	MIDDLE	SPGS	SPRINGS	4TH	FOURTH
FT	FEET/FOOT	MT	MOUNTAIN	STR	STREAM	(ETC.)	
FK(S)	FORK(S)	N	NORTH	TRIB	TRIBUTARY		

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
1	EAGLE	PSCU	WADE CR	64	4	45	141	36	15
10	MEDFRA	PSCU	NIXON FORK MINE 11-1/2 MI FROM BERRYS LANDING	63	14	30	154	48	0
17	FAIRBANKS	SBCU	CLAIM 21 BELOW DISCOVERY GOLDSTREAM CR	64	56	30	147	41	15
18	BENDELEBEN	PSCU	CUNNINGHAM CR	65	56	45	163	21	15
19	RUBY	PSCU	LONG CR TRIB TO SULATNA R	64	23	0	155	29	45
21	FAIRBANKS	PSCU	LITTLEWOOD DRIFT PLACER ENGINEER CR	64	56	0	147	34	30
27	EAGLE	PSCU	CHICKEN CR TRIB TO MOSQUITO FK OF FORTYMILE R	64	5	0	141	55	30
29	EAGLE	PSCU	DOME CR	64	23	30	141	12	45
30	OPHIR	PSCU	ANVIL CR	63	6	45	156	30	15
36	LIVENGOOD	SBCU	FISH CR TRIB TO LITTLE CHENA R	65	1	15	147	10	30
38	RUBY	PSCU	MASCOT BENCH, LONG CR DIETZ PROPERTY	64	24	15	155	28	30
42	RUBY	PSCU	POORMAN CR	64	6	0	155	34	30
43	IDITAROD	PSCU	GANES CR TRIB TO INNOKO R OPHIR AREA	62	57	0	156	33	0
47	OPHIR	PSCU	PUNTILA DREDGE ON LITTLE CR TRIB TO INNOKO R	63	4	30	156	26	30
48	RUBY	PSCU	BEAR PUP	64	24	15	155	28	30
51	RUBY	PSCU	MONUMENT CR TRIB TO SULATNA R	64	15	45	155	24	15
52	OPHIR	PSCU	VICTOR GULCH SPRUCE CR AREA	63	6	0	156	29	0
55	RUBY	PSCU	MOOSE CR	64	2	30	155	48	0
56	RUBY	PSCU	MOUTH OF SOLOMON CR	64	4	0	155	38	15
59	RUBY	PSCU	GLEN GULCH	64	24	15	155	21	45
67	RUSSIAN MISSION	PSCU	OPHIR CR	61	15	15	159	53	0
71	IDITAROD	SBCU	PUNTILA DREDGE UPPER PLACER ON GANES CR	62	58	30	156	30	30
74	LIVENGOOD	PSCU	LIVENGOOD AREA OLIVE CR	65	29	30	148	30	30
80	OPHIR	PSCU	OPHIR CR	63	5	0	156	33	30
84	EAGLE	PSCU	WADE CR	64	6	45	141	33	15
90	RUBY	PSCU	FLOYD & CO. POORMAN CR	64	5	30	155	30	15
94	SOLOMON	PSCU	BIG CR TRIB TO GROUSE CR SLISKOVICH CLAIM	64	58	45	164	44	0
96	LIVENGOOD	SBCU	LOWER CLEARY CR F.E. CO. DREDGE NO. 3	65	7	0	147	30	30
97	LIVENGOOD	SBCU	FAIRBANKS CR JUST ABOVE MOUTH OF DEEP CR	65	3	30	147	9	30
98	FAIRBANKS	PSCU	GOLDSTREAM CR WAGNER PROPERTY	64	57	30	147	35	0
99	LIVENGOOD	SBCU	CHATHAM CR	65	4	30	147	25	30
100	LIVENGOOD	SBCU	FAIRBANKS CR NEAR MEEHAN	65	4	30	147	10	30
102	FAIRBANKS	PSCU	ESTER CR AT MOUTH OF EVA CR TRIB TO CRIPPLE CR	64	50	45	148	1	30
103	FAIRBANKS	PSCU	READY BULLION CR ABOVE ESTER CR CLAIM NO. 2	64	50	45	148	1	30
106	LIVENGOOD	SBCM	UPPER CLEARY CR F.E. CO. NO. 5 DREDGE	65	6	0	147	25	0
109	FAIRBANKS	PSCU	GILMORE CR .7 MI ABOVE HILL PUP JANIKSELA PLACER	64	58	45	147	23	0
112	NOME	PSCU	LITTLE CR	64	31	45	165	27	30
117	BENDELEBEN	PSCU	CUNNINGHAM CR	65	55	30	163	21	30
118	NOME	PSCU	MONROEVILLE BEACH NOME	64	31	45	165	27	30
119	NOME	SBCU	GUNMAN & AMES DREDGE GLACIER CR	64	33	15	165	30	0
122	BENDELEBEN	PSCU	LITTLE GARFIELD CR	65	30	0	164	21	45
125	RUBY	PSCU	LONG CR MIDNIGHT CO.	64	19	0	155	31	0
127	SOLOMON	SBCU	QUIGGLEY HYDRAULIC PLACER PENNY CR	64	39	0	164	21	15
128	RUBY	PSCU	ROBINSON PLACER GROUND ON RUBY CR	64	44	0	155	29	30
130	RUBY	PSCU	GREENSTONE CR TRIB TO LONG CR IN LONG AREA	64	18	15	155	29	30
131	RUBY	PSCU	LUCKY CR	64	26	30	155	22	0
133	RUBY	PSCU	SHORT CR TRIB TO LONG CR	64	20	30	155	35	0
141	RUBY	PSCU	SPRUCE CR TRIB TO SULATNA R	64	10	0	155	25	30
145	LIVENGOOD	PSCU	FAIRBANKS CR NO. 12 BENCH L LIMIT	65	0	30	147	16	0
148	LIVENGOOD	PSCU	FAIRBANKS CR CLAIM 3 ABOVE DISCOVERY	65	4	0	147	14	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
149	GOODNEWS	PSCU	KATTAMUSE CR DISCOVERY CLAIM	59	20	15	161	13	30
150	LIVENGOOD	PSCU	LITTLE ELDORADO CR NEAR MARSHALL GULCH	65	4	15	147	32	45
165	LIVENGOOD	PSCU	PEDRO CR BELOW DISCOVERY CLAIM	65	0	15	147	32	30
168	EAGLE	PSCU	NAPOLEON CR TRIB TO S FK FORTYMILE R	64	6	45	141	40	30
184	LIVENGOOD	PSCU	MOUTH OF LILLIAN CR NO.1 ABOVE DISCOVERY	65	28	45	148	35	0
188	RUSSIAN MISSION	PSCU	OWHAT R 7 MI USTR OF ANIAK	61	39	15	159	22	45
192	LIVENGOOD	PSCU	LIVENGOOD CR AREA	65	33	30	148	24	0
196	MT MC KINLEY	PSCU	LITTLE MOOSE CR TOKLAT R CLAIM NO. 20	63	47	0	150	22	30
201	NOME	PSCU	SLEDGE CR	64	41	30	165	37	30
212	TELLER	PSCU	CASSITERITE CR	65	28	45	167	8	30
220	RUSSIAN MISSION	PSCU	OWHAT CR N TRIB TO KUSKOKWIM R	61	37	15	159	23	0
222	TELLER	SDCU	BUCK CR AMERICAN TIN DREDGING CO.	65	39	0	167	31	0
232	MT HAYES	PSCU	MEYERS & FRDELICH GROUND ON BEND OF SLATE CR	63	10	45	144	50	15
238	MT HAYES	PSCU	RUDY GULCH CHISNA R	63	9	45	144	45	0
240	BETHEL	PSCU	RIGLUGALIK R BETHEL AREA	60	46	30	161	23	0
241	MT HAYES	PSCU	SLATE CR MILLER CLAIMS N OF MILLER GULCH	63	13	30	144	47	45
247	NOME	PSCU	SUBMARINE BEACH GIBSON CLAIM	64	30	15	165	27	30
254	TALKEETNA	PSCU	MILLS CR CACHE CR DISTRICT	62	20	30	151	22	0
256	EAGLE	PSCU	INGLE CR	64	6	0	142	1	30
260	TALKEETNA	PSCU	ST LOUIS BENCH BIRD CR	62	35	0	150	57	0
261	CPHIR	PSCU	BOOB CR E OF TOLSTOI	63	21	15	157	1	30
268	GOODNEWS	PSCU	ARGLIK R	59	33	45	161	28	30
270	TELLER	PSCU	BEACH E OF TELLER MISSION	65	19	30	166	24	30
276	CANDLE	PSCU	BEAR CR	65	37	15	161	9	0
277	EAGLE	PSCU	S FK FORTYMILE R JOS DANKER NO.6	64	3	45	141	50	0
279	NOME	PSCU	OSBORN CR NOME	64	34	30	165	6	0
286	NOME	PSCU	NOME BEACH	64	30	15	165	27	30
288	BENDELEBEN	PSCU	DICK CR CLAIM NO. 3 ABOVE DISCOVERY	65	50	15	164	57	45
293	MT HAYES	PSCU	SLATE CR	63	10	30	144	47	45
296	MEDFRA	PSCU	RUSTY GULCH BACK OF APPEL MT	63	5	0	155	27	30
299	BENDELEBEN	PSCU	JUMP CR	65	51	15	162	1	15
304	NORTON BAY	PSCU	BONANZA CR E OF UNGALIK	64	33	30	160	44	45
313	BENDELEBEN	PSCU	BOULDER CR TRIB TO NOXAPAGA R	65	33	0	164	18	45
315	CANDLE	PSCU	PEACE R NEAR ANZAC CR	65	23	0	161	2	45
331	FAIRBANKS	PSCU	FIRST CHANCE CR	64	57	15	147	32	30
332	NOME	PSCU	HOBSON CR	64	45	30	165	18	45
444	CANDLE	PSCU	DIME CR ABOVE DISCOVERY CLAIM	65	6	45	161	8	30
475	TALKEETNA	PSCU	HEAD OF CACHE CR WM PETERSON PROPERTY	62	31	30	150	59	30
476	TALKEETNA	PSCU	SLOPE ABOVE NUGGET CR	62	33	30	150	57	30
482	TALKEETNA	PSCU	CANYON CR TRIB TO LONG CR	62	36	0	150	45	30
483	MC GRATH	PSCM	ALDER GULCH VINASALE MT	62	41	15	155	43	45
488	TELLER	PSCU	CASSITERITE CR	65	28	45	167	8	30
489	TELLER	PSCU	CASSITERITE CR	65	28	45	167	8	30
493	TELLER	PSCU	GOODWIN GULCH TRIB TO GOODWIN CR CAPE MT AREA	65	35	45	167	54	0
494	TELLER	PSCU	CAPE CR OVERLOOK CLAIM NEAR NORTH STAR MINES	65	34	45	167	55	0
495	TELLER	PSCU	BUCK CR POTATO MT	65	38	0	167	30	0
497	TELLER	PSCM	CAPE CR TIN CITY	65	33	30	167	57	15
506	TELLER	SCCU	GROUSE CR BELOW BUCK CR POTATO MT AREA	65	37	15	167	27	0
532	EAGLE	PSCU	LOST CHICKEN CR	64	4	0	141	52	45
535	EAGLE	PSCU	MYERS FK	64	6	0	141	55	15

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
540	OPHIR	PSCU	OPHIR CR	63	6	0	156	32	30
542	HAGEMEISTER IS	PSCU	6 MI S OF PLATINUM	58	55	30	161	46	45
543	HAGEMEISTER IS	CRCU	PLAIN BTW PLATINUM AND CLIFFS TO SE	58	57	15	161	46	30
545	HAGEMEISTER IS	PSCU	BEACH 7200 FT N OF MOUTH OF SALMON R	58	52	45	161	46	30
580	TELLER	PSCU	UPPER END OF IRON CR NEAR POTATO MT	65	38	30	167	33	0
585	TELLER	PSCU	BEACH 1000 FT E OF MOUTH OF BOULDER CR	65	38	30	167	59	0
587	TELLER	PSCU	BEACH 1200 FT NE OF RED FOX CR	65	43	0	167	32	30
607	TELLER	PSCU	W SIDE CASSITERITE CR ABOVE CAMP CR	65	28	45	167	8	30
608	TELLER	PSCU	DRY CHANNEL CASSITERITE CR BELOW CAMP CR	65	28	45	167	8	30
649	NOME	PSCU	DOROTHY CR TRIB OF NOME R	64	49	30	165	14	30
651	IDITAROD	PSCU	FLAT CR TRIB OF OTTER CR	62	24	0	158	0	0
681	RUBY	PSCU	5TH OF JULY CR BELOW WINTER TRAIL	64	21	30	155	31	45
683	RUBY	SSCU	HEAD OF GLACIER CR N SIDE OF CECIL DOME	64	39	0	155	23	30
684	RUBY	PSCU	BIRCH CR JUST BELOW CROOKED CR	64	27	0	155	20	30
688	RUBY	PSCU	BIRCH CR BTW STRAIGHT AND CROOKED CRS	64	27	0	155	21	30
727	OPHIR	PSCU	CRIPPLE CR SE OF CRIPPLE	63	33	30	156	4	30
728	OPHIR	PSCU	UPPER OPHIR CR BELOW UPPER DISCOVERY	63	5	15	156	33	0
900	MEDFRA	PSCU	GREER GULCH	63	15	45	154	44	45
901	MEDFRA	PSCU	HOLMES GULCH	63	12	45	154	46	0
902	MEDFRA	PSCU	HOLMES GULCH	63	12	45	154	46	0
903	MEDFRA	PSCU	CABIN AT WHISTLING	63	13	30	154	45	0
911	MEDFRA	PSCU	TINY OR ENCIO GULCH	63	13	30	154	45	0
912	MEDFRA	PSCU	HIDDEN BELOW ENCIO	63	13	30	154	45	0
913	MEDFRA	PSCU	MYSTERY CR	63	14	45	154	45	30
918	BETHEL	PSCU	CANYON CR HALFWAY BTW NYAC AND GOODNEWS	60	16	30	160	12	30
921	RUSSIAN MISSION	PSCU	TULUKSAK R 1/2 MI ABOVE BEAR CR	61	1	30	159	56	45
922	BETHEL	PSCU	CRIPPLE CR 4 MI ABOVE SALMON R	60	46	30	159	33	30
928	BETHEL	PSCU	MARVEL CR	60	54	15	159	37	30
929	BETHEL	PSCU	MARVEL CR	60	53	45	159	37	15
1019	MT MC KINLEY	PSCU	CARIBOU CR BELOW MOUTH CREVICE CR	63	35	45	150	46	30
1021	MT MC KINLEY	PSCU	CARIBOU CR	63	36	30	150	45	30
1023	MT MC KINLEY	PSCU	CARIBOU CR	63	36	15	150	47	0
1026	MT MC KINLEY	PSCU	GLACIER CR CLAIM NO. 14 JUST BELOW FIFTEEN GULCH	63	34	45	150	53	0
1028	MT MC KINLEY	PSCU	CARIBOU CR	63	36	15	150	42	45
1035	CANDLE	PSCU	SPRING CR	65	22	0	161	15	0
1036	CANDLE	PSCU	SWEEPSTAKES CR	65	19	45	161	16	0
1049	CANDLE	PSCU	SNOW GULCH TRIB TO SPRING CR	65	21	0	161	15	0
1055	CANDLE	PSCU	SWEEPSTAKES CR	65	22	0	161	16	45
1060	CANDLE	PSCU	LOWER SWEEPSTAKES CR	65	19	0	161	13	30
1069	CANDLE	PSCU	SWEEPSTAKES CR BEND BELOW FKS	65	21	30	161	18	0
1268	TALKEETNA	PSCU	CACHE CR JUST ABOVE MOUTH OF NUGGET CR	62	31	0	150	54	0
1277	TALKEETNA	PSCU	MORGANS HIGH BENCH CUT NUGGET CR	62	33	15	150	59	0
1283	TALKEETNA	PSCU	NUGGET CR HIGH BENCH NEAR MOUTH	62	31	0	150	54	0
1287	TALKEETNA	PSCU	LONG CR L BANK NEAR MOUTH	62	30	0	150	55	0
1290	TALKEETNA	PSCU	CACHE CR 2000 FT DSTR OF NUGGET CR	62	30	45	150	55	30
1295	TALKEETNA	PSCU	CACHE CR TERASKIS CUT	62	29	30	150	57	0
1297	TALKEETNA	PSCU	CACHE CR 2000 FT BELOW MOUTH OF TROUT CR	62	29	30	150	57	0
1301	TALKEETNA	PSCU	THUNDER CR HAUGHARNS CUT	62	32	30	151	0	0
1304	TALKEETNA	PSCU	CHEECHAKO GULCH KRUMMENACHERS CUT	62	28	0	151	0	30
1313	TALKEETNA	PSCU	CACHE CR JUST DSTR OF DOLLAR CR	62	27	0	151	2	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
1317	TALKEETNA	PSCU	NEAR MOUTH OF BIRD CR	62	34	45	150	54	0
1322	TALKEETNA	PSCU	RUBY CR TRIB OF WILLOW CR	62	35	0	150	52	30
1325	TALKEETNA	PSCU	PETERS CR AT PETERSVILLE DRAGLINE TAILINGS	62	30	0	150	47	0
1332	TALKEETNA	SBCU	MORGANS BENCH CUT ON NUGGET CR	62	33	0	150	58	30
1336	TALKEETNA	SBCU	CACHE CR OPPOSITE LUCKY GULCH	62	30	0	150	57	30
1442	LIVENGOOD	PSCU	BELLE CR 100 FT ABOVE HWY BRIDGE	65	13	15	147	12	0
1446	LIVENGOOD	SBCU	RUTH CR	65	31	15	148	31	30
1447	LIVENGOOD	PSCU	MC CORD CR	65	28	15	148	16	30
1448	LIVENGOOD	PSCU	TOLOVANA R DSTR FROM MC CORD CR	65	28	15	148	16	30
1449	LIVENGOOD	PSCU	SMALL CR ON S SIDE OF AMY DOME E OF ESTER CR	65	29	0	148	24	30
1450	LIVENGOOD	PSCU	ESTER CR JUST USTR FROM LIVENGOOD RD	65	29	0	148	29	0
1453	LIVENGOOD	PSCU	OLIVE CR PARKERS CLAIMS	65	29	30	148	30	30
1454	LIVENGOOD	PSCU	LILLIAN CR	65	30	15	148	34	0
1455	LIVENGOOD	PSCU	AMY CR	65	32	15	148	26	30
1457	LIVENGOOD	PSCU	GOODLUCK CR FROM TAILINGS PILE	65	33	0	148	24	30
1469	MT HAYES	PSCU	BERRY CR 300 FT ABOVE HWY BRIDGE	63	41	15	144	21	0
1471	MT HAYES	PSCU	SEARS CR 1/4 MI ABOVE HWY BRIDGE	63	41	30	144	27	30
1472	MT HAYES	PSCU	DRY CR 250 FT ABOVE HWY BRIDGE	63	41	15	144	33	30
1473	MT HAYES	PSCU	LITTLE GERSTLE R 300 FT ABOVE HWY BRIDGE	63	47	0	144	48	0
1474	MT HAYES	PSCU	ALASKA HWY MI 1367 BY MOUTH OF JOHNSON R	63	42	30	144	38	0
1475	MT HAYES	PSCU	CHIEF CR 75 FT ABOVE HWY BRIDGE	63	37	15	144	0	30
1476	TANACROSS	PSCU	ALASKA HWY MI 1350 TRIB OF TANANA R	63	33	45	143	53	30
1477	TANACROSS	PSCU	ALASKA HWY MI 1345 TRIB OF TANANA R	63	23	30	143	46	30
1478	TANACROSS	PSCU	ALASKA HWY MI 1334.6 TRIB OF TANANA R	63	23	0	143	46	0
1479	TANACROSS	PSCU	YERRICK CR 100 FT ABOVE HWY BRIDGE	63	22	45	143	37	0
1491	NABESNA	PSCU	STATION CR 1/2 MI ABOVE HWY BRIDGE	62	56	0	143	39	15
1493	NABESNA	PSCU	TRIB OF MENTASTA CR 4.5 MI E STATION CR	62	56	15	143	30	0
1494	NABESNA	PSCU	TRIB OF MENTASTA CR 6.6 MI E STATION CR	62	56	0	143	24	0
1495	NABESNA	PSCU	TRIB OF MENTASTA CR 9.2 MI E STATION CR	62	57	45	143	22	30
1496	NABESNA	PSCU	TRIB OF LITTLE TOK R 1 MI BELOW TRAIL CR	62	58	30	143	18	0
1497	TANACROSS	PSCU	TRIB OF LITTLE TOK R 4 MI BELOW TRAIL CR	63	1	15	143	20	30
1498	TANACROSS	PSCU	TRIB LITTLE TOK R 5.5 MI BELOW TRAIL CR	63	2	15	143	21	0
1499	TANACROSS	PSCU	TRIB OF TOK R 5.5 MI NE OF 1498	63	7	30	143	14	30
1500	TANACROSS	PSCU	ROAD CUT AT MOUTH OF LITTLE TOK R	63	5	0	143	19	30
1501	TANACROSS	PSCU	TRIB OF TOK R 5.5 MI BELOW LITTLE TOK R	63	8	45	143	15	30
1504	NABESNA	PSCU	1ST RT TRIB TO INDIAN PASS CR	62	51	0	143	51	0
1505	NABESNA	PSCU	3RD L TRIB TO INDIAN PASS CR	62	51	0	143	51	0
1506	NABESNA	PSCU	1ST L TRIB TO INDIAN PASS CR	62	51	0	143	51	0
1507	NABESNA	PSCU	2ND RT TRIB OF SLANA R ABOVE PORCUPINE CR	62	49	30	143	45	0
1509	MT HAYES	PSCU	GULKANA R 1 MI BELOW TOE OF GLACIER	63	12	30	145	30	15
1510	MT HAYES	PSCU	RT TRIB OF PHELAN CR 4.5 MI ABOVE MOUTH	63	16	30	145	39	15
1511	MT HAYES	PSCU	RT TRIB OF PHELAN CR 3.5 MI ABOVE MOUTH	63	17	30	145	38	45
1512	MT HAYES	PSCU	RT TRIB OF PHELAN CR 2 MI ABOVE MOUTH	63	18	15	145	40	30
1513	MT HAYES	PSCU	DELTA R 1/4 MI BELOW PHELAN CR	63	19	30	145	45	0
1514	MT HAYES	PSCU	RT TRIB DELTA R 2.25 MI BELOW CASTNER CR	63	25	45	145	45	30
1736	IDITAROD	PSCU	QUARTZ GULCH ON DONLIN CR	62	4	45	158	11	30
1771	NABESNA	PSCU	CROSS CR	62	10	0	142	7	0
1775	IDITAROD	SBCU	WILLOW CR MANLEY WORKINGS	62	21	0	158	7	45
1799	IDITAROD	PSCU	GOLD CR AT FOOT OF HWS SLOPE	62	21	15	158	3	0
1803	IDITAROD	PSCU	CLEARY CR W LIMIT OF HWS PK	62	21	30	158	0	0

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
1804	IDITAROD	SBCU	CHICKEN CR FRITZ AWE MINE NEAR MOUTH OF CR	62	19	45	157	58	45
1805	IDITAROD	PSCU	FT OF STEEP GRADIENT OF CHICKEN CR	62	20	45	157	58	15
1814	IDITAROD	PSCU	HEAD OF CHICKEN CR	62	23	0	157	58	15
1815	IDITAROD	SBCU	CHICKEN CR	62	22	15	157	59	30
1819	IDITAROD	SBCU	FIRST CHANCE CR	62	22	30	157	55	30
1820	IDITAROD	PSCU	W FK OF SLATE CR	62	25	30	157	56	0
1831	IDITAROD	PSCU	FRANK SALEM CUT ON GRANITE CR	62	28	15	157	53	0
1838	IDITAROD	SBCU	HALAMUTE PUP FRED LUSHER MINE	62	27	0	157	57	30
1867	IDITAROD	SBCU	OTTER CR RILEY DREDGE CONC	62	27	15	158	1	15
1872	IDITAROD	PSCM	COTTONWOOD CR AT BRIDGE OF IDITAROD RD	62	28	0	158	1	30
1873	IDITAROD	PSCU	COTTONWOOD CR AT MI 1 ON IDITAROD RD	62	28	0	158	1	30
1874	IDITAROD	SBCU	FLAT CR MATHESON DREDGE AT FLAT	62	27	15	158	1	15
1877	IDITAROD	PSCU	FLAT CR UPPER PART W LIMIT CUT NEAR UPPER END	62	26	0	158	0	30
1883	IDITAROD	SBCU	FLAT CR PAT SAVAGE MINE	62	25	45	157	59	15
1917	MC GRATH	SBCU	CANDLE CK	62	53	15	155	49	0
1925	IDITAROD	SBCU	JULIAN CR W SIDE OF MID FK GEORGE R	62	12	30	157	22	30
1936	BENDELEBEN	PSCU	HOT SPRINGS CR	65	52	15	164	37	45
1983	BENDELEBEN	PSCU	REINDEER CR	65	48	0	164	37	30
1984	BENDELEBEN	PSCU	REINDEER CR	65	49	30	164	46	15
1989	BENDELEBEN	PSCU	HOT SPRINGS CR	65	52	30	164	37	0
2025	BENDELEBEN	PSCU	FISH R	65	54	15	164	26	30
2027	BENDELEBEN	PSCU	HUMBOLDT CR	65	53	30	164	25	45
2033	BENDELEBEN	PSCM	HUMBOLDT CR	65	53	45	164	22	30
2034	BENDELEBEN	PSCU	FISH R	65	56	0	164	17	30
2046	TELLER	PSCU	HENRY CR AREA	65	39	30	165	7	15
2048	TELLER	PSCU	HENRY CR AREA	65	38	45	165	8	30
2053	TELLER	PSCU	COLUMBIA CR	65	40	0	165	9	45
2056	TELLER	PSCU	WASHINGTON CR	65	43	45	165	3	30
2058	TELLER	PSCU	HENRY CR AREA	65	40	0	165	9	45
2065	TELLER	PSCU	HENRY CR AREA	65	39	15	165	5	0
2082	TELLER	PSCU	COLUMBIA CR	65	40	15	165	11	0
2083	TELLER	PSCU	WASHINGTON CR	65	42	15	165	6	30
2092	BENDELEBEN	PSCU	HARRIS CR AREA LUCKY CR	65	41	0	164	32	0
2097	BENDELEBEN	PSCU	HARRIS CR	65	39	45	164	31	30
2107	BENDELEBEN	PSCU	HARRIS CR MOUTH	65	36	30	164	35	30
2116	BENDELEBEN	PSCU	IRON CR	65	36	30	164	27	0
2118	BENDELEBEN	PSCU	NAPOLEON CR NORTH FORK AREA	65	37	15	164	29	0
2119	RUSSIAN MISSION	PSCU	BEAR CR 3/4 MI ABOVE BONANZA CR	61	3	30	159	46	30
2120	BETHEL	SBCU	CRIPPLE CR MT HAMILTON AREA	60	42	0	159	32	30
2121	BETHEL	SBCU	MARVEL CR	60	55	0	159	33	0
2128	VALDEZ	PSCU	RT FK SQUIRREL CR	61	42	30	145	16	30
2129	VALDEZ	PSCU	HEAD OF BERNARD CR	61	35	30	145	10	0
2130	VALDEZ	PSCU	HEAD OF BERNARD CR	61	35	30	145	10	0
2131	VALDEZ	PSCU	ROCK CR	61	44	30	145	9	30
2132	VALDEZ	PSCU	TRIB OF LITTLE TONSINA R	61	32	0	145	13	30
2134	MC CARTHY	PSCU	RT TRIB OF DAN CR	61	22	0	142	28	30
2136	MC CARTHY	PSCU	YOUNG CR	61	20	45	142	44	30
2140	VALDEZ	PSCU	TIEKEL R	61	26	0	145	8	0
2141	VALDEZ	PSCU	FALL CR	61	25	0	145	7	30
2142	VALDEZ	PSCU	RT TRIB OF FALL CR	61	24	30	145	11	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	N LATITUDE MIN	N LATITUDE SEC	W LONGITUDE DEG	W LONGITUDE MIN	W LONGITUDE SEC
2143	VALDEZ	PSCU	BOULDER CR	61	20	0	145	19	30
2144	VALDEZ	PSCU	STUART CR	61	15	45	145	17	45
2148	MC CARTHY	SBCU	DAN CR	61	22	30	142	29	0
2150	VALDEZ	PSCU	SHEEP CR	61	7	30	145	49	30
2151	VALDEZ	PSCU	LOWE R	61	5	15	145	52	45
2155	VALDEZ	PSCU	L TRIB OF LITTLE TONSINA R	61	29	30	145	13	30
2156	VALDEZ	PSCU	BERNARD CR	61	37	30	145	7	30
2157	VALDEZ	PSCU	TONSINA R	61	39	0	145	9	30
2158	VALDEZ	PSCU	RT TRIB OF TONSINA R	61	36	45	144	32	30
2159	VALDEZ	PSCU	RT TRIB OF COPPER R	61	36	15	144	27	30
2161	CULKANA	PSCU	TOLSONA CR	62	5	30	145	57	30
2162	VALDEZ	PSCU	LITTLE NELCHINA R	61	59	45	146	56	0
2163	ANCHORAGE	PSCU	GLENN HWY MI 117	61	51	15	147	23	15
2165	ANCHORAGE	PSCU	GLENN HWY CARIBOU CR	61	48	30	147	42	0
2166	ANCHORAGE	PSCU	GLENN HWY HICKS CR	61	47	15	147	56	0
2168	ANCHORAGE	PSCU	GLENN HWY GLACIER PT	61	47	30	147	39	0
2169	ANCHORAGE	PSCU	GLENN HWY CASCADE CR	61	47	15	148	6	45
2170	ANCHORAGE	PSCU	GLENN HWY PURINTON CR	61	49	0	148	9	0
2171	ANCHORAGE	PSCU	GLENN HWY CHICKALOON R	61	48	45	148	26	0
2173	VALDEZ	PSCU	STREAM DRAINING VALDEZ GLACIER	61	8	45	146	10	45
2174	ANCHORAGE	PSCU	GLENN HWY MATANUSKA R	61	46	30	149	29	30
2175	ANCHORAGE	PSCU	GLENN HWY KINGS R	61	44	0	148	44	0
2177	ANCHORAGE	PSCU	GLENN HWY MI 65	61	43	45	148	49	45
2178	ANCHORAGE	PSCU	GLENN HWY GRANITE CR	61	43	15	148	51	0
2179	TALKEETNA MTS	PSCU	SLATE CR TRIB TO CROOKED CR	62	0	15	147	15	0
2180	TALKEETNA MTS	PSCU	NORTH CR TRIB TO CROOKED CR	62	1	15	147	17	30
2181	TALKEETNA MTS	SBCU	ALBERT CR TRIB TO CROOKED CR	62	0	15	147	20	30
2182	TALKEETNA MTS	PSCU	CROOKED CR	62	2	15	147	14	30
2183	ANCHORAGE	PSCU	GLENN HWY GRAVEL CR	61	46	30	147	59	0
2184	ANCHORAGE	PSCU	GLENN HWY ESKA CR	61	44	45	148	55	0
2185	ANCHORAGE	PSCU	GLENN HWY MOOSE CR	61	41	30	149	3	30
2186	ANCHORAGE	PSCU	GLENN HWY MATANUSKA R	61	36	15	149	4	0
2187	ANCHORAGE	PSCU	FISHHOOK CR	61	47	0	149	17	30
2188	ANCHORAGE	PSCU	HEAD OF FISHHOOK CR	61	48	15	149	17	30
2190	ANCHORAGE	PSCU	WILLOW CR	61	45	30	149	35	45
2191	ANCHORAGE	PSCU	LITTLE SUSITNA R	61	46	15	149	11	30
2192	ANCHORAGE	PSCU	ARCHANGEL CR	61	48	15	149	11	0
2193	ANCHORAGE	PSCU	GRUBSTAKE GULCH	61	44	45	149	24	15
2194	ANCHORAGE	PSCU	L TRIB OF MATANUSKA R	61	35	30	149	0	15
2195	ANCHORAGE	PSCU	EKLUTNA CR	61	24	15	149	10	30
2196	ANCHORAGE	PSCU	SHIP CR	61	13	15	149	36	30
2198	ANCHORAGE	PSCU	LITTLE SUSITNA R	61	40	0	149	19	30
2199	ANCHORAGE	PSCU	PETERS CR	61	24	45	149	28	0
2201	ANCHORAGE	PSCU	KNIK R ABOVE MOUTH OF PALMER CR	61	30	45	149	1	0
2202	ANCHORAGE	PSCU	FISH CR	61	26	15	149	46	0
2203	ANCHORAGE	PSCU	GLENN HWY WOLVERINE CR	61	39	0	149	1	0
2251	EAGLE	PSCU	31 MI ABOVE MOUTH ON FORTYMILE R	64	16	30	141	17	30
2253	CHANDALAR	PSCU	TOBIN CR BELOW JCT OF 2 MAIN FKS	67	30	30	148	26	30
2281	TANANA	PSCU	QUARTZ CR	65	8	45	150	48	30
2296	TANANA	PSCM	RUBY CR TRIB OF MINOOK CR	65	24	30	150	9	0

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2298	TANANA	PSCU	DEEP CR	65	3	30	151	1	30
2309	TANANA	PSCU	UTAH CR	65	9	45	150	39	0
2310	TANANA	PSCU	2ND L HW TRIB TO UTAH CR	65	9	45	150	39	0
2311	TANANA	PSCU	HEAD OF FISH CR	65	5	30	151	15	30
2312	TANANA	PSCU	R HW TRIB TO FISH CR	65	5	30	151	15	30
2313	TANANA	PSCU	HEAD OF BOULDER CR	65	10	15	150	50	15
2411	TANANA	SBCU	FRANCIS MINE EUREKA CR	65	10	0	150	13	30
2418	TANANA	SBCU	LOWER RHODE IS CR	65	9	30	150	16	0
2432	TANANA	SBCU	HUNTER CR	65	28	45	150	4	30
2438	MC CARTHY	SBCU	REX CR CHITITU MINES	61	18	30	142	33	30
2440	SOLOMON	PSCU	CAPE NOME 2ND RT TRIB TO ELDORADO R	64	28	0	164	58	0
2441	NOME	PSCU	HASTINGS CR CAPE NOME AREA	64	29	0	165	0	0
2442	NOME	PSCU	CAPE NOME AREA GOLDENGATE CR	64	28	0	165	0	0
2444	NOME	PSCU	CAPE NOME AREA GOLDENGATE CR MOUTH	64	27	45	165	3	0
2446	SOLOMON	PSCU	CAPE NOME BEACH NORTON SOUND	64	26	30	164	59	15
2447	SOLOMON	PSCU	CAPE NOME 1ST RT TRIB TO ELDORADO R	64	28	0	164	53	0
2448	CANDLE	PSCU	ANZAC CR PEACE R AREA	65	24	0	161	7	0
2464	CANDLE	PSCU	1ST L TRIB TO PEACE R	65	27	0	161	7	0
2468	CANDLE	PSCU	1ST L TRIB TO PEACE R	65	27	0	161	7	0
2469	CANDLE	PSCU	PEACE R 1ST RT TRIB TO 1ST L TRIB	65	27	0	161	7	0
2473	CANDLE	PSCU	PEACE R 1ST RT TRIB	65	27	0	161	7	0
2477	CANDLE	PSCU	PEACE R 1ST RT TRIB TO 1ST RT TRIB	65	27	0	161	7	0
2478	CANDLE	PSCU	PEACE R 1ST RT TRIB	65	27	0	161	7	0
2481	CANDLE	PSCU	BUCKLAND R W FK 1ST L TRIB TO BEAR CR	65	28	15	161	3	0
2482	CANDLE	PSCU	BUCKLAND R W FK ABOVE BEAR CR	65	28	15	161	3	0
2485	CANDLE	PSCU	BEAR CR 50 YDS BELOW 1ST L TRIB	65	32	45	160	48	30
2486	CANDLE	PSCU	BEAR CR HW OF 1ST L TRIB	65	32	45	160	48	30
2487	CANDLE	PSCU	BEAR CR 75 YDS BELOW 1ST RT TRIB	65	32	45	160	48	45
2488	CANDLE	PSCU	BEAR CR 100 FT BELOW MOUTH OF CUB CR	65	32	15	160	51	30
2489	CANDLE	PSCU	BEAR CR 100 YDS BELOW 3RD RT TRIB	65	31	45	160	58	30
2490	CANDLE	PSCU	BEAR CR 2ND RT TRIB BELOW BOB CR	65	31	45	160	58	30
2491	CANDLE	PSCU	BEAR CR 1ST RT TRIB DSTR FROM BOB CR	65	31	45	160	58	30
2492	CANDLE	PSCU	BEAR CR AREA BOB CR 150 FT BELOW MOUTH	65	31	45	160	58	30
2494	CANDLE	PSCU	BEAR CR AREA BOB CR	65	31	45	160	58	30
2496	CANDLE	SBCU	BEAR CR WALLACE PORTERS SLUICE BOX	65	33	0	161	3	0
2501	CANDLE	PSCU	BEAR CR 1ST RT TRIB BELOW BOB CR	65	32	0	161	1	0
2502	CANDLE	PSCU	BEAR CR 100 FT BELOW MOUTH OF SPLIT CR	65	33	0	161	3	0
2503	CANDLE	PSCU	BEAR CR AREA SPLIT CR	65	32	45	161	2	45
2504	CANDLE	PSCU	BEAR CR AREA DISCOVERY GULCH SPLIT CR	65	32	45	161	6	0
2506	CANDLE	PSCU	BEAR CR AREA 1ST RT TRIB ABOVE SPLIT CR	65	33	30	161	4	0
2507	CANDLE	PSCU	BEAR CR 2ND RT TRIB ABOVE SPLIT CR	65	33	30	161	4	0
2508	CANDLE	PSCU	BEAR CR AREA POPLAR CR	65	35	0	161	8	0
2509	CANDLE	PSCU	BEAR CR AREA EAGLE CR	65	35	30	161	8	0
2511	CANDLE	PSCU	BEAR CR AREA EAGLE CR	65	36	30	161	8	45
2512	CANDLE	PSCU	BEAR CR AREA CAMP CR	65	37	30	161	10	0
2513	CANDLE	PSCU	BEAR CR AREA MAY CR	65	37	30	161	10	15
2514	CANDLE	PSCU	BEAR CR 2-1/2 MI ABOVE MAY CR	65	37	30	161	10	0
2515	CANDLE	PSCU	CUB CR 40 YDS ABOVE MOUTH	65	31	15	160	54	0
2517	CANDLE	PSCU	CUB CR 1 MI ABOVE MOUTH	65	31	15	160	54	0
2519	CANDLE	PSCU	1ST L TRIB TO CUB CR	65	31	15	160	55	15

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2521	CANDLE	PSCU	CUB CR 2ND L TRIB	65	28	30	161	6	30
2522	CANDLE	PSCU	CUB CR HWS OF 2ND L TRIB	65	28	30	161	6	30
2523	CANDLE	PSCP	CUB CR 3RD L TRIB	65	28	30	161	6	30
2525	CANDLE	PSCU	CUB CR BTW 3RD AND 4TH L TRIBS	65	28	30	161	6	30
2527	CANDLE	PSCU	CUB CR BELOW JCT OF HW BRS	65	28	30	161	6	30
2528	CANDLE	PSCU	CUB CR AREA 1ST L TRIB TO L HW FK	65	28	45	161	11	0
2529	CANDLE	PSCU	CUB CR AREA 1ST RT TRIB TO L HW	65	28	45	161	11	0
2530	CANDLE	PSCU	CUB CR L HW BR	65	28	45	161	11	0
2531	CANDLE	PSCU	L HW BR OF CUB CR	65	28	45	161	11	0
2533	CANDLE	PSCU	STR ON GRANITE MT ABOVE CUB CR	65	28	45	161	11	0
2538	CANDLE	PSCU	CUB CR AREA MID HW BR	65	28	45	161	11	0
2543	CANDLE	PSCU	CUB CR AREA MID HW BR	65	28	45	161	11	0
2544	CANDLE	PSCM	HIGH ON GRANITE MT ABOVE MID HW FK OF CUB CR	65	28	45	161	11	0
2549	CANDLE	PSCU	RT HW BR OF CUB CR	65	28	45	161	11	0
2550	CANDLE	PSCU	1ST RT TRIB TO RT HW BR OF CUB CR	65	26	45	161	11	15
2555	CANDLE	PSCU	1ST L TRIB TO RT HW BR OF CUB CR	65	26	45	161	11	0
2556	CANDLE	PSCU	2ND L TRIB TO RT HW BR OF CUB CR	65	26	45	161	11	15
2557	CANDLE	PSCU	CUB CR 2ND RT TRIB TO RT HW FK	65	26	45	161	11	15
2558	CANDLE	PSCU	CUB CR AREA RT HW BR	65	26	45	161	11	15
2559	CANDLE	PSCU	CUB CR AREA 3RD L TRIB TO RT HW BR	65	26	45	161	11	15
2560	CANDLE	PSCU	CUB CR 4TH L TRIB TO RT HW FK	65	26	45	161	11	15
2561	CANDLE	PSCU	RT HW BR OF CUB CR	65	26	45	161	11	15
2564	CANDLE	PSCU	STR ON GRANITE MT ABOVE KIWALIK R	65	26	45	161	11	15
2566	CANDLE	PSCU	STR ON GRANITE MT ABOVE KIWALIK R	65	28	45	161	11	0
2567	CANDLE	PSCU	STR ON GRANITE MT ABOVE KIWALIK R	65	28	30	161	11	15
2569	CANDLE	PSCU	GRANITE MT ABOVE RT HW FK OF RT BR KIWALIK R	65	28	45	161	11	0
2570	CANDLE	PSCU	ABOVE RT HW FK OF RT BR OF KIWALIK R	65	28	45	161	11	0
2571	CANDLE	PSCU	GRANITE MT ABOVE RT HW FK OF RT BR OF KIWALIK R	65	28	45	161	11	0
2575	CANDLE	PSCU	GRANITE MT ABOVE SYENITE GULCH QUARTZ CR AREA	65	28	45	161	11	0
2580	CANDLE	PSCU	BELOW JCT OF RT & L HW FKS OF RT BR OF KIWALIK R	65	28	45	161	11	0
2582	CANDLE	PSCU	3RD RT TRIB OF KIWALIK R ABOVE QUARTZ CR	65	27	30	161	25	30
2583	CANDLE	PSCU	2ND RT TRIB TO KIWALIK R ABOVE QUARTZ CR	65	29	15	161	27	0
2584	CANDLE	PSCU	2ND RT TRIB TO KIWALIK R ABOVE QUARTZ CR	65	32	30	161	30	0
2586	CANDLE	PSCU	L HW FK OF MID FK QUARTZ CR BELOW SYENITE GULCH	65	28	45	161	11	0
2587	CANDLE	PSCU	RT HW FK OF MID FK QUARTZ CR	65	28	45	161	11	0
2589	CANDLE	PSCU	3RD L TRIB TO L FK QUARTZ CR	65	29	30	161	22	30
2590	CANDLE	PSCU	2ND L TRIB TO L FK QUARTZ CR	65	29	30	161	22	30
2591	CANDLE	PSCU	1ST L TRIB TO L FK QUARTZ CR	65	29	30	161	22	30
2593	CANDLE	PSCU	5TH L TRIB ABOVE RT FK QUARTZ CR	65	31	45	161	23	0
2596	CANDLE	PSCU	QUARTZ CR BELOW 3RD L TRIB ABOVE RT FK	65	31	45	161	23	0
2597	CANDLE	PSCU	QUARTZ CR ABOVE 2ND L TRIB ABOVE RT FK	65	31	45	161	23	0
2599	CANDLE	PSCU	1ST L TRIB TO 1ST L TRIB QUARTZ CR ABOVE RT FK	65	32	45	161	26	45
2600	CANDLE	PSCU	QUARTZ CR 1ST L TRIB ABOVE RT FK	65	32	45	161	26	30
2601	CANDLE	PSCU	1ST L TRIB TO QUARTZ CR ABOVE RT FK	65	32	45	161	26	30
2602	CANDLE	PSCM	QUARTZ CR AREA RT FK OF DEER CR	65	38	0	161	23	30
2603	CANDLE	PSCU	2ND RT TRIB TO BUCK CR QUARTZ CR AREA	65	38	0	161	23	30
2604	CANDLE	PSCU	1ST L TRIB TO BUCK CR QUARTZ CR AREA	65	38	0	161	23	0
2605	CANDLE	PSCU	1ST L TRIB TO 3RD RT TRIB TO BUCK CR	65	38	0	161	23	30
2606	CANDLE	PSCU	L HW FK TO 3RD RT TRIB TO BUCK CR	65	38	0	161	23	30
2608	CANDLE	PSCU	2ND L TRIB TO BUCK CR QUARTZ CR AREA	65	38	0	161	23	0

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2609	CANDLE	PSCU	HWS OF BUCK CR QUARTZ CR AREA	65	38	0	161	23	30
2610	CANDLE	PSCU	1ST RT TRIB ABOVE MOUTH OF QUARTZ CR	65	35	45	161	29	30
2611	CANDLE	PSCU	QUARTZ CR 1ST RT TRIB ABOVE MOUTH	65	37	0	161	28	0
2612	CANDLE	PSCU	1ST RT TRIB ABOVE MOUTH OF QUARTZ CR	65	37	0	161	28	0
2613	CANDLE	PSCU	1ST L TRIB TO 1ST RT TRIB OF QUARTZ CR	65	35	45	161	29	45
2614	CANDLE	PSCU	4TH RT TRIB TO 1ST RT TRIB ABOVE MOUTH QUARTZ CR	65	38	15	161	27	0
2622	CANDLE	PSCU	RT HW FK OF 1ST RT TRIB ABOVE MOUTH OF QUARTZ CR	65	38	0	161	26	45
2623	CANDLE	PSCU	QUARTZ CR AREA MID FK OF 1ST RT TRIB USTR	65	38	15	161	26	45
2624	CANDLE	PSCU	L FK OF 1ST RT TRIB ABOVE MOUTH QUARTZ CR	65	35	45	161	29	45
2625	CANDLE	PSCU	BELOW 1ST RT TRIB ABOVE MOUTH QUARTZ CR	65	35	45	161	29	45
2627	CANDLE	PSCU	1ST RT TRIB TO COAL CR KIWALIK R AREA	65	38	30	161	33	45
2629	CANDLE	PSCU	CONNOLLY CR IN HUNTER CR AREA	65	38	45	161	33	30
2631	CANDLE	PSCU	1ST RT TRIB TO CONNOLLY CR	65	39	30	161	35	0
2632	CANDLE	PSCU	L HW FK OF 2ND RT TRIB TO CONNOLLY CR	65	39	30	161	35	0
2633	CANDLE	PSCU	HUNTER CR AREA RT FK OF 2ND RT TRIB CONNOLLY CR	65	39	30	161	35	15
2635	CANDLE	PSCU	2ND L TRIB TO HUNTER CR	65	39	45	161	37	30
2639	CANDLE	PSCU	HUNTER CR AREA 1ST L TRIB TO LINDA CR	65	43	15	161	34	0
2640	CANDLE	PSCU	LINDA CR IN HUNTER CR AREA	65	43	0	161	34	0
2642	CANDLE	PSCU	HWS OF LINDA CR HUNTER CR AREA	65	43	15	161	34	0
2643	CANDLE	PSCU	MUCK CR 6TH L TRIB TO HUNTER CR	65	45	30	161	31	45
2645	CANDLE	PSCU	HUNTER CR AREA MUCK CR	65	45	30	161	31	45
2646	CANDLE	PSCU	HUNTER CR AREA 2ND RT TRIB TO HUNTER CR	65	46	15	161	28	45
2648	CANDLE	PSCU	1ST RT TRIB TO RT FK HUNTER CR	65	45	0	161	24	45
2651	CANDLE	PSCU	2ND L TRIB TO RT FK HUNTER CR	65	44	30	161	21	45
2652	CANDLE	PSCU	3RD L TRIB TO RT FK HUNTER CR	65	44	30	161	22	0
2657	CANDLE	PSCU	RT FORK OF HUNTER CR	65	44	30	161	21	30
2658	CANDLE	PSCU	2ND RT TRIB TO RT FK HUNTER CR	65	44	30	161	22	0
2659	CANDLE	PSCU	2ND RT TRIB TO RT FK HUNTER CR	65	44	30	161	21	30
2660	CANDLE	PSCU	2ND RT TRIB TO RT FK HUNTER CR	65	44	30	161	21	45
2661	CANDLE	PSCU	3RD RT TRIB TO RT FK HUNTER CR	65	44	30	161	21	45
2665	CANDLE	PSCU	L HW FK OF RT FK HUNTER CR	65	44	15	161	18	0
2668	CANDLE	PSCU	1ST RT TRIB TO RT HW FK OF RT FK HUNTER CR	65	44	15	161	18	0
2669	CANDLE	PSCU	2ND RT TRIB TO RT HW FK OF RT FK HUNTER CR	65	44	15	161	18	15
2673	CANDLE	PSCU	L FK HUNTER CR ABOVE RT FK	65	45	0	161	27	30
2674	CANDLE	PSCU	1ST L TRIB TO L FK HUNTER CR	65	45	0	161	27	30
2676	CANDLE	PSCM	HUNTER CR AREA 2ND L TRIB TO L FK HUNTER CR	65	43	30	161	27	15
2678	CANDLE	PSCU	HARE CR 3RD L TRIB TO L FK HUNTER CR	65	42	45	161	26	0
2679	CANDLE	PSCU	HUNTER CR AREA HARE CR	65	42	45	161	26	15
2680	CANDLE	PSCU	L FK OF HUNTER CR JUST ABOVE HARE CR	65	41	45	161	24	30
2681	CANDLE	PSCM	4TH L TRIB (SPRUCE CR) TO L FK HUNTER CR	65	41	45	161	24	30
2682	CANDLE	PSCU	1ST L TRIB TO SPRUCE CR	65	41	45	161	24	30
2683	CANDLE	PSCU	2ND L TRIB TO SPRUCE CR HUNTER CR AREA	65	41	45	161	24	30
2684	CANDLE	PSCU	JUST BELOW HW FKS OF 2ND L TRIB OF SPRUCE CR	65	41	45	161	24	30
2685	CANDLE	PSCM	L HW FK OF 2ND L TRIB TO SPRUCE CR	65	41	45	161	24	30
2686	CANDLE	PSCU	RT HW FK OF 2ND L TRIB TO SPRUCE CR	65	41	45	161	24	30
2687	CANDLE	PSCU	HWS OF SPRUCE CR HUNTER CR AREA	65	41	45	161	24	30
2689	CANDLE	PSCU	SLOPE ABOVE SPRUCE CR DRAINS TO L FK HUNTER CR	65	41	45	161	24	30
2690	CANDLE	PSCU	L FK HUNTER CR BTW 4TH & 5TH L TRIB	65	41	0	161	23	0
2693	CANDLE	PSCU	1ST RT TRIB TO WASP CR	65	41	0	161	23	0
2694	CANDLE	PSCU	1ST RT TRIB TO 1ST RT TRIB TO WASP CR	65	41	0	161	23	0

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2695	CANDLE	PSCU	1ST L TRIB TO 1ST RT TRIB TO WASP CR	65	41	0	161	23	0
2696	CANDLE	PSCU	2ND L TRIB TO 1ST RT TRIB WASP CR	65	41	0	161	23	0
2697	CANDLE	PSCU	2ND RT TRIB TO 1ST RT TRIB TO WASP CR	65	41	0	161	23	0
2698	CANDLE	PSCU	3RD L TRIB TO 1ST RT TRIB TO WASP CR	65	41	0	161	23	0
2700	CANDLE	PSCU	RT HW FK TO 1ST RT TRIB TO WASP CR	65	41	0	161	23	0
2701	CANDLE	PSCU	WASP CR IN HUNTER CR AREA	65	41	0	161	23	0
2704	CANDLE	PSCU	1ST L TRIB TO WASP CR HUNTER CR AREA	65	41	0	161	23	0
2706	CANDLE	PSCU	WASP CR IN HUNTER CR AREA	65	41	0	161	23	0
2708	CANDLE	PSCU	RT HW FK WASP CR HUNTER CR AREA	65	41	0	161	23	0
2709	CANDLE	PSCU	HUNTER CR AREA L HW FK WASP CR	65	41	0	161	23	0
2710	CANDLE	PSCU	L FK HUNTER CR BTW 6TH & 7TH L TRIB	65	41	0	161	23	0
2711	CANDLE	PSCU	MOUTH OF 7TH L TRIB TO L FK HUNTER CR	65	41	0	161	23	0
2714	CANDLE	PSCU	10TH L TRIB TO L FK HUNTER CR	65	41	0	161	23	0
2716	CANDLE	PSCU	L FK HUNTER CR ABOVE 10TH L TRIB	65	41	0	161	23	0
2717	CANDLE	PSCU	11TH L TRIB TO L FK OF HUNTER CR	65	41	30	161	18	45
2719	CANDLE	PSCU	2ND RT TRIB TO L FK HUNTER CR	65	41	30	161	18	30
2721	CANDLE	PSCU	L HW FK OF 2ND RT TRIB TO L FK HUNTER CR	65	41	30	161	18	30
2722	CANDLE	PSCU	RT HW FK OF 2ND RT TRIB TO L FK HUNTER CR	65	41	30	161	18	30
2723	CANDLE	PSCU	3RD RT TRIB TO L FK HUNTER CR	65	41	30	161	18	30
2725	CANDLE	PSCU	12TH L TRIB TO L FK HUNTER CR	65	40	45	161	14	0
2726	CANDLE	PSCU	1ST L TRIB TO WEST CLEM CR S OF CLEM MT	65	57	30	161	23	30
2727	CANDLE	PSCU	DUCK CR AREA 2ND L TRIB TO WEST CLEM CR	65	57	30	161	24	0
2728	CANDLE	PSCU	WEST CLEM CR IN DUCK CR AREA	65	57	30	161	24	0
2729	CANDLE	PSCU	1ST L TRIB TO 3RD RT TRIB DUCK CR	65	55	15	161	23	0
2730	CANDLE	PSCU	3RD RT TRIB TO DUCK CR ABOVE WEST CLEM CR	65	55	30	161	23	0
2732	CANDLE	PSCU	1ST RT TRIB TO 4TH RT TRIB DUCK CR	65	55	30	161	23	0
2733	CANDLE	PSCU	4TH RT TRIB TO DUCK CR ABOVE WEST CLEM CR	65	54	15	161	21	30
2735	CANDLE	PSCU	1ST L TRIB TO RT FK DUCK CR	65	47	15	161	12	0
2738	CANDLE	PSCU	2ND L TRIB TO RT FK DUCK CR	65	50	15	161	22	15
2739	CANDLE	PSCU	JUST BELOW JCT OF HW FKS OF RT FK DUCK CR	65	52	45	161	18	0
2740	CANDLE	PSCU	RT HW FK TO RT FK OF DUCK CR	65	52	45	161	18	0
2745	CANDLE	PSCU	L HW FK TO RT HW FK TO RT FK DUCK CR	65	52	45	161	19	0
2746	CANDLE	PSCU	1ST RT TRIB TO L HW FK TO RT FK DUCK CR	65	52	45	161	19	0
2747	CANDLE	PSCU	L HW FK TO RT FK DUCK CR	65	52	45	161	18	0
2749	CANDLE	PSCM	L FK OF DUCK CR	65	48	30	161	26	30
2750	CANDLE	PSCU	2ND RT TRIB TO EAST CLEM CR	65	58	15	161	18	0
2751	CANDLE	PSCU	2ND RT TRIB TO 1ST L TRIB TO BUCKLAND R	65	59	15	161	19	0
2753	CANDLE	PSCU	BUCKLAND R AREA EAST CLEM CR	65	58	15	161	19	0
2757	CANDLE	PSCU	3RD L TRIB TO RT FK 2ND L TRIB BUCKLAND R	65	55	0	161	16	0
2761	CANDLE	PSCU	FAIRHAVEN CR AREA 1ST RT TRIB TO MEINZER CR	65	52	15	161	11	30
2763	CANDLE	PSCU	1ST RT TRIB TO MEINZER CR	65	52	15	161	11	30
2764	CANDLE	PSCU	MEINZER CR BTW 1ST RT & 2ND L TRIB	65	52	15	161	11	30
2766	CANDLE	PSCU	2ND RT TRIB TO MEINZER CR	65	52	15	161	11	30
2769	CANDLE	PSCU	RT FK OF L FK OF 3RD L TRIB TO MEINZER CR	65	52	15	161	15	0
2773	CANDLE	PSCU	4TH L TRIB TO MEINZER CR	65	51	0	161	14	30
2778	CANDLE	PSCU	6TH L TRIB TO MEINZER CR	65	50	15	161	15	0
2782	CANDLE	PSCM	4TH RT TRIB TO MEINZER CR	65	47	15	161	14	0
2785	CANDLE	PSCU	11TH L TRIB TO MEINZER CR	65	47	15	161	14	0
2790	CANDLE	PSCU	1ST L TRIB TO 4TH L TRIB TO FAIRHAVEN CR	65	47	45	161	6	0
2797	CANDLE	PSCU	RT HW FK TO RT HW FK FISHER CR FAIRHAVEN CR AREA	65	46	0	161	6	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2793	CANDLE	PSCU	1ST L TRIB TO FAIRHAVEN CR BELOW SUGAR LOAF CR	65	44	0	161	12	30
2799	CANDLE	PSCU	SUGAR LOAF CR FORTY YDS FROM MOUTH	65	44	0	161	12	30
2802	CANDLE	PSCU	1ST RT TRIB TO 2ND L TRIB OF SUGAR LOAF CR	65	44	0	161	12	30
2804	CANDLE	PSCU	BELOW JCT OF HW FKS OF SUGAR LOAF CR	65	44	0	161	12	30
2806	CANDLE	PSCU	RT HW FK TO L HW FK OF SUGAR LOAF CR	65	44	0	161	12	30
2807	CANDLE	PSCU	L HW FK TO L HW FK OF SUGAR LOAF CR	65	44	0	161	12	30
2810	CANDLE	PSCU	RT HW FK OF SUGAR LOAF CR FAIRHAVEN CR AREA	65	44	0	161	12	30
2811	CANDLE	PSCU	20 YDS ABOVE SUGAR LOAF CR ON FAIRHAVEN CR	65	44	0	161	7	0
2813	CANDLE	PSCU	FAIRHAVEN CR 2ND L TRIB ABOVE SUGAR LOAF CR	65	42	30	161	10	0
2814	CANDLE	PSCU	2ND L TRIB TO FAIRHAVEN CR	65	42	30	161	10	0
2816	CANDLE	PSCU	SCOTCH CR FIFTY YDS FROM MOUTH	65	40	45	161	10	30
2818	CANDLE	PSCU	FAIRHAVEN CR AREA L HW FK OF SCOTCH CR	65	41	0	161	10	45
2820	CANDLE	PSCU	FAIRHAVEN CR 50 YDS ABOVE MOUTH OF SCOTCH CR	65	40	45	161	10	45
2834	SOLOMON	PSCU	KACHAUIK CR 3.5 MI USTR FROM MOUTH	64	38	0	163	1	0
2835	SOLOMON	PSCU	2ND L TRIB TO KACHAUIK CR BELOW L BR	64	38	30	163	0	0
2836	SOLOMON	PSCU	RT HW FK OF 2ND L TRIB TO KACHAUIK CR	64	38	30	163	0	0
2837	SOLOMON	PSCU	L HW FK OF 2ND L TRIB TO KACHAUIK CR	64	38	30	163	0	0
2838	SOLOMON	PSCU	KACHAUIK CR JUST BELOW MOUTH OF L BR	64	40	0	162	59	0
2840	SOLOMON	PSCU	KACHAUIK CR BELOW 1ST RT TRIB OF L BR	64	40	0	162	59	0
2842	SOLOMON	PSCU	RT HW FK TO 1ST RT TRIB TO L BR OF KACHAUIK CR	64	40	0	162	54	30
2843	SOLOMON	PSCU	KACHAUIK CR 1ST RT TRIB TO L BR	64	40	0	162	54	30
2844	SOLOMON	PSCU	KACHAUIK CR 1ST RT TRIB TO L BR	64	40	0	162	54	30
2845	SOLOMON	PSCU	L HW FK TO 1ST RT TRIB TO L BR OF KACHAUIK CR	64	40	0	162	54	30
2846	SOLOMON	PSCU	KACHAUIK CR AREA 2ND RT TRIB TO L BR	64	39	0	162	52	0
2847	SOLOMON	PSCU	L BR KACHAUIK CR ABOVE 2ND RT TRIB	64	39	0	162	52	0
2848	SOLOMON	PSCU	KACHAUIK CR 3RD L TRIB TO L BR	64	39	0	162	52	0
2849	SOLOMON	PSCU	KACHAUIK CR AREA L BR HALF MILE UP FROM BEND	64	39	0	162	52	0
2850	SOLOMON	PSCU	KACHAUIK CR 1ST L TRIB ABOVE L BR	64	40	30	162	58	45
2851	SOLOMON	PSCU	1ST L TRIB TO KACHAUIK CR ABOVE L BR	64	40	30	162	58	45
2852	SOLOMON	PSCU	KACHAUIK CR MID BR	64	40	30	162	58	45
2853	SOLOMON	PSCU	2ND L TRIB TO MID BR KACHAUIK CR	64	41	45	162	53	30
2855	SOLOMON	PSCU	250 YDS ABOVE 2ND L TRIB TO MID BR KACHAUIK CR	64	41	45	162	53	30
2856	SOLOMON	PSCU	KACHAUIK CR 3RD L TRIB TO MID BR	64	41	45	162	53	30
2857	SOLOMON	PSCU	KACHAUIK CR AREA MID FK BELOW 3RD L TRIB	64	41	45	162	53	30
2858	SOLOMON	PSCU	3RD RT TRIB TO MID FK KACHAUIK CR	64	41	45	162	53	30
2859	SOLOMON	PSCU	KACHAUIK CR 4TH RT TRIB TO MID FK	64	41	45	162	53	30
2861	SOLOMON	PSCU	5TH RT TRIB TO MID BR OF KACHAUIK CR	64	41	45	162	53	30
2862	SOLOMON	PSCU	7TH RT TRIB TO MID BR OF KACHAUIK CR	64	41	45	162	53	30
2863	SOLOMON	PSCU	5TH L TRIB TO MID BR OF KACHAUIK CR	64	41	45	162	53	30
2864	SOLOMON	PSCU	8TH RT TRIB TO MID FK OF KACHAUIK CR	64	41	45	162	53	30
2865	SOLOMON	PSCU	KACHAUIK CR ABOVE 8TH RT TRIB TO MID FK	64	41	45	162	53	30
2866	SOLOMON	PSCU	KACHAUIK CR 1ST RT TRIB TO RT BR	64	42	15	162	59	0
2867	SOLOMON	PSCU	KACHAUIK CR 1ST RT TRIB TO RT BR	64	42	15	162	59	0
2868	SOLOMON	PSCU	KACHAUIK CR 1ST L TRIB TO RT BR	64	42	15	162	59	0
2869	SOLOMON	PSCU	2ND L TRIB TO RT BR OF KACHAUIK CR	64	43	0	162	56	30
2870	SOLOMON	PSCU	KACHAUIK CR ON 3RD L TRIB TO RT BR	64	43	0	162	56	30
2871	SOLOMON	PSCU	KACHAUIK CR 3RD L TRIB TO RT BR	64	43	0	162	56	30
2872	SOLOMON	PSCU	3RD L TRIB TO RT BR OF KACHAUIK CR	64	43	0	162	56	30
2873	SOLOMON	PSCU	RT HW FK TO 3RD L TRIB TO RT BR OF KACHAUIK CR	64	43	0	162	56	30
2874	SOLOMON	PSCU	RT BR KACHAUIK CR USTR FROM 3RD L TRIB	64	43	0	162	56	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2875	SOLOMON	PSCU	KACHAUIK CR 2ND RT TRIB TO RT BR	64	43	0	162	56	30
2876	SOLOMON	PSCU	KACHAUIK CR AREA 4TH L TRIB TO RT BR	64	43	0	162	56	30
2877	SOLOMON	PSCU	4TH L TRIB TO RT BR OF KACHAUIK CR	64	43	0	162	56	30
2878	SOLOMON	PSCU	5TH L TRIB TO RT BR KACHAUIK CR	64	43	0	162	56	30
2879	SOLOMON	PSCU	KACHAUIK CR RT BRANCH ABOVE 5TH L TRIB	64	43	0	162	56	30
2880	SOLOMON	PSCU	BEACH E OF MOUTH OF KACHAUIK CR	64	36	30	163	4	30
2881	SOLOMON	PSCU	BEACH SE OF MOUTH OF KACHAUIK CR	64	35	15	163	1	30
2882	SOLOMON	PSCU	BELOW JCT OF RT & L BRS OF CHEENIK CR	64	34	30	162	59	30
2883	SOLOMON	PSCU	1ST L TRIB TO L BR OF CHEENIK CR	64	35	0	162	56	0
2884	SOLOMON	PSCU	ABOVE 1ST L TRIB ON L BR OF CHEENIK CR	64	35	0	162	56	0
2885	SOLOMON	PSCU	L HW FK TO L BR OF CHEENIK CR	64	35	0	162	56	0
2886	SOLOMON	PSCU	RT HW FK TO L BR OF CHEENIK CR	64	35	0	162	56	0
2887	SOLOMON	PSCU	CHEENIK CR RT BR	64	35	15	162	58	30
2889	SOLOMON	PSCU	GOLOVNIN BAY BEACH LAGOON ON E SIDE	64	33	0	162	58	0
2890	SOLOMON	PSCU	GOLOVNIN BAY S OF LAGOON E OF GOLOVIN	64	32	45	162	55	30
2892	SOLOMON	PSCU	E SIDE OF GOLOVNIN BAY BEACH	64	31	30	162	54	0
2893	SOLOMON	PSCU	BRYAN CR 1ST RT TRIB BELOW HW BRS	64	33	45	162	51	15
2896	SOLOMON	PSCU	BRYAN CR AREA 100 YDS DSTR OF RT FK	64	33	45	162	51	15
2897	SOLOMON	PSCU	L HW BR OF BRYAN CR	64	33	45	162	51	15
2898	SOLOMON	PSCU	BRYAN CR L HW BR	64	33	45	162	51	15
2899	SOLOMON	PSCU	PORTAGE CR 1/4 MI UP FROM MOUTH	64	30	30	162	49	0
2900	SOLOMON	PSCU	RT HW BR OF PORTAGE CR	64	30	30	162	47	0
2901	SOLOMON	PSCU	L HW BR OF PORTAGE CR	64	29	45	162	47	30
2902	SOLOMON	PSCU	GOLOVNIN BAY 2ND STR N OF SLAUGHTERHOUSE CR	64	28	45	162	49	0
2903	SOLOMON	PSCU	FIRST STR N OF SLAUGHTERHOUSE CR	64	28	45	162	49	0
2904	SOLOMON	PSCU	GOLOVNIN BAY BEACH W OF SAMPLE 2903	64	28	45	162	49	0
2905	SOLOMON	PSCU	BEACH GOLOVNIN BAY N OF SLAUGHTERHOUSE CR	64	28	45	162	49	0
2906	SOLOMON	PSCU	GOLOVNIN BAY N OF SLAUGHTERHOUSE CR	64	28	0	162	50	45
2907	SOLOMON	PSCU	SLAUGHTERHOUSE CR ABOVE MOUTH OF RT HW FK	64	28	0	162	47	0
2908	SOLOMON	PSCU	L HW BR OF SLAUGHTERHOUSE CR	64	28	0	162	47	0
2909	SOLOMON	PSCU	GOLOVNIN BAY 1/2 MI S OF SLAUGHTERHOUSE CR	64	27	0	162	50	30
2910	SOLOMON	PSCU	GOLOVNIN BAY BEACH N SIDE MISSION PENINSULA	64	27	0	162	50	30
2911	SOLOMON	PSCU	GOLOVNIN BAY S SIDE MISSION PENINSULA	64	27	0	162	50	30
2912	SOLOMON	PSCU	MISSION CR 100 YDS USTR FROM MOUTH	64	27	0	162	50	30
2913	SOLOMON	PSCU	MISSION CR 20 YDS BELOW HW FEEDERS	64	27	0	162	45	45
2914	SOLOMON	PSCU	GOLOVNIN BAY 1ST STR S MISSION CR	64	25	45	162	47	30
2915	SOLOMON	PSCU	GOLOVNIN BAY BEACH E 2ND STR S MISSION PENINSULA	64	25	45	162	47	30
2916	SOLOMON	PSCU	GOLOVNIN BAY BEACH S OF MISSION PENINSULA	64	24	45	162	47	0
2917	SOLOMON	PSCU	GOLOVNIN BAY 2ND STR S OF MISSION CR	64	24	45	162	47	0
2919	SOLOMON	PSCU	GOLOVNIN BAY 2ND STR S OF MISSION CR	64	24	45	162	47	0
2920	SOLOMON	PSCU	GOLOVNIN BAY BEACH N OF CAPE DARBY	64	23	30	162	47	30
2922	SOLOMON	PSCU	3RD STR S OF MISSION CR	64	23	30	162	47	30
2923	SOLOMON	PSCU	4TH STR S OF CARSON CR	64	25	0	162	38	30
2924	SOLOMON	PSCU	3RD STR S OF CARSON CR	64	25	0	162	38	30
2925	SOLOMON	PSCU	NORTON BAY BEACH S OF CARSON CR	64	25	0	162	38	30
2926	SOLOMON	PSCU	NORTON BAY BEACH 2ND STR S OF CARSON CR	64	26	15	162	37	0
2927	SOLOMON	PSCU	2ND STR S OF CARSON CR	64	26	15	162	37	0
2928	SOLOMON	PSCU	RT BR OF 1ST STR S OF CARSON CR	64	28	0	162	37	15
2930	SOLOMON	PSCU	RT BR OF 1ST STR S OF CARSON CR	64	27	15	162	39	0
2931	SOLOMON	PSCU	RT BR OF 1ST STR S OF CARSON CR	64	27	15	162	39	0

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2932	SOLOMON	PSCU	RT BR OF 1ST STR S OF CARSON CR	64	27	15	162	39	0
2933	SOLOMON	PSCU	L BR OF 1ST STR S OF CARSON CR	64	28	0	162	37	15
2934	SOLOMON	PSCU	L BR OF 1ST STR S OF CARSON CR	64	28	0	162	37	15
2935	SOLOMON	PSCU	L BR OF 1ST STR S OF CARSON CR	64	28	30	162	39	45
2936	SOLOMON	PSCU	BEACH N OF 1ST STR S OF CARSON CR	64	28	45	162	36	15
2937	SOLOMON	PSCU	CARSON CR 300 YDS ABOVE MOUTH	64	28	45	162	36	15
2939	SOLOMON	PSCU	2ND L TRIB TO CLEAR CR	64	31	45	162	38	15
2940	SOLOMON	PSCU	NORTON BAY BEACH N OF CARSON CR	64	29	45	162	35	0
2941	SOLOMON	PSCU	NORTON BAY BEACH N OF CARSON CR	64	30	30	162	34	15
2942	SOLOMON	PSCU	NORTON BAY 1ST STR N OF CARSON CR	64	30	30	162	34	15
2943	SOLOMON	PSCU	NORTON BAY BEACH 2ND STR N OF CARSON CR	64	32	0	162	32	30
2945	SOLOMON	PSCU	MINIATULIK CR 1/4 MI ABOVE MOUTH	64	40	15	162	11	45
2946	SOLOMON	PSCU	NORTON BAY BEACH OPPOSITE MOSES PT	64	42	0	162	3	0
2947	SOLOMON	PSCU	KWINIUK R RT GRAVEL BAR AT MOUTH	64	42	0	162	3	0
2948	SOLOMON	PSCU	KWINIUK R LOWER END OF FISH CAMP	64	43	30	162	2	45
2949	SOLOMON	PSCU	KWINIUK R JUST USTR FROM LARGEST MEANDER	64	44	30	162	3	30
2950	SOLOMON	PSCU	2ND RT TRIB TO KWINIUK R AT CAMP 18	64	45	30	162	4	30
2951	SOLOMON	PSCU	1/2 MI BELOW 3RD RT TRIB ON KWINIUK R	64	48	0	162	8	0
2952	SOLOMON	PSCU	KWINIUK R 1.5 MI ABOVE 3RD RT TRIB	64	47	45	162	11	0
2953	SOLOMON	PSCU	4TH RT TRIB TO KWINIUK R 3/4 MI ABOVE MOUTH	64	44	0	162	19	15
2954	SOLOMON	PSCU	KWINIUK R ABOVE 4TH RT TRIB BELOW CAMP 19	64	44	0	162	19	15
2955	SOLOMON	PSCU	KWINIUK R 1ST L TRIB BELOW CAMP 19	64	44	0	162	19	15
2956	SOLOMON	PSCU	1ST L TRIB TO KWINIUK R BELOW CAMP 19	64	44	0	162	19	15
2957	SOLOMON	PSCU	KWINIUK R L BAR IN FRONT OF CAMP 19	64	44	0	162	19	15
2958	SOLOMON	PSCU	KWINIUK R BELOW IS ABOVE CAMP 19	64	44	0	162	19	15
2959	SOLOMON	PSCU	ABOVE 1ST L TRIB ABOVE CAMP 19 ON KWINIUK R	64	44	0	162	19	15
2960	SOLOMON	PSCU	KWINIUK R L BAR ABOVE ISLANDS ABOVE CAMP 19	64	43	0	162	22	30
2961	SOLOMON	PSCU	3RD L TRIB ABOVE CAMP 19 KWINIUK R AREA	64	43	0	162	22	30
2962	SOLOMON	PSCU	3RD L TRIB OF KWINIUK R ABOVE CAMP 19	64	43	0	162	22	30
2963	SOLOMON	PSCU	2ND RT TRIB TO KWINIUK R BELOW HW FKS	64	40	15	162	25	30
2965	SOLOMON	PSCU	1ST RT TRIB TO KWINIUK R BELOW HW FKS	64	37	0	162	31	45
2966	NORTON BAY	PSCU	MOUTH OF TUBUTULIK R	64	44	45	161	52	45
2967	NORTON BAY	PSCU	TUBUTULIK R RT BAR AT FISH CAMP	64	45	30	161	54	30
2968	NORTON BAY	PSCU	TUBUTULIK R 2.5 MI DSTR OF CAMP 15	64	47	15	161	56	0
2969	NORTON BAY	PSCU	TUBUTULIK R 1-1/2 MI BELOW CAMP 10	64	49	30	161	58	30
2970	SOLOMON	PSCU	TUBUTULIK R AT CAMP 10	64	50	30	162	3	45
2971	SOLOMON	PSCU	TUBUTULIK R CENTER BAR AT MOUTH OF R	64	50	30	162	7	30
2972	SOLOMON	PSCU	TUBUTULIK R .25 MI BELOW CLEAR CR	64	53	45	162	8	0
2973	SOLOMON	PSCU	L COBBLE BAR OF CLEAR CR AT SIDE OF CAMP 11	64	53	45	162	8	0
2974	SOLOMON	PSCU	CLEAR CR ABOVE MOUTH OF 1ST L TRIB	64	53	30	162	11	0
2975	SOLOMON	PSCU	2ND RT TRIB TO 1ST L TRIB TO CLEAR CR	64	54	15	162	13	45
2976	SOLOMON	PSCU	3RD RT TRIB TO 1ST L TRIB TO CLEAR CR	64	54	15	162	13	45
2977	SOLOMON	PSCU	1ST L TRIB TO CLEAR CR	64	54	15	162	13	45
2978	SOLOMON	PSCU	4TH RT TRIB TO 1ST L TRIB TO CLEAR CR	64	54	15	162	13	45
2980	SOLOMON	PSCU	TUBUTULIK R AREA 1ST L TRIB TO CLEAR CR	64	54	15	162	13	45
2981	SOLOMON	PSCU	TUBUTULIK R OLD STREAMBED 1/2 MI ABOVE 1ST TRIB	64	53	30	162	11	0
2982	SOLOMON	PSCU	CLEAR CR 1/2 MI ABOVE 1ST L TRIB	64	53	30	162	11	0
2984	SOLOMON	PSCU	1ST L TRIB TO 2ND L TRIB OF CLEAR CR	64	53	45	162	16	30
2986	SOLOMON	PSCU	1ST L TRIB TO 2ND L TRIB TO CLEAR CR	64	53	45	162	16	30
2987	SOLOMON	PSCU	1ST L TRIB TO 2ND L TRIB TO CLEAR CR	64	53	45	162	16	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
2988	SOLOMON	PSCU	2ND L TRIB TO 2ND L TRIB OF CLEAR CR	64	53	15	162	16	0
2989	SOLOMON	PSCU	2ND L TRIB TO CLEAR CR	64	52	45	162	14	0
2990	SOLOMON	PSCU	1ST RT TRIB TO 2ND L TRIB OF CLEAR CR	64	52	45	162	14	0
2998	SOLOMON	PSCU	SMALL STR AT CAMP 12	64	52	45	162	14	0
3000	SOLOMON	PSCU	IS 1/2 MI BELOW 3RD L TRIB OF CLEAR CR	64	51	45	162	14	15
3001	SOLOMON	PSCU	TUBUTULIK R AREA CLEAR CR ABOVE 3RD L TRIB	64	51	45	162	14	15
3002	SOLOMON	PSCU	3RD L TRIB TO CLEAR CR	64	51	45	162	14	15
3004	SOLOMON	PSCU	TUBUTILIK R AREA 3RD L TRIB OF CLEAR CR	64	52	0	162	17	0
3005	SOLOMON	PSCU	2ND RT TRIB TO 3RD L TRIB OF CLEAR CR	64	52	0	162	17	0
3007	SOLOMON	PSCU	BTW FKS OF 2ND RT TRIB TO 3RD L TRIB OF CLEAR CR	64	52	0	162	17	0
3011	SOLOMON	PSCU	RT HW FK OF 3RD L TRIB TO CLEAR CR	64	52	0	162	17	0
3012	SOLOMON	PSCU	1ST RT TRIB ABOVE 3RD L TRIB OF CLEAR CR	64	51	30	162	16	15
3013	SOLOMON	PSCU	2ND RT TRIB ABOVE 3RD L TRIB OF CLEAR CR	64	51	30	162	16	15
3014	SOLOMON	PSCU	CLEAR CR 150 YDS ABOVE 4TH L TRIB	64	51	30	162	16	15
3015	SOLOMON	PSCU	CLEAR CR 50 YDS BELOW SAMPLE 3016	64	51	30	162	16	15
3016	SOLOMON	PSCU	CLEAR CR BTW 4TH AND 5TH L TRIB	64	51	30	162	16	15
3017	SOLOMON	PSCU	6TH L TRIB OF CLEAR CR	64	51	30	162	16	15
3019	SOLOMON	PSCU	RT FK TO 6TH L TRIB OF CLEAR CR	64	51	0	162	19	30
3020	SOLOMON	PSCU	7TH L TRIB TO CLEAR CR	64	51	0	162	17	30
3021	SOLOMON	PSCU	TUBUTULIK AREA 7TH L TRIB OF CLEAR CR	64	51	0	162	17	30
3022	SOLOMON	PSCU	MOUTH OF 8TH L TRIB OF CLEAR CR	64	50	15	162	20	30
3024	SOLOMON	PSCU	CLEAR CR 100 YDS ABOVE 8TH L TRIB	64	50	15	162	20	30
3025	SOLOMON	PSCU	TUBUTULIK R JUST BELOW CLEAR CR	64	53	45	162	8	0
3026	SOLOMON	PSCU	2ND IS USTR FROM MOUTH OF CLEAR CR	64	55	15	162	8	30
3027	SOLOMON	PSCU	CHUKAJAK CR TUBUTULIK R AREA	64	55	15	162	8	30
3028	SOLOMON	PSCU	300 YDS UP VULCAN CR TUBUTULIK R AREA	64	55	15	162	8	30
3030	SOLOMON	PSCU	TUBUTULIK R AREA VULCAN CR	64	56	30	162	7	0
3031	SOLOMON	PSCU	VULCAN CR JUST BELOW 3RD RT TRIB	64	56	30	162	11	30
3033	SOLOMON	PSCU	VULCAN CR 300 YDS BELOW 3RD RT TRIB	64	56	0	162	13	45
3034	SOLOMON	PSCU	TUBUTILIK R AREA ABOVE 3RD RT TRIB ON VULCAN CR	64	56	30	162	11	30
3035	SOLOMON	PSCU	4TH RT TRIB TO VULCAN CR	64	56	30	162	11	30
3036	SOLOMON	PSCU	TUBUTULIK R 100 YDS ABOVE VULCAN CR	64	55	15	162	8	30
3037	SOLOMON	PSCU	TUBUTULIK R OPPOSITE LOWER VULCAN PT RIDGE	64	56	30	162	2	30
3038	SOLOMON	PSCU	TUBUTULIK R ABOVE IS OPP VUL PT RIDGE	64	59	15	162	5	0
3039	SOLOMON	PSCU	TUBUTULIK R 1-1/2 MI BELOW LOST CR	64	59	15	162	5	0
3040	BENDELEBEN	PSCU	TUBUTULIK R JUST ABOVE LOST CR	65	0	15	162	5	30
3041	BENDELEBEN	PSCU	TUBUTULIK R 1ST L TRIB BELOW ADMIRAL CR	65	1	45	162	8	0
3042	BENDELEBEN	PSCU	TUBUTULIK R JUST BELOW ADMIRAL CR	65	2	30	162	9	0
3043	BENDELEBEN	PSCU	ADMIRAL CR .25 MI USTR OF MOUTH	65	2	30	162	14	15
3044	BENDELEBEN	PSCU	300 YDS UP FROM MOUTH OF ROCK CR QUARTZ CR AREA	65	1	45	162	11	30
3045	BENDELEBEN	PSCU	ROCK CR 1.25 MI USTR OF MOUTH	65	1	45	162	11	30
3046	BENDELEBEN	PSCU	OLD STREAMBED 1-1/4 MI ABOVE MOUTH ROCK CR	65	1	45	162	11	30
3047	BENDELEBEN	PSCU	TUBUTULIK R AREA 300 YDS UP ROCK CR	65	1	45	162	11	30
3048	SOLOMON	PSCU	ROCK CR NEAR UPPERMOST SPRUCE FOREST	64	59	30	162	15	0
3049	SOLOMON	PSCU	1ST L TRIB TO ROCK CR	64	57	45	162	22	0
3051	SOLOMON	PSCU	L HW BR OF ROCK CR TUBUTULIK R AREA	64	57	45	162	22	0
3053	SOLOMON	PSCU	80 YDS ABOVE MOUTH OF RT HW BR OF ROCK CR	64	57	45	162	22	0
3054	BENDELEBEN	PSCU	TUBUTULIK R OPPOSITE MOUTH OF ROCK CR	65	1	45	162	11	30
3055	BENDELEBEN	PSCU	TUBUTULIK R ABOVE ADMIRAL CR	65	2	15	162	10	0
3056	BENDELEBEN	PSCU	TUBUTULIK R 300 YDS ABOVE MOUTH OF ROCK CR	65	1	45	162	11	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
3057	BENDELEBEN	PSCU	GROUSE CR IN TUBUTULIK R AREA	65	2	0	162	13	0
3058	BENDELEBEN	PSCU	GROUSE CR BELOW JCT OF RT & L BRS	65	2	45	162	13	15
3059	BENDELEBEN	PSCU	NEAR OLD SLUICE BOX ON L BR GROUSE CR	65	2	45	162	13	15
3060	BENDELEBEN	PSCU	50 YDS ABOVE CABIN L BR GROUSE CR	65	2	45	162	13	15
3061	BENDELEBEN	PSCU	TUBUTILIK R AREA RT FK OF L BR GROUSE CR	65	2	45	162	13	15
3062	BENDELEBEN	PSCU	L HW FK OF L BR GROUSE CR	65	2	45	162	13	15
3063	BENDELEBEN	PSCU	GROUSE CR 50 YDS ABOVE MOUTH OF RT BR	65	3	15	162	12	30
3065	BENDELEBEN	PSCU	BELOW JCT OF HW FKS ON RT BR GROUSE CR	65	3	15	162	12	30
3066	BENDELEBEN	PSCU	40 YDS ABOVE MOUTH L FK OF RT BR GROUSE CR	65	3	15	162	12	30
3067	BENDELEBEN	PSCU	L HW FK OF RT BR OF GROUSE CR	65	3	15	162	12	30
3068	BENDELEBEN	PSCU	TUBUTULIK R .25 MI ABOVE GROUSE CR	65	3	15	162	12	30
3069	BENDELEBEN	PSCU	OLD STREAMBED DSTR OF 1ST RT TRIB ROCK CR	65	1	30	162	15	30
3070	BENDELEBEN	PSCU	TUBUTULIK R BELOW 1ST RT TRIB ABOVE ROCK CR	65	1	30	162	15	30
3073	BENDELEBEN	PSCU	TUBUTULIK R 200 YDS DSTR FROM BIG CR	65	2	0	162	17	30
3074	BENDELEBEN	PSCU	BIG CR 35 YDS ABOVE MOUTH	65	2	0	162	17	30
3076	BENDELEBEN	PSCU	TUBUTULIK R 60 YDS ABOVE BIG CR	65	2	0	162	17	30
3077	BENDELEBEN	PSCU	1ST L TRIB TO TUBUTLIK R ABOVE GROUSE CR	65	2	0	162	17	30
3079	BENDELEBEN	PSCU	TUBUTULIK R .25 MI BELOW CARIBOU CR	65	4	15	162	17	30
3080	BENDELEBEN	PSCU	TUBUTULIK R 50 YDS ABOVE CARIBOU CR	65	4	15	162	17	30
3081	BENDELEBEN	PSCU	TUBUTULIK R 450 YDS ABOVE CARIBOU CR	65	4	15	162	17	30
3083	BENDELEBEN	SRCP	INMACHUK R NEAR MOUTH OF ARIZONA CR	65	53	45	162	59	30
3088	BENDELEBEN	PSCP	HEAD OF COTTONWOOD CR	65	44	15	163	14	30
3089	BENDELEBEN	PSCP	MOUTH OF 1ST N TRIB TO COTTONWOOD CR	65	45	45	163	19	30
3095	BENDELEBEN	PSCP	MAGNET CR AT JCT WITH PINNELL R	65	47	45	163	2	0
3100	FAIRBANKS-	PSCP	XXX MINE ON MOOSE CR 8 MI NE OF FERRY	64	3	30	149	2	0
3105	EAGLE	PSCU	BOUNDARY CR 1.5 MI ABOVE MOUTH	64	40	30	141	1	45
3107	EAGLE	PSCU	L TRIB TO YUKON 3.5 MI BELOW BOUNDARY CR	64	42	45	141	3	30
3108	EAGLE	PSCU	MOUTH OF CUBAN GULCH	64	44	0	141	3	30
3109	EAGLE	PSCU	MOUTH OF EAGLE CR	64	46	30	141	2	0
3110	EAGLE	PSCU	YUKON R 1.5 MI BELOW SEVENTYMILE R	64	56	0	141	21	0
3112	EAGLE	PSCU	YUKON R 2.5 MI BELOW SEVENTYMILE R	64	56	45	141	22	0
3113	EAGLE	PSCU	MOUTH OF TATONDUK R	64	59	45	141	18	0
3176	COLEEN	PSCU	RABBIT MT E OF COLEEN R	67	31	15	142	20	30
3177	COLEEN	PSCU	HOWLING DOG CR	67	11	0	141	55	0
3178	COLEEN	PSCU	DAVID CR	67	9	0	141	51	30
3179	COLEEN	PSCU	1/2 MI ABOVE MOUTH OF RAPID R	67	17	0	141	38	30
3181	COLEEN	PSCU	1/2 MI ABOVE MOUTH OF CAMPBELL R	67	18	45	141	26	30
3182	COLEEN	PSCU	SUNAGUN CR .25 MI ABOVE MOUTH	67	24	45	141	0	0
3183	COLEEN	PSCU	LOWER SUNAGUN CR	67	25	0	141	1	30
3192	COLEEN	PSCU	MID SUNAGUN CR	67	25	30	141	3	0
3194	COLEEN	PSCU	HEAD OF SUNAGUN CR	67	29	0	141	2	45
3197	COLEEN	PSCU	SUNAGUN CR NW HWS FK	67	30	15	141	6	0
3199	COLEEN	PSCU	RT TRIB TO PORCUPINE R ABOVE PRECAMBRIAN	67	23	0	141	11	0
3200	COLEEN	PSCU	FRED CR W OF CANALASKA MT	67	21	45	141	6	30
3201	COLEEN	PSCU	CREEK OPPOSITE MOUTH OF FRED CR	67	23	30	141	7	0
3202	COLEEN	PSCU	NEXT RT TRIB TO PORCUPINE R ABOVE 3201	67	23	30	141	5	0
3203	COLEEN	PSCU	NEXT L TRIB TO PORCUPINE R ABOVE 3202	67	23	0	141	4	15
3204	COLEEN	PSCU	NEXT RT TRIB TO PORCUPINE R ABOVE 3203	67	23	15	141	3	15
3205	COLEEN	PSCU	1ST L TRIB TO PORCUPINE R DSTR FOR SUNAGUN CR	67	23	15	141	1	30
3244	MT MICHELSON	PSCU	SADLEROCHIT R	69	20	15	145	19	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
3246	MT MICHELSON	PSCU	HULAHULA R	69	27	30	144	15	0
3330	KETCHIKAN	PSCU	HOADLEY CR 2 MI N OF KETCHIKAN	55	21	0	131	37	30
3332	KETCHIKAN	PSCU	1ST STR N OF SAWMILL CR	55	21	0	131	37	30
3335	KETCHIKAN	PSCU	CR BELOW BRIDGE ON RD .5 MI N OF MAIN RD	55	21	0	131	37	30
3337	KETCHIKAN	PSCU	2ND STR N OF FOURMILE HYDER DISTRICT	55	59	45	130	4	15
3338	BRADFIELD CANAL	PSCU	1ST STR N OF RIVERSIDE MINE	56	1	0	130	4	0
3339	KETCHIKAN	PSCU	FISH CR ABOVE RD BRIDGE AT FOURMILE	55	58	15	130	3	30
3343	KETCHIKAN	PSCU	1ST STR N OF HYDER	55	56	15	130	2	15
3370	KETCHIKAN	PSCU	SKOOKUM CR ABOVE MT VIEW MINE PORTAL	55	59	30	130	3	0
3371	KETCHIKAN	PSCU	FISH CR BELOW MT VIEW MINE POWERHOUSE	55	58	45	130	3	15
3372	KETCHIKAN	PSCU	ADNAC CR BELOW MT VIEW TRAIL BRIDGE	55	58	45	130	3	15
3373	KETCHIKAN	PSCU	1ST BIG TRIB TO FISH CR BELOW ADNAC CR	55	58	45	130	3	15
3374	KETCHIKAN	PSCU	3RD TRIB TO FISH CR BELOW ADNAC CR	55	58	45	130	3	15
3375	KETCHIKAN	PSCU	4TH TRIB TO FISH CR BELOW ADNAC CR	55	58	45	130	3	15
3377	KETCHIKAN	PSCU	1ST SMALL TRIB TO FISH CR BELOW ADNAC CR	55	58	45	130	3	15
3449	RUBY	PSCP	BIRCH CR	64	26	30	155	20	0
3468	RUBY	PSCU	FLINT CR 1 MI ABOVE 1ST PUP JCT	64	22	30	155	19	15
3513	RUBY	PSCU	MONUMENT CR	64	14	45	155	26	45
3516	RUBY	PSCU	TRAIL CR	64	23	15	155	13	30
3533	RUBY	PSCU	MIDNIGHT CR	64	17	45	155	34	45
3536	RUBY	PSCU	BEAR PUP ABOVE LAST TAILINGS LONG CR AREA	64	20	0	155	38	30
3543	MEDFRA	PSCU	RUBY CR AT TAILINGS	63	13	15	154	53	30
3646	CIRCLE	SBCU	PORTAGE CR H C CARSTEN MINE	65	26	15	144	37	15
3648	CIRCLE	PSCU	PORTAGE CR H C CARSTEN MINE	65	26	15	144	37	15
3649	CIRCLE	PSCU	NEXT TO LAST L TRIB TO PORTAGE CR	65	26	15	144	37	15
3651	CIRCLE	PSCU	L TRIB TO PORTAGE CR ABOVE 3649	65	26	15	144	39	0
3652	CIRCLE	PSCU	MOUTH OF HWS FK OF PORTAGE CR	65	26	15	144	37	15
3656	CIRCLE	PSCU	HWS FK OF PORTAGE CR	65	28	15	144	44	30
3657	CIRCLE	PSCU	ROAD CUT JUST BELOW SAMPLE 3656	65	28	15	144	44	30
3658	CIRCLE	PSCU	ROAD CUT .25 MI UP RD FROM SAMPLE 3649	65	26	15	144	39	0
3659	CIRCLE	PSCU	ROAD CUT 1000 FT UP FROM SAMPLE 3658	65	26	15	144	39	0
3660	CIRCLE	PSCU	LOWER PART OF HOT SPGS CR	65	28	30	144	39	30
3661	CIRCLE	PSCU	MID PART OF HOT SPGS CR	65	27	45	144	40	15
3664	CIRCLE	PSCU	LOWER PART OF MOLDEM CR	65	28	15	144	46	30
3668	CIRCLE	PSCU	HWS OF KETCHEM CR	65	27	0	144	45	30
3672	CIRCLE	SBCU	DEADWOOD CR JUST BELOW SWITCH CR	65	29	15	144	52	15
3673	CIRCLE	SBCU	DEADWOOD CR .5 MI BELOW SWITCH CR	65	29	15	144	52	15
3677	CHARLEY RIVER	SBCM	WOODCHOPPER CR	65	19	0	143	29	0
3688	EAGLE	PSCU	COPPER CR ABOVE COPPER CR COPPER WORKS	64	50	30	143	17	0
3689	EAGLE	PSCU	ATWATER BAR S FK FORTYMILE R	64	3	15	141	47	30
3699	EAGLE	PSCU	OUR CR SE MT VETA	64	5	30	143	18	45
3704	EAGLE	PSCU	MY CR SE MT VETA	64	6	45	143	16	30
3716	EAGLE	PSCU	75 YDS ABOVE MOUTH OF BEN CR	64	41	0	142	43	0
3718	EAGLE	PSCU	1/2 MI ABOVE MOUTH OF RUBY CR	64	38	0	142	46	0
3719	EAGLE	PSCU	1/2 MI FROM MOUTH OF GOLD RUN	64	35	15	142	45	30
3776	ILIAMNA	PSCU	1ST STR ENTERING PILE BAY ON S SIDE	59	40	0	154	11	15
3777	ILIAMNA	PSCU	4 MI FROM MOUTH OF PILE R	59	50	45	153	52	30
3778	ILIAMNA	PSCU	1ST STR IN NW ARM OF PILE BAY	59	48	0	153	58	30
3779	ILIAMNA	PSCU	MILLETS PROSPECT NEAR CHEKOK BAY	59	47	30	154	30	0
3795	LAKE CLARK	PSCM	2ND STR ENTERING S SIDE LITTLE LAKE CLARK	60	25	0	153	38	30

SAMPLE	MAP NAME	SAMPLE CODE	LOCATION	N LATITUDE DEG	MIN	SEC	W LONGITUDE DEG	MIN	SEC
3796	LAKE CLARK	PSCU	200 YDS ABOVE MOUTH OF CHOKOTONK R	60	26	30	153	36	0
3798	LAKE CLARK	PSCU	PORTAGE CR 50 YDS FROM MOUTH	60	21	30	154	1	15
3799	LAKE CLARK	PSCU	BOWMEN CUT	60	22	30	154	2	30

Randomization

The subset of 803 nonmagnetic concentrates was taken on a basis of weight from a larger set of concentrates which, prior to processing, were arranged in random sequence through the use of tables of random permutations (Moses and Oakford, 1963). The larger set, comprising 1069 concentrates, included 266 that weighed less than 1 gram each, the minimum weight suitable for the present experiment, thus only 803 were analyzed.

Processing

The raw concentrates from the Alaskan Placer Concentrate File were processed by William R. Marsh in random sequence according to the following procedure:

1. Each raw concentrate was divided into two parts with a microsplitter, and one part was returned to the file.
2. The other part was shaken on a 20-mesh stainless-steel sieve to obtain a sized fraction with grains smaller than 841 microns (20 mesh).
3. The fraction smaller than 841 microns was separated into magnetic and nonmagnetic portions by use of a hand magnet.
4. The nonmagnetic portions were separated in bromoform (sp. g. 2.87) to obtain a heavy fraction for analysis. The heavy fraction was divided by microsplitter into three parts: (a) samples of at least 100 mg each for semiquantitative spectrographic analysis (Hamilton and others, 1974); (b) samples of at least 1 gram each for the determination of indium and thallium (this paper); and (c) a residue for mineralogical study.
5. The nonmagnetic concentrates weighing 1 gram or more were transmitted in 1971 to George L. Crenshaw and Arthur E. Hubert for analysis by atomic absorption spectrophotometry for indium and thallium.

Method of analysis

The method of analysis by atomic absorption spectrophotmetry used for the 803 nonmagnetic concentrates has a sensitivity of 0.2 part per million (ppm) for indium and thallium in geologic materials (Hubert and Lakin, 1972, p. 383). Inasmuch as the crustal abundances of these elements are 0.1-0.25 ppm and 0.3-1.3 ppm respectively (Parker, 1967), the method of analysis affords great advantages over spectrographic methods in exploration, where the usual lower limits of detection in semiquantitative procedures are 10 ppm for indium and 50 ppm for thallium.

Unground, 1 g splits of the nonmagnetic concentrate were covered with aqua regia and evaporated slowly to dryness, and the residue was then covered with hydrofluoric acid and again evaporated slowly to dryness to assist in bringing the very insoluble concentrates into solution. Thereafter, the analytical method followed the procedure described by Hubert and Lakin (1972). The residue from the two dissolutions was dissolved in a solution of bromine in hydrobromic acid, warmed to drive off excess bromine, and diluted with water. This solution was cooled, and methyl isobutyl ketone (MIBK) was added to extract the indium and thallium, care being taken to minimize the interference from iron by extracting the MIBK with 1.5N hydrobromic acid. Indium and thallium were measured by use of appropriate cathode lamps and aspiration into an air-acetylene flame in an atomic absorption instrument. The rate of analysis was 50 samples per man-day for the two elements. The analyses were made by George L. Crenshaw and Arthur E. Hubert, U.S. Geological Survey, in December 1971.

Results

Values for indium and thallium

The results of these analyses are given in table 2 and statistical summaries are given in table 3. Of the 803 nonmagnetic concentrates

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Table 2.--NEAR HERE

Table 3.--NEAR HERE

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analyzed, 442 contain 0.2 ppm or more indium and 446 have 0.2 ppm or more thallium. Maximum values are 41 ppm indium and 14 ppm thallium, and means are 0.3 and 0.2 respectively (table 3). Thus, the concentrates are surprisingly lean in both elements.

That low abundances could be expected for indium and thallium in this set of samples was shown by the results of the semiquantitative spectrographic analyses of splits of these nonmagnetic concentrates. At lower limits of detection of 20 ppm for indium and 100 ppm for thallium, only 10 samples were found to contain indium, and none had thallium (Hamilton and others, 1974). Indium was reported to be present in abundances ranging from 30 ppm to 300 ppm, which is greatly in excess of the values for indium found for the same samples by atomic absorption analysis (table 4). The large

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Table 4.--NEAR HERE

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differences between the values reported for these samples, where the results by atomic absorption spectrophotometry are from one-ninth to one-twentieth of the values obtained by the spectrographic procedure, immediately suggests some deficiency in the method used to take the nonmagnetic concentrate into solution for analysis by atomic absorption.

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			ANCHORAGE
2163	BFO107	0.2N	0.3
2165	BFO130	0.2	0.4
2166	BFO123	0.2N	0.4
2168	BFO037	0.2	0.2N
2169	BFO126	0.2N	0.2N
2170	BFO054	0.2N	0.2N
2171	BFO035	0.2	0.2N
2174	BFO064	0.2N	0.5
2175	BFO078	0.2N	0.2N
2177	BFO039	0.2	0.2N
2178	BFO049	0.2N	0.2N
2183	BFO056	0.2N	0.4
2184	BFO058	0.2N	0.5
2185	BFO108	0.2N	0.2N
2186	BFO038	0.2	0.2N
2187	BFN380	0.2	0.2N
2188	BFN508	0.2N	0.5
2190	BFN644	0.2N	0.2N
2191	BFN679	0.2N	0.2N
2192	BFN783	0.2N	0.2N
2193	BFN943	0.2N	0.3
2194	BFO115	0.2N	0.2N
2195	BFO100	0.2N	0.2
2196	BFO090	0.2N	0.2N
2198	BFO034	0.3	0.2N
2199	BFO059	0.2N	0.2N
2201	BFO085	0.2N	0.5
2202	BFO075	0.2N	0.2N
2203	BFO048	0.2N	0.2N
			BENDELEBEN
18	BFN760	0.2N	12.5
117	BFN769	0.2N	1.2
122	BFN765	0.3	0.2
288	BFN428	0.2N	0.4
299	BFN421	0.2N	0.9
313	BFN736	0.4	0.5
1936	BFN544	0.4	3.3
1983	BFN451	0.2N	0.7
1984	BFN407	0.2	0.5
1989	BFN677	0.2N	0.2N
2025	BFN463	0.5	2.4
2027	BFN429	0.4	0.6
2033	BFN438	0.5	0.3
2034	BFN891	0.2N	1.1
2090	BFN906	0.2N	1.2

TABLE 2.--INDIUM AND THALLIUM IN B03 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
		BENDELEBEN- CONTINUED	
2097	BFN444	0.2N	1.4
2107	BFN812	0.2	1.2
2116	BFN693	0.2N	0.3
2118	BFN854	0.3	1.6
3040	BFN712	0.3	0.2N
3041	BFN768	0.2	0.5
3042	BFN914	0.2	0.2
3043	BFN753	0.2N	0.2N
3044	BFN571	0.3	0.4
3045	BFN816	0.4	0.4
3046	BFN389	0.6	0.2
3047	BFN683	0.4	0.4
3054	BFN553	0.2	0.2N
3055	BFN530	0.4	0.2N
3056	BFN612	0.2N	0.2
3057	BFN735	0.3	0.2N
3058	BFN690	0.2N	0.2N
3059	BFN874	0.2N	0.3
3060	BFN385	0.2	0.2
3061	BFN347	0.2	0.2
3062	BFN477	0.2	0.4
3063	BFN804	0.6	0.3
3065	BFN427	0.6	0.2N
3066	BFN481	0.4	0.2
3067	BFN681	0.6	0.3
3068	BFN779	0.2N	0.2N
3069	BFN371	0.2	0.6
3070	BFN666	0.2	0.2N
3073	BFN439	0.2	0.3
3074	BFN836	0.5	0.6
3076	BFN592	0.2N	0.4
3077	BFN894	0.7	0.2N
3079	BFN989	0.2N	0.2N
3080	BFD012	0.2N	0.2N
3081	BFD022	0.2	0.2
3083	BFD009	0.2N	0.4
3088	BFN973	0.2N	0.6
3089	BFD003	0.2N	5.0
3095	BFN970	0.2N	0.2N
		BETHEL	
240	BFN898	0.3	0.2N
918	BFN811	0.2	0.2N
922	BFN740	1.6	0.4
923	BFN757	0.3	0.2N
929	BFN464	0.3	0.3

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			BETHEL - CONTINUED
2120	BFN931	0.6	0.8
2121	BFN598	0.5	0.9
			BRADFIELD CANAL
3338	BFN993	0.2N	0.4
			CANDLE
276	BFN626	0.2N	0.3
315	BFN835	0.4	0.5
444	BFN834	0.4	0.2N
1035	BFN792	0.2	0.2
1036	BFN377	0.2N	0.2N
1049	BFN904	0.2N	2.3
1055	BFN515	0.3	0.2
1060	BFN859	0.3	0.2N
1069	BFN584	0.2	0.2N
2448	BFN704	0.2N	0.2N
2464	BFN406	0.2N	0.2
2468	BFN457	0.2	0.3
2469	BFN918	0.2	0.2
2473	BFN916	0.2N	0.2N
2477	BFN942	0.2	0.2
2478	BFN941	0.2N	0.6
2481	BFN342	0.2N	0.4
2482	BFN848	0.2N	0.6
2485	BFN911	0.2	0.2N
2486	BFN801	0.2	0.2N
2487	BFN595	0.3	0.2N
2488	BFN957	0.2N	0.2
2489	BFN560	0.2N	0.2N
2490	BFN850	0.3	0.3
2491	BFN671	0.3	0.4
2492	BFN330	0.2	0.2N
2494	BFN657	0.2	0.3
2496	BFN387	0.2N	0.3
2501	BFN648	0.4	0.3
2502	BFN775	0.2	0.4
2503	BFN954	0.4	0.2N
2504	BFN486	0.2N	0.2N
2506	BFN391	0.3	0.2N
2507	BFN833	0.2N	0.4
2508	BFN635	0.3	0.2N
2509	BFN751	0.2N	0.2N
2511	BFN705	0.3	0.2N
2512	BFN557	0.2N	0.2N

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			CANDLE - CONTINUED
2513	BFN702	0.2	0.2
2514	BFN662	0.2N	0.2N
2515	BFN952	0.2N	0.2N
2517	BFN953	0.2N	0.2
2519	BFN896	0.2N	0.5
2521	BFN866	0.2N	0.3
2522	BFN714	0.3	0.4
2523	BFN869	0.2	0.3
2525	BFN945	0.3	0.4
2527	BFN579	0.2	0.2N
2528	BFN358	0.2	0.3
2529	BFN329	0.3	0.4
2530	BFN752	0.2L	0.2L
2531	BFN521	0.2	0.2
2533	BFN925	0.2N	0.3
2535	BFN340	0.2N	0.3
2543	BFN349	0.2N	0.2
2544	BFN489	0.2N	0.2N
2549	BFN417	0.2	0.2N
2550	BFN416	0.3	0.2
2555	BFN580	0.2	0.3
2556	BFN468	0.2N	0.2N
2557	BFN924	0.2	0.2
2558	BFN423	0.2	0.3
2559	BFN359	0.2N	0.2N
2560	BFN892	0.2	0.2
2561	BFN585	0.2N	0.2N
2564	BFN828	0.2	0.2
2566	BFN935	0.2	0.2N
2567	BFN713	0.2N	0.2
2568	BFN569	0.2N	0.2N
2570	BFN661	0.3	0.2N
2571	BFN524	0.2N	0.4
2575	BFN531	0.2N	0.2
2580	BFN526	0.2	0.2
2582	BFN603	0.3	0.2
2583	BFN810	0.2N	0.2
2584	BFN501	0.2	0.4
2586	BFN453	0.3	0.2N
2587	BFN863	0.2	0.2
2589	BFN570	0.2N	0.3
2590	BFN397	0.2	0.4
2591	BFN376	0.4	0.3
2593	BFN622	0.2N	0.2
2596	BFN748	0.2N	0.2
2597	BFN708	0.2N	0.2N
2599	BFN670	0.2	0.4

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			CANDLE - CONTINUED
2600	BFN772	0.2	0.2N
2601	BFN597	0.2N	0.2N
2602	BFN422	0.2N	0.2N
2603	BFN807	0.4	0.2N
2604	BFN884	0.2N	0.4
2605	BFN680	0.2N	0.2
2606	BFN601	0.3	0.5
2608	BFN880	0.2N	0.4
2609	BFN419	0.2N	0.2N
2610	BFN540	0.2	0.4
2611	BFN780	0.3	0.2N
2612	BFN617	0.2N	0.2N
2613	BFN471	0.2N	0.2
2614	BFN561	0.2	0.4
2622	BFN574	0.2	0.2
2623	BFN351	0.2N	0.2N
2624	BFN675	0.2N	0.4
2625	BFN508	0.2	0.3
2627	BFN798	0.2	0.2
2629	BFN744	0.2N	0.2
2631	BFN905	0.2N	0.2N
2632	BFN623	0.2N	0.2N
2633	BFN363	0.2N	0.2N
2635	BFN494	0.2N	0.2N
2639	BFN338	0.2N	0.2N
2640	BFN727	0.2	0.2N
2642	BFN542	0.2N	0.2
2643	BFN624	0.2	0.2N
2645	BFN403	0.2N	0.2N
2646	BFN355	0.3	0.2N
2646	BFN777	0.2	0.2N
2651	BFN479	0.2N	0.2N
2652	BFN432	0.2	0.2N
2657	BFN946	0.2	0.2N
2658	BFN497	0.4	0.3
2659	BFN921	0.2	0.5
2660	BFN732	0.2N	0.2N
2661	BFN733	0.2	0.5
2665	BFN794	0.2	0.2N
2668	BFN538	0.4	0.2N
2669	BFN558	0.4	0.2
2673	BFN669	0.3	0.2
2674	BFN719	0.2N	0.2N
2676	BFN344	0.2	0.2N
2678	BFN614	0.2N	0.2N
2679	BFN400	0.2	0.2
2680	BFN652	0.3	0.2N

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			CANDLE - CONTINUED
2681	BFN442	0.3	0.2N
2682	BFN895	0.2N	0.2N
2683	BFN646	0.2N	0.2N
2684	BFN484	0.3	0.2
2685	BFN890	0.3	0.3
2686	BFN411	0.2N	0.2N
2687	BFN468	0.3	0.2N
2689	BFN530	0.2	0.2N
2690	BFN883	0.3	0.2
2693	BFN663	0.2	0.2N
2694	BFN815	0.2N	0.2
2695	BFN853	0.2	0.2N
2696	BFN672	0.3	0.3
2697	BFN605	0.2N	0.2N
2698	BFN943	0.2	0.2N
2700	BFN603	0.2N	0.2N
2701	BFN837	0.2N	0.2N
2704	BFN467	0.3	0.2N
2706	BFN717	0.2N	0.2N
2708	BFN586	0.3	0.4
2709	BFN461	0.2N	0.2N
2710	BFN547	0.2	0.2
2711	BFN699	0.2N	0.2N
2714	BFN774	0.2N	0.2
2716	BFN590	0.2N	0.2N
2717	BFN473	0.2N	0.2N
2719	BFN865	0.2	0.2N
2721	BFN500	0.3	0.3
2722	BFN818	0.2	0.4
2723	BFN599	0.2	0.2N
2725	BFN817	0.2N	0.2
2726	BFN665	0.3	0.2N
2727	BFN456	0.2	0.2N
2728	BFN927	0.2	0.2N
2729	BFN581	0.2N	0.2N
2730	BFN764	0.2	0.2N
2732	BFN534	0.2	0.2N
2733	BFN703	0.2N	0.2N
2735	BFN758	0.2N	0.2N
2738	BFN563	0.4	0.2N
2739	BFN480	0.2N	0.2N
2740	BFN522	0.2N	0.2N
2745	BFN466	0.2	0.2
2746	BFN902	0.2	0.2N
2747	BFN749	0.2N	0.2N
2749	BFN640	0.3	0.2N
2750	BFN897	0.2N	0.2N

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			CANDLE - CONTINUED
2751	BFN650	0.2N	0.2N
2753	BFN382	0.2	0.2N
2757	BFN470	0.2N	0.2N
2761	BFN414	0.2	0.2
2763	BFN771	0.3	0.2
2764	BFN697	0.3	0.2N
2766	BFN809	0.2N	0.2
2769	BFN506	0.2	0.2N
2773	BFN629	0.2N	0.2N
2778	BFN923	0.2N	0.2N
2782	BFN447	0.2N	0.2
2785	BFN967	0.3	0.6
2790	BFN679	0.2N	0.2N
2797	BFN582	0.3	0.2N
2798	BFN399	0.3	0.3
2799	BFN747	0.2	0.2N
2802	BFN535	0.2N	0.2N
2804	BFN676	0.3	0.2
2806	BFN936	0.2N	0.2N
2807	BFN606	0.2	0.2
2810	BFN431	0.2	0.2N
2811	BFN594	0.2	0.2N
2813	BFN743	0.2N	0.2N
2814	BFN460	0.2N	0.2N
2816	BFN900	0.2N	0.2N
2818	BFN370	0.2N	0.2N
2820	BFN527	0.2N	0.2N
			CHANDALAR
2253	BFN656	1.2	0.5
			CHARLEY RIVER
3677	BFO128	0.2N	0.4
			CIRCLE
3646	BFO122	0.2	0.2N
3648	BFO023	0.3	0.2N
3649	BFO045	0.2N	0.6
3651	BFO083	0.2	0.5
3652	BFO116	0.2	0.5
3656	BFO052	0.2N	1.0
3657	BFO118	0.2	1.1
3658	BFO030	0.2	1.8
3659	BFO103	0.2N	1.2

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			CIRCLE - CONTINUED
3660	BF0086	0.7	1.7
3661	BF0041	0.8	1.4
3664	BF0110	0.3	2.0
3668	BF0088	0.2N	1.0
3672	BF0029	0.5	0.2N
3673	BF0131	0.4	0.2N
			COLEEN
3176	BF0046	0.2N	1.6
3177	BF0098	0.2N	0.4
3178	BF0061	0.2N	0.2N
3179	BF0064	0.2	0.2
3181	BF0051	0.2N	0.2N
3182	BF0050	0.2N	1.0
3183	BF0113	0.2N	2.4
3192	BF0112	0.2N	0.9
3194	BF0109	0.6	1.5
3197	BF0044	2.5	0.2N
3199	BF0074	0.2N	1.1
3200	BF0043	0.2N	2.1
3201	BF0087	0.2N	0.6
3202	BF0047	0.2N	0.7
3203	BF0065	0.2N	0.6
3204	BF0105	0.2	0.9
3205	BF0119	0.2N	1.0
			EAGLE
1	BFN788	0.3	0.3
27	BFN695	0.8	0.2
29	BFN882	0.2N	0.2N
84	BFN485	0.2N	0.4
168	BFN454	0.3	1.5
256	BFN404	0.2N	0.2
277	BFN793	0.2	0.2N
532	BFN362	0.6	0.2
535	BFN922	0.6	0.2
2251	BFN513	0.2N	0.2N
3105	BFN976	0.2N	0.2N
3107	BF0008	0.2N	0.2
3108	BF0018	0.2	0.2
3109	BFN998	0.2N	0.2N
3110	BFN982	0.2N	1.3
3112	BF0020	0.3	2.0
3113	BFN995	0.2N	0.5
3688	BF0005	0.2	0.5

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			EAGLE - CONTINUED
3689	BF0013	0.2N	0.9
3699	BF0016	0.2	0.2N
3704	BFN984	0.2N	0.2N
3716	BFN975	0.7	0.2
3718	BF0019	0.4	0.5
3719	BFN985	0.2N	0.4
			FAIRBANKS
17	BFN518	0.2	0.4
21	BFN502	0.2	0.4
98	BFN950	0.2N	0.5
102	BFN352	0.2N	1.2
103	BFN492	0.2N	0.4
109	BFN487	0.4	0.4
331	BFN776	1.5	1.3
3100	BFN999	0.2N	0.2
			GOODNEWS
149	BFN919	0.2	0.2N
268	BFN711	0.4	0.2N
			GULKANA
2161	BFN877	0.2N	0.2N
			HAGEMEISTER IS.
542	BFN450	0.2N	0.2N
543	BFN928	0.2N	0.2N
545	BFN799	0.2	0.7
			IDITAROD
43	BFN532	0.8	0.9
71	BFN528	0.4	0.2N
651	BFN641	0.2N	0.2
1736	BFN849	0.2N	1.7
1775	BFN637	0.2N	0.2N
1799	BFN472	0.2N	0.2N
1803	BFN933	0.2N	0.9
1804	BFN367	0.2N	0.4
1805	BFN945	0.3	0.2N
1814	BFN826	0.2N	0.2N
1815	BFN654	0.3	0.9
1819	BFN495	0.2N	0.4

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			IDITAROD - CONTINUED
1820	BFN614	0.2N	0.2N
1831	BFN893	0.2	0.2
1836	BFN667	0.6	0.7
1867	BFN587	0.2	0.5
1872	BFN578	0.2N	0.2N
1873	BFN426	0.2N	0.2N
1874	BFN823	0.2	0.2N
1877	BFN415	0.4	0.2N
1883	BFN434	0.4	0.2
1925	BFN476	0.2	1.0
			ILIAMNA
3776	BFN972	0.2N	0.2N
3777	BFN987	0.2N	0.2N
3778	BFN992	0.2N	0.2N
3779	BFN980	0.4	0.2
			KETCHIKAN
3330	BFO007	0.2	0.2N
3332	BFO011	0.2	0.2N
3335	BFN969	0.2N	0.2N
3337	BFN971	0.2N	0.3
3339	BFO002	0.2N	0.3
3343	BFO006	0.2	0.2N
3370	BFO015	0.3	0.4
3371	BFN979	0.2N	0.7
3372	BFN977	0.2N	0.2
3373	BFN983	0.2N	0.2
3374	BFO014	0.2	0.2N
3375	BFN978	0.2N	0.2N
3377	BFN974	0.2N	0.2
			LAKE CLARK
3795	BFN997	0.2N	0.2N
3796	BFO010	0.2N	0.2N
3798	BFN996	0.2N	0.2
3799	BFO001	0.2N	0.2
			LIVENGOOD
36	BFN962	0.5	0.3
74	BFN643	0.2N	12.7
96	BFN413	0.2	0.3
97	BFN521	0.2N	0.2N

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			LIVENGOOD - CONTINUED
99	BFN716	1.3	0.6
100	BFN963	0.2N	0.2N
106	BFN441	0.2	0.4
145	BFN519	0.2N	0.2N
148	BFN691	0.2	0.2
150	BFN541	0.2N	0.7
165	BFN907	0.2N	0.7
184	BFN876	0.3	0.8
192	BFN797	0.2N	2.8
1442	BFN855	0.2	0.2
1446	BFN476	0.2	0.6
1447	BFN633	0.2N	0.2N
1448	BFN944	0.2N	0.2N
1449	BFN436	0.2N	0.2N
1450	BFN730	0.2N	0.2N
1453	BFN564	0.2N	8.0
1454	BFN543	0.5	2.1
1455	BFN549	0.4	0.6
1457	BFN533	0.2N	2.0
			MC CARTHY
2134	BFN960	0.2N	0.2N
2136	BFN791	0.2N	0.4
2148	BFD091	0.2N	0.2N
2436	BFN903	0.7	9.6
			MC GRATH
483	BFN755	0.9	0.7
1917	BFN858	0.4	0.4
			MEDFRA
10	BFN630	2.1	0.9
296	BFN459	0.4	0.2
900	BFN408	0.4	0.2N
901	BFN917	0.4	0.2
902	BFN819	0.3	0.2N
903	BFN647	0.2N	0.2N
911	BFN642	0.2N	0.2N
912	BFN688	0.2	0.2N
913	BFN847	0.3	0.2N
3543	BFN990	5.1	0.8
			MT. HAYES
232	BFN491	0.3	0.2

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			MT. HAYES - CONTINUED
238	BFN493	0.2N	0.2N
241	BFN937	0.5	0.8
293	BFN862	0.2N	0.3
1469	BFD114	0.2	0.5
1471	BFD067	0.3	0.2N
1472	BFD120	0.3	1.5
1473	BFD089	0.2N	0.4
1474	BFD095	0.2N	0.4
1475	BFD076	0.2	0.2
1509	BFD117	0.2N	0.2N
1510	BFD137	0.2N	0.2N
1511	BFD027	0.2	0.2N
1512	BFD026	0.2	0.2N
1513	BFD077	0.2N	0.2N
1514	BFD055	0.2N	1.1
			MT. MC KINLEY
196	BFN556	0.2	0.4
1019	BFN589	0.2N	0.3
1021	BFN658	0.2N	0.4
1023	BFN759	0.2N	0.3
1026	BFN554	0.2	0.2N
1023	BFN433	0.2N	0.4
			MT. MICHELSON
3244	BFN994	0.2N	1.3
3246	BFN988	0.2N	0.6
			NABESNA
1491	BFD059	0.2N	0.5
1493	BFD121	0.2N	0.4
1494	BFD053	0.2N	1.4
1495	BFD070	0.2N	2.6
1496	BFD094	0.2N	0.3
1504	BFD093	0.2N	0.2N
1505	BFD106	0.2N	0.2N
1506	BFD081	0.2N	0.2N
1507	BFD024	0.2	0.2N
1771	BFN505	0.2	0.7
			NOME
112	BFN846	0.3	0.4
118	BFN692	0.2N	0.2N

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			NOME - CONTINUED
119	BFN333	0.2	0.3
201	BFN878	0.2N	0.2N
247	BFN956	0.2N	0.4
279	BFN782	0.2N	0.2N
286	BFN701	0.6	2.6
332	BFN871	0.2N	0.3
649	BFN619	0.2N	0.2N
2441	BFN961	0.2N	0.2N
2442	BFN381	0.2N	0.2N
2444	BFN401	0.2N	0.2N
			NORTON BAY
304	BFN504	1.0	0.9
2966	BFN682	0.2	0.2
2967	BFN827	0.2N	0.6
2968	BFN857	0.3	0.2N
2969	BFN551	0.2	0.5
			OPHIR
30	BFN754	0.4	0.9
47	BFN636	1.9	1.2
52	BFN529	0.9	1.0
80	BFN618	0.7	1.7
261	BFN627	0.5	1.0
540	BFN926	1.1	4.6
727	BFN800	1.1	1.0
728	BFN731	0.2N	0.5
			RUBY
19	BFN856	0.2N	0.2
38	BFN425	0.6	0.6
42	BFN723	0.5	1.3
48	BFN331	0.4	0.2N
51	BFN885	0.2	0.9
55	BFN649	0.9	0.9
56	BFO135	0.4	0.7
59	BFN750	0.6	1.1
90	BFN332	0.2	0.2N
125	BFN947	0.2	0.4
128	BFN593	0.2	0.2N
130	BFN348	0.2N	0.2N
131	BFN887	0.2N	0.2N
133	BFN824	0.2N	0.2N
141	BFN651	11.5	1.2

TABLE 2.--INDIUM AND THALLIUM IN BD3 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			RUBY - CONTINUED
681	BFN337	0.2N	0.2N
683	BFN577	0.2	1.5
684	BFN685	0.4	0.4
688	BFN699	0.2N	0.2N
3449	BFD004	0.2	0.2N
3488	BFN981	0.2N	0.9
3513	BFN991	0.2N	0.2N
3516	BFD021	0.3	0.8
3533	BFD017	0.3	0.8
3536	BFN986	0.2N	0.2N
			RUSSIAN MISSION
67	BFN951	0.2	0.2N
188	BFN600	0.4	2.0
220	BFN820	0.2	1.9
921	BFN763	0.4	0.2N
2119	BFN813	0.2	0.2
			SOLOMON
94	BFN552	0.2N	0.2
127	BFN653	0.4	0.2N
2440	BFN536	0.2N	0.8
2446	BFN559	0.2	0.2N
2447	BFN549	0.3	0.2N
2834	BFN913	0.2	0.2N
2835	BFN844	0.3	0.2
2836	BFN418	0.3	0.2N
2837	BFN462	0.2N	0.2N
2838	BFN710	0.2	0.2N
2840	BFN787	0.3	0.3
2842	BFN393	0.2	0.3
2843	BFN949	0.3	0.6
2844	BFN766	0.3	0.6
2845	BFN496	0.4	0.3
2846	BFN357	0.4	0.5
2847	BFN537	0.2	0.3
2848	BFN841	0.2	0.4
2849	BFN346	0.2	0.2N
2850	BFN910	0.3	0.2N
2851	BFN459	0.2	0.2
2852	BFN739	0.2	0.3
2853	BFN383	0.2N	0.3
2855	BFN566	0.4	0.5
2856	BFN786	0.3	0.4
2857	BFN354	0.2	0.6

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			SOLOMON - CONTINUED
2858	BFN520	0.2N	0.4
2859	BFN784	0.2	0.4
2861	BFN512	0.3	0.4
2862	BFN607	0.4	0.2
2863	BFN539	0.5	0.8
2864	BFN615	0.4	0.5
2865	BFN934	0.2	0.6
2866	BFN908	0.2N	0.4
2867	BFN761	0.3	0.4
2868	BFD136	0.4	0.2
2869	BFN698	0.2N	0.7
2870	BFN372	0.3	0.2N
2871	BFN728	0.3	0.3
2872	BFN609	0.2N	0.4
2873	BFN523	0.2	0.4
2874	BFD133	0.2	0.4
2875	BFN790	0.2	0.2
2876	BFN336	0.2N	0.4
2877	BFN420	0.2	0.2N
2878	BFD132	0.2	0.2
2879	BFN954	0.3	0.2N
2880	BFN966	0.2N	0.2N
2881	BFN738	0.2N	0.2
2882	BFN673	0.2N	0.2N
2883	BFN395	0.4	0.2N
2884	BFN475	0.2N	0.2N
2885	BFN572	0.3	0.2
2886	BFN687	0.3	0.3
2887	BFN893	0.3	0.2N
2889	BFN339	0.2N	0.2N
2890	BFD134	0.2N	0.2N
2892	BFN602	0.2N	0.2N
2893	BFN756	0.2N	0.2
2896	BFN356	0.3	0.2N
2897	BFN402	0.3	0.2
2898	BFN791	0.2	0.2N
2899	BFN573	0.2	0.2N
2900	BFN511	0.3	0.3
2901	BFN398	0.2	0.2N
2902	BFN550	0.2N	0.2
2903	BFN872	0.2N	0.2N
2904	BFN873	0.2	0.2
2905	BFN394	0.2	0.2N
2906	BFN375	0.2	0.2N
2907	BFN368	0.2	0.2N
2908	BFN430	0.2N	0.2N
2909	BFN437	0.3	0.2

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			SOLOMON - CONTINUED
2910	BFN605	0.3	0.2N
2911	BFN507	0.2	0.2N
2912	BFN341	0.2	0.2N
2913	BFN546	0.2N	0.2N
2914	BFN514	0.3	0.2
2915	BFN684	0.3	0.2N
2916	BFN868	0.2	0.2N
2917	BFN575	0.3	0.2
2919	BFN499	0.2	0.2
2920	BFN562	0.4	0.4
2922	BFN867	0.2	1.2
2923	BFN718	0.3	0.7
2924	BFN729	0.4	0.5
2925	BFN920	0.2N	0.2N
2926	BFN384	0.2	0.5
2927	BFN825	0.2	0.2N
2928	BFN785	0.3	0.2N
2930	BFN864	0.2	0.2
2931	BFN709	0.4	0.4
2932	BFN909	0.3	0.2N
2933	BFN881	0.3	0.2
2934	BFN737	0.3	0.2N
2935	BFN742	0.2	0.2N
2936	BFN870	0.2N	0.4
2937	BFN821	0.2	0.2
2939	BFN636	0.3	0.2N
2940	BFN664	0.3	0.5
2941	BFN443	0.2N	0.6
2942	BFN707	0.2	0.3
2943	BFN632	0.3	0.2
2945	BFN366	0.2N	0.2
2946	BFN965	0.2N	0.2
2947	BFN452	0.2N	0.2N
2948	BFN789	0.2	0.3
2949	BFN424	0.2	0.3
2950	BFN449	0.2N	0.2N
2951	BFN668	0.2	0.2
2952	BFN734	0.2	0.2
2953	BFN478	0.2	0.2
2954	BFN390	0.2N	0.2N
2955	BFN762	0.2N	0.2
2956	BFN674	0.3	0.2N
2957	BFN840	0.2N	0.2N
2958	BFN959	0.2	0.2N
2959	BFN568	0.2N	0.2N
2960	BFN613	0.4	0.2
2961	BFN888	0.2N	0.2

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			SOLOMON - CONTINUED
2962	BFN482	0.2N	0.2N
2963	BFN861	0.3	0.2N
2965	BFN796	0.2N	0.4
2970	BFN545	0.2	0.5
2971	BFN388	0.3	0.2N
2972	BFN860	0.3	0.3
2973	BFN516	0.2N	0.6
2974	BFN915	0.4	0.4
2975	BFN410	0.3	0.2N
2976	BFN445	0.2	0.4
2977	BFN694	0.2	1.1
2978	BFN412	0.3	0.3
2980	BFN353	0.2	0.8
2981	BFN386	0.2N	0.2
2982	BFN588	0.4	0.2
2984	BFN525	0.3	0.7
2986	BFN802	0.3	0.5
2987	BFN955	0.4	0.6
2988	BFN396	0.2N	1.4
2989	BFN912	0.2N	0.2N
2990	BFN503	0.5	2.2
2998	BFN805	0.5	1.0
3000	BFN555	0.4	0.7
3001	BFN360	0.4	1.0
3002	BFN778	0.2	0.6
3004	BFN345	0.3	1.2
3005	BFN596	0.2N	0.4
3007	BFN496	0.4	0.5
3011	BFN948	0.2	2.2
3012	BFN659	0.2	0.2
3013	BFN616	0.2N	0.2
3014	BFN720	0.4	0.4
3015	BFN795	0.4	0.4
3016	BFN715	0.3	0.5
3017	BFN631	0.2N	0.3
3019	BFN378	0.4	0.7
3020	BFN725	0.2N	0.6
3021	BFN369	0.3	1.0
3022	BFN440	0.4	0.9
3024	BFN939	0.2	0.4
3025	BFN645	0.2N	0.3
3026	BFN409	0.2	0.2N
3027	BFN620	0.2N	0.2N
3028	BFN625	0.3	0.2
3030	BFN334	0.2	0.4
3031	BFN458	0.3	2.6
3033	BFN901	0.3	0.5

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			SOLOMON - CONTINUED
3034	BFN343	0.2	0.4
3035	BFN745	0.4	1.0
3036	BFN576	0.2N	0.2N
3037	BFN652	0.4	0.3
3038	BFN968	0.2N	0.2
3039	BFN655	0.2	0.3
3048	BFN929	0.3	0.3
3049	BFN628	0.2N	1.6
3051	BFN510	0.3	0.6
3053	BFN741	0.2N	0.4
			TALKEETNA
254	BFN610	0.2N	0.2N
260	BFN696	0.2N	0.2
475	BFN938	1.4	1.7
476	BFN639	0.3	0.4
482	BFN660	0.4	0.2N
1268	BFN455	0.2N	0.2N
1277	BFN374	0.2	0.3
1283	BFN932	0.2N	1.0
1287	BFN361	0.2N	0.2N
1290	BFN651	0.2	0.2
1295	BFN565	0.2	0.2N
1297	BFN726	0.4	0.4
1301	BFN673	0.2	0.4
1304	BFN364	0.3	0.2N
1313	BFN721	0.2	0.2N
1317	BFN829	0.3	0.4
1322	BFN591	0.2N	0.5
1325	BFN634	0.2N	0.2N
1332	BFN832	0.2N	0.2N
1336	BFN930	0.2N	0.2N
			TALKEETNA MTNS.
2179	BFN604	0.2N	0.2N
2180	BFN335	0.2N	0.2N
2181	BFN405	0.5	0.2N
2182	BFN448	0.2	0.2N
			TANACROSS
1476	BF0042	0.2N	0.2N
1477	BF0092	0.2N	0.5
1478	BF0099	0.2N	0.4
1479	BF0060	0.2N	0.3

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			TANACROSS - CONTINUED
1497	BFD036	0.2	0.4
1498	BFD082	0.2N	0.6
1499	BFD073	0.2N	0.6
1500	BFD101	0.2N	0.2N
1501	BFD079	0.2N	1.3
			TANANA
2281	BFN886	0.2N	0.2N
2296	BFN435	0.2N	0.2N
2298	BFN689	0.6	0.3
2309	BFN638	0.2	0.2N
2310	BFN838	0.2	0.2N
2311	BFN509	0.2N	0.2N
2312	BFN869	0.2N	0.2N
2313	BFN583	0.2N	0.2N
2411	BFN490	0.3	0.2
2418	BFN724	0.5	0.4
2432	BFN746	0.2N	0.2N
			TELLER
212	BFN373	41.0	2.5
222	BFN839	0.3	0.2N
270	BFN767	0.2	0.2N
486	BFN678	19.2	2.1
489	BFN706	11.8	1.7
493	BFN611	0.2N	0.2N
494	BFN483	0.2N	14.1
495	BFN773	0.2N	0.2N
497	BFN665	0.2N	0.5
506	BFN350	0.2N	0.2N
580	BFN517	0.2	0.6
585	BFN822	0.5	0.2N
587	BFN365	0.2N	0.2N
607	BFN722	8.2	1.4
608	BFN770	18.0	2.5
2046	BFN842	0.2	0.4
2048	BFN379	0.3	0.9
2053	BFN392	0.2N	2.4
2056	BFN831	0.2	1.6
2058	BFN646	0.2N	1.4
2065	BFN567	0.2	0.2
2082	BFN940	0.2N	2.5
2083	BFN700	0.2N	3.0
			VALDEZ
2128	BFC080	0.2N	0.2

TABLE 2.--INDIUM AND THALLIUM IN 803 NONMAGNETIC CONCENTRATES FROM ALASKA

FILE NO	SAMPLE	IN	TL
			VALDEZ - CONTINUED
2129	BF0111	0.2N	0.2N
2130	BF0040	0.2N	0.2N
2131	BF0062	0.2N	0.2N
2132	BF0097	0.2N	0.2N
2140	BF0057	0.2N	0.2
2141	BF0096	0.2N	1.1
2142	BF0125	0.2	0.7
2143	BF0066	0.2N	0.6
2144	BF0127	0.2N	0.6
2150	BF0102	0.2N	1.1
2151	BF0028	0.4	0.2N
2155	BF0072	0.2N	0.2N
2156	BF0129	0.2N	0.2N
2157	BF0069	0.2N	0.2N
2158	BF0104	0.2N	0.2N
2159	BF0025	0.2	0.2N
2162	BF0031	0.2	0.2N
2173	BF0032	0.4	0.5

Table 3.--Frequency distributions and histograms for indium and thallium in 803 nonmagnetic concentrates from Alaska

FREQUENCY TABLE FOR VARIABLE 5 (IN)

LOG LIMITS LOWER - UPPER	OBS FREQ	CUM FREQ	PERCENT FREQ	PERCENT CUM FREQ	THEOR FREQ (NORMAL DIST)	(THEOR FREQ - OBS FREQ)**2/THEOR FREQ
N	0	0	0.0	0.0		
L	0	0	0.0	0.0		
T	0	0	0.0	0.0		
-6.990E-01 - -4.890E-01	320	320	72.40	72.40	1.221E 02	3.209E 02
-4.890E-01 - -2.790E-01	80	400	18.10	90.50	1.146E 02	1.043E 01
-2.790E-01 - -6.897E-02	21	421	4.75	95.25	6.421E 01	2.908E 01
-6.897E-02 - 1.410E-01	8	429	1.81	97.06	2.147E 01	8.453E 00
1.410E-01 - 3.510E-01	5	434	1.13	98.19	4.279E 00	1.214E-01
3.510E-01 - 5.610E-01	1	435	0.23	98.42	5.074E-01	4.782E-01
5.610E-01 - 7.710E-01	1	436	0.23	98.64	0.0	0.0
7.710E-01 - 9.810E-01	1	437	0.23	98.87	0.0	0.0
9.810E-01 - 1.191E 00	2	439	0.45	99.32	0.0	0.0
1.191E 00 - 1.401E 00	2	441	0.45	99.77	0.0	0.0
1.401E 00 - 1.611E 00	0	441	0.0	99.77	0.0	0.0
1.611E 00 - 1.821E 00	1	442	0.23	100.00	3.725E-02	2.689E 01
G	0	442	0.0	100.00		
H	0	442				
B	361	803				
TOTALS LESS H AND B	442				3.272E 02	3.943E 02

HISTOGRAM FOR VARIABLE 5 (IN)
MIDPOINTS ARE EXPRESSED AS ANTILOGS

```
2.547E-01 XXXX
```

Table 3.--Frequency distributions and histrograms for indium and thallium in 803 nonmagnetic concentrates from Alaska--Continued

PERCENT TABLE FOR VARIABLE S [illegible] IN [illegible] BY LINEAR INTERPOLATION FROM FREQUENCY TABLE
IF SELECTED PERCENTILES FALL WITHIN DATA EITHER ABOVE OR BELOW THE LIMITS OF DETECTION,
THE DATA VALUE ON THE TABLE IS GIVEN AS 0.999999E 50

SELECTED PERCENTILE	DATA VALUE	ANTI LOG OF VALUE
50.00	0.999999E 50	0.999999E 50
75.00	-0.458782E 00	0.347710E 00
80.00	-0.400770E 00	0.397402E 00
90.00	-0.284745E 00	0.519105E 00
92.50	-0.190470E 00	0.644955E 00
95.00	-0.799698E-01	0.831822E 00
96.50	0.761926E-01	0.119177E 01
97.50	0.222930E 00	0.167082E 01
98.00	0.315751E 00	0.206896E 01
99.00	0.104193E 01	0.110136E 02

Table 3.--Frequency distributions and histograms for indium and thallium in 803 nonmagnetic concentrates from Alaska--Continued

FREQUENCY TABLE FOR VARIABLE 6 (TL)

LOG LIMITS LOWER	-	UPPER	OBS FREQ	CUM FREQ	PERCENT FREQ	PERCENT CUM FREQ	THEOR FREQ (NORMAL DIST)	(THEOR FREQ - OBS FREQ)**2/THEOR FREQ
		N	0	0	0.0	0.0		
		L	0	0	0.0	0.0		
		T	0	0	0.0	0.0		
-6.990E-01	-	-5.290E-01	121	121	25.97	25.97	6.513E 01	4.794E 01
-5.290E-01	-	-3.590E-01	149	270	31.97	57.94	8.604E 01	4.606E 01
-3.590E-01	-	-1.890E-01	70	340	15.02	72.96	8.958E 01	4.279E 00
-1.890E-01	-	-1.897E-02	41	381	8.80	81.76	7.348E 01	1.436E 01
-1.897E-02	-	1.510E-01	41	422	8.80	90.56	4.750E 01	8.889E-01
1.510E-01	-	3.210E-01	19	441	4.08	94.64	2.419E 01	1.114E 00
3.210E-01	-	4.910E-01	17	458	3.65	98.28	9.707E 00	5.480E 00
4.910E-01	-	6.610E-01	1	459	0.21	98.50	3.068E 00	1.394E 00
6.610E-01	-	8.310E-01	2	461	0.43	98.93	7.639E-01	2.000E 00
8.310E-01	-	1.001E 00	2	463	0.43	99.36	1.498E-01	2.265E 01
1.001E 00	-	1.171E 00	3	465	0.64	100.00	2.622E-02	3.373E 02
		G	0	465	0.0	100.00		
		H	0	466				
		B	337	803				
TOTALS LESS H AND B			466				3.996E 02	4.836E 02

HISTOGRAM FOR VARIABLE 6 (TL)
MIDPOINTS ARE EXPRESSED AS ANTILOGS

```
2.432E-01 XXXXXXXXXXXXXXXXXXXXXXXXX
3.598E-01 XXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX
5.321E-01 XXXXXXXXXXXXXXX
7.871E-01 XXXXXXXXX
1.164E 00 XXXXXXXXX
1.722E 00 XXXX
2.547E 00 XXXX
3.767E 00
5.572E 00
8.242E 00
1.219E 01 X
```

THE FOLLOWING STATISTICS ARE COMPUTED FOR THE UNQUALIFIED VALUES ONLY

MINIMUM ANTILOG = 2.00000E-01
MAXIMUM ANTILOG = 1.41000E 01
GEOMETRIC MEAN = 4.67451E-01
GEOMETRIC DEVIATION = 2.21177E 00
VARIANCE OF LOGS = 1.18846E-01

PERCENT TABLE FOR VARIABLE 6 (TL) BY LINEAR INTERPOLATION FROM FREQUENCY TABLE
IF SELECTED PERCENTILES FALL WITHIN DATA EITHER ABOVE OR BELOW THE LIMITS OF DETECTION,

Table 3.--Frequency distributions and histograms for indium and thallium in 803 nonmagnetic concentrates from Alaska--Cont.

THE DATA VALUE ON THE TABLE IS GIVEN AS 0.9999991E 50

SELECTED PERCENTILE	DATA VALUE	ANTI LOG OF VALUE
50.00	-0.401185E 00	0.397023E 00
75.00	-0.149580E 00	0.708631E 00
80.00	-0.529701E-01	0.885177E 00
90.00	0.140249E 00	0.131118E 01
92.50	0.232803E 00	0.170610E 01
95.00	0.339029E 00	0.217786E 01
96.50	0.407930E 00	0.255817E 01
97.50	0.454530E 00	0.284793E 01
98.00	0.477830E 00	0.300490E 01
99.00	0.859931E 00	0.724320E 01

Table 4.--Comparison of the results of the analyses of nonmagnetic concentrates from Alaska for indium by atomic absorption spectrophotometry and semiquantitative spectrographic procedure (ppm)

File number (table 1)	Quadrangle	Indium	
		By atomic absorption spectrophotometry (1)	By semiquantitative spectrographic analysis (2)
727	Ophir	1.1	100
141	Ruby	11.5	300
212	Teller	41.0	150
488	--do--	19.2	70
489	--do--	11.8	150
605	--do--	N.A.	70
607	--do--	8.2	70
608	--do--	18.0	150
609	--do--	N.A.	70
4184	--do--	N.A.	30

(1) From table 2 this report

(2) From Hamilton and others, 1974

N.A. = not analyzed owing to lack of adequate weight of concentrate.

Insoluble residues and mineralogical sources for indium and thallium

Small amounts of insoluble residues commonly were left after the nonmagnetic concentrate was attacked with aqua regia and hydrofluoric acid. Generally only a few milligrams of insoluble residue remained, but in some samples as much as 20 or 30 percent of the concentrate was not dissolved.

The mineralogical composition of 20 of the largest insoluble residues was determined by Sam Rosenblum, who examined the residues by optical and X-ray diffraction methods. The results of these studies are shown in table 5.

Table 5.--NEAR HERE

Most of the material left in the residues was found to be bright and clean, locally etched grains of natural minerals, of which cassiterite and garnet were most common. However, several residues consisted largely of artificially formed, whitish opaline silica, either coating garnets or as powder. Other artificial alteration products were a gray clayey material formed from biotite, and a yellow, powdery tungsten compound determined by X-ray diffraction analysis to be tungsten oxide hydrate ($WO_3 \cdot 1H_2O$). The original tungsten-bearing minerals were dissolved.

Table 5.--Mineralogical composition of insoluble residues from the dissolution of nonmagnetic concentrates from Alaska.

[Mineralogical analyses by Sam Rosenblum, U.S. Geological Survey]

File number (table 1)	Quadrangle	Average grain size (mm)	Minerals (percent)
122	Bendeleben	0.5	Garnet with artificial coating of opal, 10-15; hematite, 1-2; opaline silica, 70-80; cassiterite, 1-2; rutile, <1.
2710	Candle	0.5	Garnet with cream-white artificial coating, 5-10; cream-white artificial alteration product, 80+; staurolite, 1-2; altered fragments of phyllite, 1-2; kyanite, <1; topaz, <1; hematite, <1.
3672	Circle	0.5	Cassiterite, 80+; pink and cinnamon-colored garnet, 10-15; specular hematite, 2-4; white artificial alteration product, 1-2; rutile, <1; zircon, <1.

Table 5.--Mineralogical composition of insoluble residues from the dissolution of nonmagnetic concentrates from Alaska--Continued

File number (table 1)	Quadrangle	Average grain size (mm)	Minerals (percent)
29	Eagle	1.25	Rutile, 40-50; clayey artificial alteration product after garnet, 50; ilmenite, 5-10.
1831	Iditarod	0.25	Zircon, 50-60; chromite, 40+; magnetite, 1-3; opal, <1.
1454	Livengood	0.5	White artificial alteration product, 40+; gray artificial alteration product 50+; chromite, 5-7; garnet, <1.
540	Ophir	0.25	Chromite, 85-95; cassiterite, 2-4; white artificial alteration product, 1; limonite, <1.
19	Ruby	0.5	Cassiterite, 99; clayey actinolite, <1, rutile, <1; hematite, <1; xenotime, <1.
125	----do----	0.5	Cassiterite, 90-95; hematite, 2-4; garnet, 1-2; rutile, <1; andalusite(?), <1.

Table 5.--Mineralogical composition of insoluble residues from the dissolution of nonmagnetic concentrates from Alaska--Continued

File number (table 1)	Quadrangle	Average grain size (mm)	Minerals (percent)
131	Ruby	0.25	Cassiterite, 85+; almandine, 5-7; ilmenite, 1-2; tourmaline, 1-2; staurolite, 1-2; rutile, 1-2; zircon, 1-2; sphene, <1.
688	----do----	1	Cassiterite, 99+; garnet, <T.
3449	----do----	1.25	Cassiterite, 99+; cinnamon-colored garnet, <1.
94	Solomon	0.25	Staurolite, 50-60; pink garnet with white artificial coating, 25-30; sillimanite, 1-2; kyanite, <1; rutile, <1; tourmaline, <1.
3027	----do----	0.5	Garnet, 10-15; cream-white artificial alteration product, 70-80; staurolite, 3-5; tourmaline (schorlite), 2-4; rutile, 1-2; chromite, <1.

Table 5.--Mineralogical composition of insoluble residues from the dissolution of nonmagnetic concentrates from Alaska--Continued

File number (table 1)	Quadrangle	Average grain size (mm)	Minerals (percent)
3053	Solomon	Bimodal, 0.1 and 1	Staurolite, 40-50; garnet, veined and coated with alteration product, 30-40; kyanite, 5-10; tournaline (schorlite), 1-3; apatite, <1.
1322	Talkeetna	0.25	Red garnet, 1-2; white clayey artificial alteration product after garnet, possibly opal, 40-50; gray clayey artificial alteration product after biotite, 40+; andalusite, 1-2; chromite, <1; topaz, <1; tourmaline, <1; tremolite, <1.
2296	Tanana	0.5	Pink garnet, 60-70; white artificial alteration product from garnet, 5-10; staurolite, 20-25; kyanite, 1-2.
212	Teller	0.5	Cassiterite, 50-60; topaz, 15-20; fluorite, 10-20; yellow artificial tungsten compound, 5-10; hematite, 3-5.

Table 5.--Mineralogical composition of insoluble residues from the dissolution of nonmagnetic concentrates from Alaska--Continued

File number (table 1)	Quadrangle	Average grain size (mm)	Minerals (percent)
222	Teller	0.5	Cassiterite, 99+; rutile, <1.
608	----do----	0.25	Cassiterite, 50-60; hematite, 30+; apatite, 3-5; yellow powdery coating (artificial tungsten compound?), 1-3; rutile, 1-2.

Many of the common minerals in which indium is enriched (Linn and Schmitt, 1972, p. 49-D-1 to 49-D-4), including tourmaline, biotite, amphiboles, and cassiterite are present in the insoluble residues. However, the indium-bearing sulfide minerals such as sphalerite and chalcopyrite are lacking in the insoluble residues, showing that where present they are taken into solution. High indium contents have been reported (Sainsbury, 1964, table 1) for cassiterite and sphalerite in the Lost River mine area of the Teller quadrangle, Alaska. Interestingly, all the samples from the Teller quadrangle shown in table 5 except file number 4184 are from Cassiterite Creek in the Lost River mine area. Sample 4184 is from another cassiterite-bearing area. Possibly in these samples the indium detected by atomic absorption is mainly from sphalerite, which is soluble, whereas little or no indium was contributed by cassiterite owing to its insolubility (table 5). Cassiterite is one of the common insoluble minerals in concentrates from Cassiterite Creek. Thus, some, and possibly most, of the mineralogical source for indium in the concentrates from Cassiterite Creek resisted solution resulting in low values by atomic absorption. High values for indium would be obtained by spectrographic analysis, because cassiterite would have been vaporized with the other minerals.

Thallium tends to be sparse in common accessory minerals such as zircon, sphene, and garnet (de Albuquerque and Shaw, 1972, p. 81-D-1 to 81-F-4), but it may be enriched in sulfide minerals like galena, sphalerite, and marcasite. Over 500 minerals are known as carriers of the elements (Vlasov, 1966, p. 494). Thallium during weathering tends to be deposited in secondary iron and manganese oxides (Rankama and Sahama, 1950, p. 727). Several of these accessory minerals resisted solution (table 5), but the sulfide minerals were dissolved. Also, where secondary iron oxide minerals are common in concentrates, as in samples from the Candle and Solomon quadrangles (Pan, K.-L., written commun., 1972), the dissolution procedure employed for the analyses by atomic absorption completely dissolved the secondary oxides. Thus, it is probable that thallium-bearing minerals in the concentrates were dissolved in preparation for the atomic absorption analyses.

Distribution of anomalous values

Owing to the fact that the lower limits of detection for indium and thallium achieved in the analyses by atomic absorption are far smaller than the lower limits attained in the semiquantitative spectrographic procedure, many more concentrates were shown to contain traces of indium and thallium by atomic absorption (table 2) than by spectrographic analyses (Hamilton and others, 1974). The absolute values reported for indium in table 2 are suspected to be too low--probably far too low--nevertheless these data still reflect some regional geochemical relations. The same may be said for the data on thallium in table 2, except that the values may be of the proper order of magnitude.

Evidently, the apparent mean value of 0.3 ppm indium in the indium-bearing concentrates, which is about the crustal abundance (Parker, 1967), is low. A higher mean value reflecting some increase of indium in the concentrates over the crustal abundance would have been found if the dissolution procedure had attacked the main indium-bearing minerals. This higher value doubtless would be substantially less than 20 ppm, which was the lower limit of detection in the spectrographic analyses (Hamilton and others, 1974). How much less than 20 ppm and more than 0.3 ppm is not known.

The data in table 3 for the indium- and thallium-bearing concentrates can be treated statistically by the method of Lepeltier (1969) to determine threshold anomalous values. Strong breaks are found in the cumulative frequency curves at 1.5 ppm for indium and 2 ppm for thallium. Both represent the 99th percentile of the respective analyses. The use of a somewhat lower value for an anomalous threshold for indium, though evidently permissible from the large number of samples reported to be below the limit of detection, is clearly contraindicated by the recognized deficiency in the solution of the indium-bearing minerals prior to analysis. For thallium, the threshold anomalous value derived from Lepeltier's method is too high because the data for some 40 percent of the samples is truncated at the lower limit of detection, but the error is on the conservative side; therefore, that value is used in the following discussion of the distribution of anomalous nonmagnetic concentrates.

Indium

Anomalous indium was found for one nonmagnetic concentrate each from the areas of the Bethel, Coleen, Fairbanks, Ophir, and Ruby quadrangles (fig. 1); for two concentrates from the Medfra quadrangle; and for five concentrates from the Teller quadrangle (table 6). The anomalous samples from the Teller

Table 6.--NEAR HERE

quadrangle are the richest in indium of those analyzed by atomic absorption. The samples from the Teller quadrangle and that from the Ruby quadrangle in table 6 were found through spectrographic analysis (Hamilton and others, 1974) to be enriched in tin. All the other samples listed in table 6 are tin-bearing although not anomalous for the element. Thus, a clear correlation is found between the nonmagnetic concentrates having anomalous indium and the presence of tin in the concentrates. This observation strengthens the interpretation that the anomalous values for indium probably are low owing to failure to dissolve cassiterite.

Table 6.--Distribution of anomalous indium in nonmagnetic concentrates from Alaska (ppm)

[N = below limit of detection of 20 ppm]

File number (table 1)	Quadrangle	Indium	
		Atomic absorption	Semiquantitative spectrographic analyses[a/]
922	Bethel	1.6	N
3197	Coleen	2.5	N
331	Fairbanks	1.5	N
10	Medfra	2.1	N
3453	----do----	5.1	N
47	Ophir	1.9	N
141	Ruby	11.5	300
212	Teller	41.0	150
488	----do----	19.2	70
489	----do----	11.8	150
607	----do----	8.2	70
608	----do----	18.2	150

a/ Hamilton and others, 1974.

Nine of the 12 nonmagnetic concentrates with anomalous indium are from placers where occurrences of tin have been noted in the literature:

Quadrangle	File number	Reference
Fairbanks	331	Cobb, 1972a
Medfra	10, 3543	Cobb, 1972b
Ruby	141	Cobb, 1972c
Teller	212, 488, 489, 607, 608	Cobb and Sainsbury, 1972

The sample from the Bethel quadrangle is from an area of gold placers lacking observed cassiterite (Cobb, 1972d), as is that from the Ophir quadrangle (Cobb, 1972e). The indium-bearing concentrate from the Coleen quadrangle is from a placer on Sunagun Creek cited by White (1952, p. 8-9) as an occurrence of uranium minerals in concentrates. Cassiterite in small amounts, unremarked in the study of the radioactive minerals, may well have been contributed to the placer from granitic intrusive rocks in the area because the results of the spectrographic analyses of sample number 3197 and of other nonmagnetic concentrates from Sunagun Creek showed 20-2,000 ppm tin (Hamilton and others, 1974).

The anomalous values for indium found by atomic absorption analyses of the nonmagnetic concentrates (table 6) are all associated with anomalous values for other elements. Spectrographic analyses disclosed that the samples in table 6 from the Teller quadrangle contain anomalous amounts of silver, arsenic, beryllium, bismuth, lead, zinc, and tungsten (Hamilton and others, 1974). Bismuth and tungsten are anomalously rich in the nonmagnetic concentrates listed in table 6 from the Bethel, Fairbanks, Medfra, and Ophir quadrangles. Generally, five to nine anomalous elements were detected by spectrographic analyses of these samples. Some of these elements are potentially of high industrial value, for example, gold, silver, beryllium, copper, lead, zinc, niobium, molybdenum, and tungsten. Associations of anomalous values for these elements, as determined by the semiquantitative spectrographic analyses, are of much greater use in geochemical exploration than the isolated anomalous values reported by the present procedure for indium.

Thallium

Anomalous thallium was found in 29 nonmagnetic concentrates from the areas of 13 quadrangles (table 7). About two-thirds of the samples contain

Table 7.--NEAR HERE

the threshold anomalous amount of 2 ppm thallium or slightly more. Only three samples contain more than 10 ppm thallium. Scant correlation exists between the concentrates with anomalous thallium and those with anomalous indium (table 6): just three samples from the Teller quadrangle are anomalous for both elements (file numbers 212, 488, and 608).

Table 7.--Distribution of anomalous thallium in nonmagnetic concentrates from Alaska (ppm)

File number (table 1)	Quadrangle	Thallium
18	Bendeleben	12.5
1936	-----do-----	3.3
2025	-----do-----	2.4
3089	-----do-----	5.0
1049	Candle	2.3
3664	Circle	2.0
3183	Coleen	2.4
3200	-----do-----	2.1
3112	Eagle	2.0
74	Livengood	12.7
192	-----do-----	2.8
1453	-----do-----	8.0
1454	-----do-----	2.1
1457	-----do-----	2.0
1495	Nabesna	2.6
286	Nome	2.6
540	Ophir	4.6
188	Russian Mission	2.0
2989	Solomon	2.2
3011	-----do-----	2.2
3031	-----do-----	2.6
2432	Tanana	9.6

Table 7.--Distribution of anomalous thallium in nonmagnetic concentrates from Alaska, cont'd (ppm)

File number (table 1)	Quadrangle	Thallium
212	Teller	2.5
488	----do----	2.1
494	----do----	14.1
608	----do----	2.5
2053	----do----	2.4
2082	----do----	2.5
2083	----do----	3.0

Seventeen of the 29 nonmagnetic concentrates with anomalous thallium are from previously recognized placer deposits or detrital mineral occurrences, and 12 are from localities lacking evidence for mineralization. In the Bendeleben quadrangle, sample number 18 is from Cunningham Creek where placer gold and lead minerals are reported (Cobb, 1972f), but the other three concentrates are not associated with known mineralization. The samples from the Candle and Circle quadrangles are associated with placer gold, and in the Circle area the placer is reported also to contain tin, tungsten, and rare-earth minerals (Cobb, 1972g; 1972h). Sample 3183 is from the Sunagun Creek detrital uranium mineral occurrence in the Coleen quadrangle, but the source of number 3200, Fred Creek, is not reported to be mineralized (Cobb, 1972i). The samples with anomalous thallium from the Eagle, Nabesna, and Russian Mission quadrangles are not from sources of known mineralization (Cobb, 1972j; Richter and Matson, 1972; Hoare and Cobb, 1972). The five concentrates from the Livengood quadrangle (Cobb, 1972k) listed in table 7 are from gold placers containing chromium, mercury, and tungsten minerals (file numbers 74 and 1453), chromium, mercury, tin, and rare-earth minerals (192 and 1457), and chromium, antimony, mercury, and tungsten minerals (1454). The beach placers at Nome (Cobb, 1972l) and the fluvial gold placers in the Ophir (Cobb, 1972e) and Tanana quadrangles (Cobb, 1972m) were sources for nonmagnetic concentrates with anomalous thallium. In the instance of the Hunter Creek placer (sample 2432) in the Tanana quadrangle, copper, lead, mercury, and tin minerals are associated with the detrital gold. One sample (file number 2989) from the Solomon quadrangle is from a placer reported to contain columbium, tin, tungsten, rare-earth, and radioactive minerals (Cobb, 1972n), but the other two samples are from localities unreported to be mineral occurrences. In the Teller

quadrangle the concentrates from Cassiterite Creek (212, 488, and 608) and Cape Creek (494) are associated with tin placers (Cobb and Sainsbury, 1972), but those from Columbia Creek (2053 and 2082) and that from Washington Creek (2083) have no known association with ore deposits or mineral occurrences.

The nonmagnetic concentrates with anomalous thallium have been shown by the results of semiquantitative spectrographic analyses to be anomalous for one or more additional elements, except sample 2053 from the Teller quadrangle, for which no other anomalous elements are reported (Hamilton and others, 1974). A dual distribution of anomalous elements was found: 15 samples contain from one to three anomalous elements and 13 samples have from four to nine associated anomalous elements. Silver and zinc are the most common associated anomalous elements, being present respectively in 15 and 14 samples. These are followed by beryllium in nine samples, bismuth and tungsten in eight samples, and tin in seven. Lead is anomalous in only four of these samples. Although thallium has close geochemical affinities with silver and lead (Vlasov, 1966, p. 491), a geochemical association with silver in these samples is not likely because the silver is largely alloyed with native gold. Thallium is commonly found in galena, but this mineral is unlikely to be an important host in these concentrates, because so few are enriched in lead. Other sulfide minerals, such as sphalerite, pyrite, chalcopyrite, and pyrrhotite commonly contain thallium (Vlasov, 1966, p. 498). Sphalerite may be one of the mineralogical sources for the thallium because 14 of these samples are anomalously rich in zinc. However, the samples lacking anomalous zinc also generally had less than 200 ppm zinc; thus, other minerals in the concentrates are quite likely to be thallium-bearing. Inasmuch as thallium is a characteristic trace element in minerals typically associated with greisen (Vlasov, 1966, p. 508), and some of the other anomalous elements found in these concentrates may also

be so formed, it is possible that the thallium is in minerals associated with the tin, tungsten, bismuth, and beryllium deposits. Possibly the anomalous thallium in concentrates with one to three other anomalous elements is largely attributable to the presence of thallium in sulfide minerals from relatively simple sulfide deposits, whereas anomalous thallium in concentrates with four to nine other anomalous elements is derived from sulfide minerals and other minerals in complex assemblages associated with greisen such as found in the Teller quadrangle (Sainsbury, 1964, table 2).

Despite the fact that thallium at the levels observed in these concentrates in analyses by atomic absorption could not be picked up in the broad-spectrum semiquantitative spectrographic analyses, the additional data yielded through analysis for thallium by atomic absorption are of little or no additional use in geochemical exploration.

Evaluation

Where the geochemical sample medium consists of nonmagnetic concentrates, and the program of geochemical exploration is based on the acquisition and interpretation of multi-element data, no need is served by independent analyses for indium and thallium by atomic absorption. Should occasion exist to study the distribution of these two elements in surficial materials, then the analytical method affords a great advance over the results given by the semiquantitative spectrographic procedure, but concentrates are not a suitable sample medium for indium unless the method for dissolution is improved.

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