DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE MAP

Distribution and chemical analyses of thermal springs in Alaska

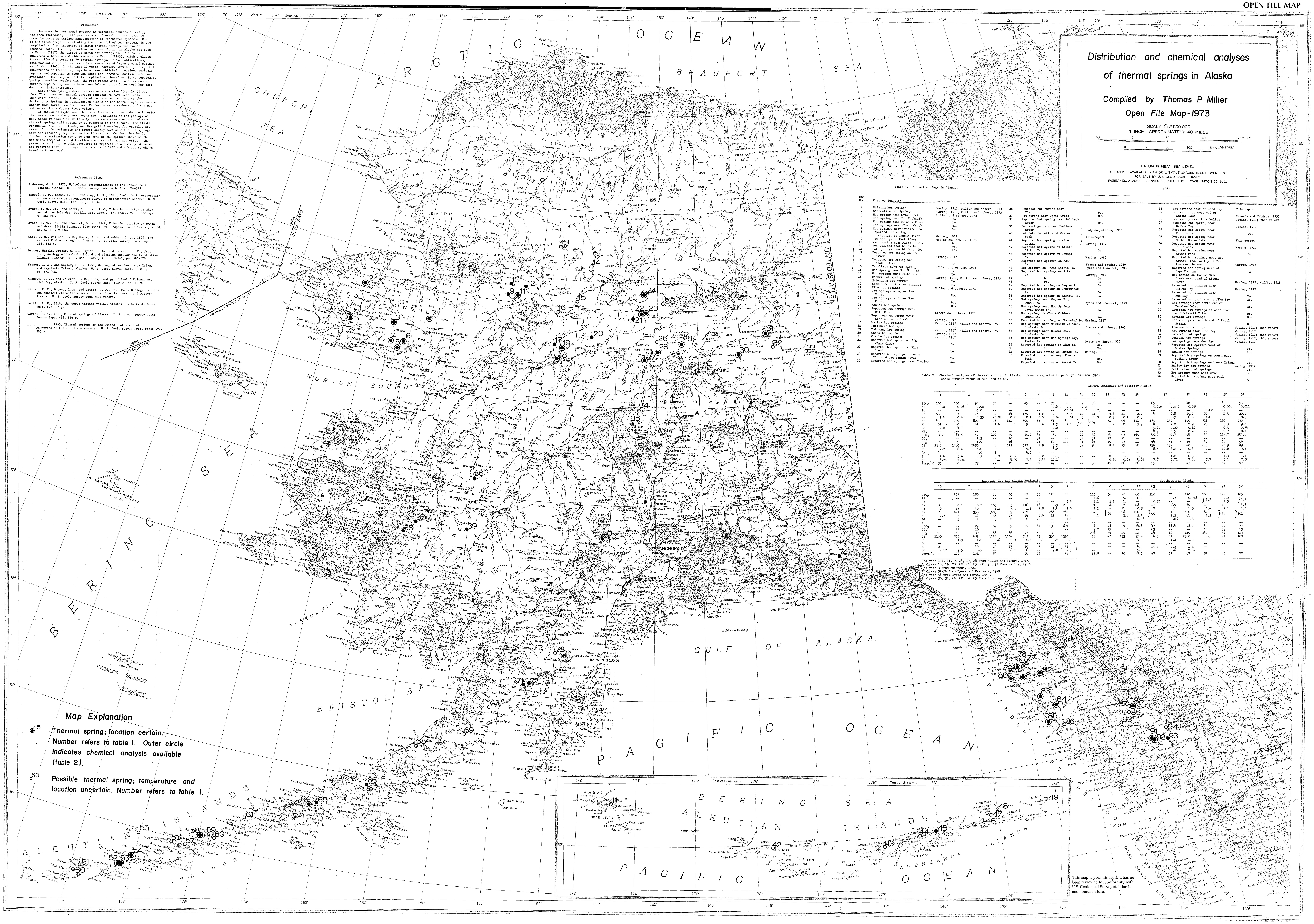
Compiled by Thomas P. Miller

Open File Map-1973

SCALE 1:2 500 000
1 INCH APPROXIMATELY 40 MILES

DATUM IS MEAN SEA LEVEL

THIS MAP IS AVAILABLE WITH OR WITHOUT SHADED RELIEF OVERPRINT
FOR SALE BY U. S. GEOLOGICAL SURVEY
FAIRBANKS, ALASKA DENVER 25, COLORADO WASHINGTON 25, D. C.
1954



Discussion

Interest in geothermal systems as potential sources of energy has been increasing in the past decade. Thermal, or hot, springs commonly occur as surface manifestation of geothermal systems. One of the first steps in evaluating the potential of such systems is the compilation of an inventory of known thermal springs and available chemical data. The only previous such compilation in Alaska has been by Waring (1917) who listed 75 known hot springs and 22 chemical analyses; a later world-wide summary by Waring (1965), which included Alaska, listed a total of 79 thermal springs. These publications, both now out of print, are excellent summaries of known thermal springs as of about 1963. In the last 10 years, however, previously unreported occurrences of thermal springs have been published in various geologic reports and topographic maps and additional chemical analyses are now available. The purpose of this compilation, therefore, is to supplement Waring's earlier reports with the more recent data. In a few cases, springs reported by Waring have been deleted since later work has cast doubt on their existence.

Only those springs whose temperatures are significantly (i.e., 15-20°C.) above mean annual surface temperature have been included in this compilation. Excluded, therefore, are such springs as the Sadlerochit Springs in northeastern Alaska on the North Slope, carbonated and/or soda springs on the Seward Peninsula and elsewhere, and the mud volcanoes of the Copper River valley.

It should be emphasized that more thermal springs undoubtedly exist then are shown on the accompanying map. Knowledge of the geology of many areas in Alaska is still only of reconnaissance nature and more thermal springs will certainly be reported in the future. The Alaska Peninsula, Aleutian Islands, and Wrangell Mountains, for example, are areas of active volcanism and almost surely have more thermal springs than are presently reported in the literature. On the other hand, further investigation may show that some of the springs shown on the map whose temperature and location are uncertain may not exist. The present compilation should therefore be regarded as a summary of known and reported thermal springs in Alaska as of 1972 and subject to change based on future work.

References Cited

Anderson, G. S., 1970, Hydrologic reconnaissance of the Tanana Basin, central Alaska: U. S. Geol. Survey Hydrologic Inv., HA-319.

Brosgé, W. P., Brabb, E. E., and King, E. R., 1970, Geologic interpretation of reconnaissance aeromagnetic survey of northeastern Alaska: U. S. Geol. Survey Bull. 1271-F, pp. 1-14.

Byers, F. M., Jr., and Barth, T. F. W., 1953, Volcanic activity on Akun and Akutan Islands: Pacific Sci. Cong., 7th, Proc., v. 2, Geology, p. 382-397.

Byers, F. M., Jr., and Brannock, W. W., 1949, Volcanic activity on Umnak and Great Sitkin Islands, 1946-1948: Am. Geophys. Union Trans., v. 30, no. 5, p. 719-734.

Cady, W. M., Wallace, R. E., Hoare, J. M., and Webber, E. J., 1955, The central Kuskokwim region, Alaska: U. S. Geol. Survey Prof. Paper 268, 132 p.

Drewes, Harald, Fraser, G. D., Snyder, G. L., and Barnett, H. F., Jr., 1961, Geology of Unalaska Island and adjacent insular shelf, Aleutian Islands, Alaska: U. S. Geol. Survey Bull. 1028-S, pp. 583-676.

Fraser, G. D., and Snyder, G. L., 1959, Geology of southern Adak Island and Kagalaska Island, Alaska: U. S. Geol. Survey Bull. 1028-M, pp. 371-408.

Kennedy, G. C., and Waldron, H. H., 1955, Geology of Pavlof Volcano and vicinity, Alaska: U. S. Geol. Survey Bull. 1028-A, pp. 1-19.

Miller, T. P., Barnes, Ivan, and Patton, W. W., Jr., 1973, Geologic setting and chemical characteristics of hot springs in central and western Alaska: U. S. Geol. Survey open-file report.

Moffit, F. H., 1918, The upper Chitina valley, Alaska: U. S. Geol. Survey Bull. 675, 82 p.

Waring, G. A., 1917, Mineral springs of Alaska: U. S. Geol. Survey Water-Supply Paper 418, 114 p.

__________ 1965, Thermal springs of the United States and other countries of the world - A summary: U. S. Geol. Survey Prof. Paper 492, 383 p.

Table 1. Thermal springs in Alaska.

Map No.	Name or location	Reference
1	Pilgrim Hot Springs	Waring, 1917; Miller and others, 1973
2	Serpentine Hot Springs	Waring, 1917; Miller and others, 1973
3	Hot spring near Lava Creek	Miller and others, 1973
4	Hot spring near Mt. Kachauik	Do.
5	Hot spring near Kwiniuk River	Do.
6	Hot springs near Clear Creek	Do.
7	Hot springs near Granite Mtn.	Do.
8	Reported hot spring on tributary on Innoko River	Waring, 1917
9	Hot springs on Hawk River	Miller and others, 1973
10	Warm spring near Purcell Mtn.	Do.
11	Hot springs near South BM	Do.
12	Hot springs near Division BM	Do.
13	Reported hot spring on Reed River	Waring, 1917
14	Reported hot spring near Alatna River	Do.
15	Tunalkten Lake hot spring	Miller and others, 1973
16	Hot spring near Sun Mountain	Do.
17	Hot springs near Dulbi River	Do.
18	Horner hot springs	Waring, 1917; Miller and others, 1973
19	Melozitna hot springs	Do.
20	Little Melozitna hot springs	Do.
21	Kilo hot springs	Miller and others, 1973
22	Hot springs on upper Ray River	Do.
23	Hot springs on lower Ray River	Do.
24	Kanuti hot springs	Do.
25	Reported hot springs near Dall River	Brosge and others, 1970
26	Reported hot spring near Little Minook Creek	Waring, 1917
27	Manley hot springs	Waring, 1917; Miller and others, 1973
28	Hutlinana hot spring	Do.
29	Tolovana hot spring	Waring, 1917; Miller and others, 1973
30	Chena hot spring	Waring, 1917
31	Circle hot springs	Waring, 1917
32	Reported hot spring on Big Windy Creek	Do.
33	Reported hot spring on Flat Creek	Do.
34	Reported hot springs between Diamond and Toklat River	Do.
35	Reported hot springs near Glacier	Do.
36	Reported hot spring near Flat	Do.
37	Hot spring near Ophir Creek	Do.
38	Reported hot spring near Tuluksak River	Do.
39	Hot springs on upper Chuilnuk River	Cady and others, 1955
40	Hot lake in bottom of Crater Peak	This report
41	Reported hot spring on Attu Island	Waring, 1917
42	Reported hot spring on Little Sitkin Is.	Do.
43	Reported hot spring on Tanaga Is.	Waring, 1965
44	Reported hot springs on Adak Is.	Fraser and Snyder, 1959
45	Hot springs on Great Sitkin Is.	Byers and Brannock, 1949
46	Reported hot springs on Atka Is.	Waring, 1917
47	Do.	Do.
48	Do.	Do.
49	Reported hot spring on Sequam Is.	Do.
50	Reported hot spring on Chuginadak Is.	Do.
51	Reported hot spring on Kagamil Is.	Do.
52	Hot springs near Geyser Bight, Umnak Is.	Byers and Brannock, 1949
53	Hot springs near Hot Springs Cove, Umnak Is.	Do.
54	Hot springs in Okmok Caldera, Umnak Is.	Do.
55	Reported hot springs on Bogoslof Is.	Waring, 1917
56	Hot springs near Makushin volcano, Unalaska Is.	Drewes and others, 1961
57	Hot springs near Summer Bay, Unalaska Is.	Do.
58	Hot springs near Hot Springs Bay, Akutan Is.	Byers and Barth, 1953
59	Reported hot springs on Akun Is.	Do.
60	Do.	Do.
61	Reported hot spring on Unimak Is.	Waring, 1917
62	Reported hot spring near Frosty Peak	Do.
63	Reported hot spring on Amagat Is.	Do.
64	Hot springs east of Cold Bay	This report
65	Hot spring at west end of Emmons Lake	Kennedy and Waldron, 1955
66	Hot spring near Port Moller	Waring, 1917; this report
67	Reported hot spring near Balboa Bay	Waring, 1917
68	Reported hot spring near Port Heiden	Do.
69	Reported hot spring near Mother Goose Lake	This report
70	Reported hot spring near Mt. Peulik	Waring, 1917
71	Reported hot spring near Katmai Pass	Do.
72	Reported hot springs near Mt. Katmai, ind. Valley of Ten Thousand Smokes	Waring, 1965
73	Reported hot spring west of Cape Douglas	Do.
74	Hot spring on Twelve Mile Creek near head of Kiagna River	Waring, 1917; Moffit, 1918
75	Reported hot springs near Lituya Bay	Waring, 1917
76	Reported hot springs near Mud Bay	Do.
77	Reported hot spring near Nika Bay	Do.
78	Hot springs near north end of Tenakee Inlet	Do.
79	Reported hot springs on east shore of Lisianski Inlet	Do.
80	Hooniah Hot Springs	Do.
81	Hot springs at north end of Peril Strait	Do.
82	Tenakee hot springs	Waring, 1917; this report
83	Hot springs near Fish Bay	Waring, 1917
84	Baranof hot springs	Waring, 1917; this report
85	Goddard hot springs	Waring, 1917; this report
86	Hot springs near Gut Bay	Waring, 1917
87	Reported hot springs west of Shakes Springs	Do.
88	Shakes hot springs	Do.
89	Reported hot springs on south side Stikine River	Do.
90	Reported hot springs on Vanak Island	Do.
91	Bailey Bay hot springs	Waring, 1917
92	Bell Island hot springs	Do.
93	Hot springs near Saks Cove	Do.
94	Reported hot springs near Unuk River	Do.

Table 2. Chemical analyses of thermal springs in Alaska. Results reported in parts per million (ppm). Sample numbers refer to map localities.

Seward Peninsula and Interior Alaska

	1	2		3	4	5	6	7	11	18	19	22	23	24	27		28	29	30	31
SiO_2	100	100	90	70	--	45	--	75	65	29	78	--	--	--	65	65	40	75	85	95
Al	0.04	0.083	0.06	--	--	--	--	0.094	0.1	0.2	--	--	--	--	0.016	0.046	0.014	--	0.028	0.012
Fe	--	--	<.01	--	--	--	--	--	<0.01	2.7	0.75	--	--	--	--	--	--	0.02	--	--
Ca	530	47	75	2	14	130	5.6	2	5.9	10	11	5.6	11	2.7	4	6.8	20.2	82	1.3	20.8
Mg	1.4	0.48	0.35	<0.025	0.2	0.1	0.06	0.04	.01	3	2.8	0.7	0.1	0.3	1	2.9	6.6	1.2	0.13	0.3
Na	1450	730	800	75	111	500	54	51	83	}58	}107	71	95	111	130	130	180	321	110	230
K	61	40	41	1.4	1.1	9	1.4	1.3	2.1			1.4	2.0	3.7	4.5	4.8	7.9	23	3.3	9.8
Li	4.0	4.7	--	--	--	--	--	0.04	--	--	--	--	--	--	0.28	0.28	0.16	--	0.3	0.34
NH_3	--	--	--	--	--	--	--	--	--	--	--	--	--	--	4.9	0.5	0.4	--	2.7	0.1
HCO_3	30.1	64.5	57	100	40	10.2	34	45.7	--	22	32	74	93	169	89.6	90.7	488	49	114.7	184.6
CO_3	--	--	1.3	--	10	--	34	--	--	32	31	22	21	--	--	--	--	--	--	--
SO_4	24	29	1.0	--	16	--	25	62	122	45	61	19	23	21	54	51	55	40	68	96
Cl	3346	1480	1450	8	122	912	4.9	9.3	6	39	92	9.1	25	28	134	132	40	615	28.9	249
F	4.7	6.4	6.0	9	--	5.8	--	8.2	--	--	--	--	--	--	8.5	8.2	0.8	0.2	18.6	9.7
Br	--	--	4.9	1	--	4.0	--	--	--	--	--	--	--	--	--	--	--	--	--	--
B	2.4	3.4	2.9	0.8	0.6	1.0	0.2	0.13	--	--	--	0.6	1.6	1.3	1.3	1.2	0.3	--	1.3	1.1
pH	6.75	7.91	--	9.1	8.97	7.3	9.43	10.14	--	--	--	9.16	9.04	8.01	7.7	7.72	7.66	7.7	9.14	7.58
Temp.°C	55	60	77	--	17	--	67	49	--	47	56	45	66	66	59	56	43	52	57	57

Aleutian Is. and Alaska Peninsula

	40	52		53			54	58	64
SiO_2	--	303	150	88	99	65	59	128	68
Al	--	--	--	--	--	--	--	--	--
Fe	--	--	--	--	--	--	--	--	9.9
Ca	182	0.1	0.2	163	153	116	18	9.9	229
Mg	70	15	40	1.2	3.3	1.1	7.5	1.4	7.0
Na	75	441	350	603	153	427	53	288	780
K	7.3	33	18	33	27	24	5.6	21	34
Li	--	3	2	3	2	2	--	--	1.5
NH_3	--	--	--	--	--	--	--	--	--
HCO_3	--	--	29	67	69	65	84	192	694
CO_3	--	33	10	--	--	--	--	--	--
SO_4	315	160	130	88	86	73	69	39	--
Cl	1100	569	482	1126	1104	782	39	350	1390
F	--	1.9	1.2	0.6	0.9	0.5	0.1	0.7	0.1
Br	--	--	--	--	--	--	--	--	--
B	24	49	49	29	27	20	3	11	32
pH	2.17	7.5	6.9	--	6.4	6.0	--	7.0	7.5
Temp.°C	--	100	101	89	--	68	22	--	54

Southeastern Alaska

	78	80	81	82	83	84	85	88	91	92
SiO_2	119	96	40	60	110	70	120	108	142	105
Al	4.6	--	5.3	0.05	1.6	0.37	0.018	}1.2	2.2	}1.2
Fe	2.1	3.1	1.4	--	0.75	--	--		1.5	
Ca	21	8.5	37	28	13	2.5	380	13	13	4.6
Mg	2.3	--	11	0.76	2.4	.14	1.9	0.4	2.1	1.0
Na	137	}59	206	190	}69	51	1500	87	}54	}201
K	4.1		3.8	3.3		1.2	61	9.2		
Li	--	--	--	0.08	--	.06	1.6	--	--	--
NH_3	--	--	--	--	--	--	--	--	--	--
HCO_3	48	18	35	54.8	43	88.4	78.7	43	27	37
CO_3	7.2	25	.0	--	63	--	--	18	53	13
SO_4	226	35	329	322	24	68	110	142	32	129
Cl	33	42	133	95.4	4.5	11	2780	6.5	11	188
F	--	--	--	5	--	1.2	1.4	--	--	--
Br	--	--	--	--	--	--	--	--	--	--
B	--	--	--	4.4	10.1	0.2	1.1	--	--	--
pH	--	--	--	9.0	--	9.6	7.37	--	--	--
Temp.°C	81.5	44	39	42.5	47	51	67	52	85	72

Analyses 1-7, 11, 22-24, 27, 28 from Miller and others, 1973.
Analyses 18, 19, 78, 80, 81, 83, 88, 91, 92 from Waring, 1917.
Analysis 3 from Anderson, 1970.
Analyses 52-54 from Byers and Brannock, 1949.
Analysis 58 from Byers and Barth, 1953.
Analyses 30, 31, 64, 82, 84, 85 from this report.

Map Explanation

◉45 Thermal spring; location certain. Number refers to table 1. Outer circle indicates chemical analysis available (table 2).

○60 Possible thermal spring; temperature and location uncertain. Number refers to table 1.

This map is preliminary and has not been reviewed for conformity with U.S. Geological Survey standards and nomenclature.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C.—1964