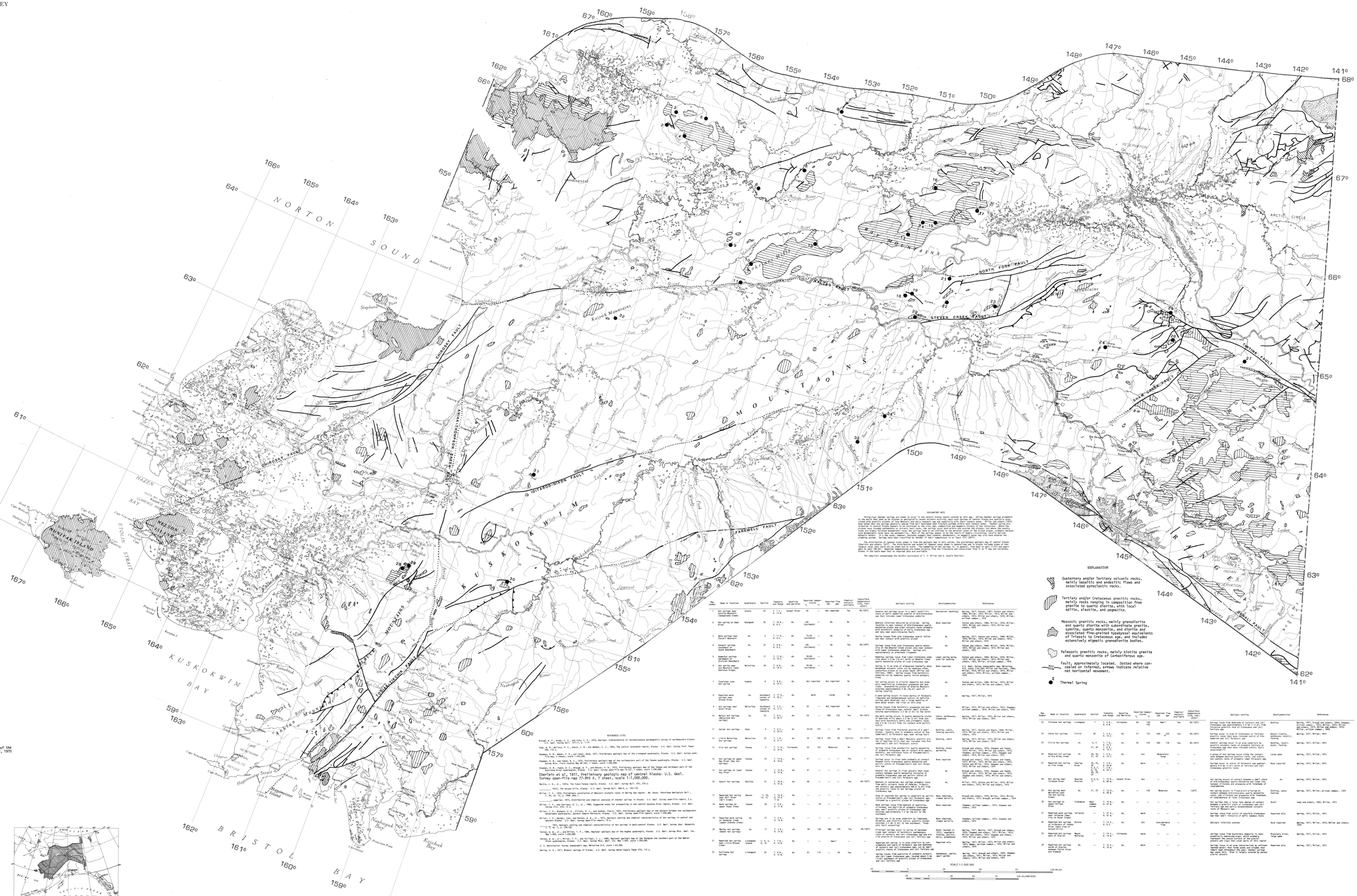
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN FILE REPORT
77-168H



Base map from the National Atlas of the U.S. of America U.S. Geol. Survey, 1970

REFERENCES CITED

Brosgé, W. P., Dutro, J. T., and Eliot, D. H., 1970, Geologic interpretation of reconnaissance aeromagnetic survey of northeastern Alaska: U.S. Geol. Survey Bull. 1311-F, p. 1-14.

Cady, W. M., Albritton, C. C., Hamin, J. M., and Webber, C. G., 1955, The central Kuskokwim region, Alaska: U.S. Geol. Survey Prof. Paper 268, p. 1-132.

Chapman, R. M., Weber, F. R., and Foster, Band, 1971, Preliminary geologic map of the Livengood quadrangle, Alaska: U.S. Geol. Survey open-file rep. 1 sheet, scale 1:250,000.

Chapman, R. M., and Tuaeff, W. J. (1972), Preliminary geologic map of the northeastern part of the Tanana quadrangle, Alaska: U.S. Geol. Survey open-file report 72-231, 1 sheet, scale 1:250,000.

Chapman, R. M., Tuaeff, W. J., Brosgé, W. P., and Dutro, J. T., 1970, Preliminary geologic map of the Chandalar and northeast part of the Fort Yukon quadrangles, Alaska: U.S. Geol. Survey open-file report 70-217, 1 sheet, scale 1:250,000.

Eberlein et al., 1977, Preliminary geologic map of central Alaska: U.S. Geol. Survey open-file map 77-168 A, 1 sheet, scale 1:1,000,000.

Martin, G. C., 1926, The Yukon-Tanana region, Alaska: U.S. Geol. Survey Bull. 772, 279 p.

_____, 1927, The Nulato Hills, Alaska: U.S. Geol. Survey Bull. 806-B, p. 141-176.

Miller, T. P., 1970, Preliminary compilation of Mesozoic plutonic rocks in Bering Sea region: Am. Assoc. Petroleum Geologists Bull., v. 54, p. 2305-2306.

Miller, T. P., Barnes, I., Patten, L. H., Kharkar, D. P., and Webber, C. G., 1972, Chemical and isotopic analyses of thermal springs in Alaska: U.S. Geol. Survey open-file report, 5 p.

Miller, T. P., and Barnington, H. J., Jr., 1960, Suggested areas for prospecting in the central Kuskokwim River region, Alaska: U.S. Geol. Survey Circ. 433, 13 p.

Miller, T. P., Grybeck, D., Clifton, H. E., and Hudson, Travis, 1972, Preliminary geologic map of the western Gulkana and southeastern Healy quadrangles, Alaska: U.S. Geol. Survey open-file report 72-231, 1 sheet, scale 1:250,000.

Miller, T. P., Grybeck, D., and Hudson, T. L., 1972, Geologic setting and chemical characteristics of hot springs in central and western Alaska: U.S. Geol. Survey open-file report, 19 p.

_____1973, Geologic setting and chemical characteristics of hot springs in west-central Alaska: U.S. Geol. Survey Jour. Research, v. 1, no. 3, p. 299-303.

Patton, W. W., Jr., and Miller, T. P., 1966, Bettles quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-484, scale 1:250,000.

Patton, W. W., Jr., Miller, T. P., and Tailleur, I. L., 1966, Bettles quadrangle map of the Chandalar and southern part of the Beaver River quadrangles, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-484, scale 1:250,000.

U.S. Geological Survey topographic map, Nefarlina D-4, scale 1:63,360.

Wahrhaftig, C. A., 1972, Mineral springs of Alaska: U.S. Geol. Survey Water-Supply Paper 419, 114 p.

EXPLANATORY NOTE

Thirty-four thermal springs are known to occur in the central Alaska region covered by this map. Unlike thermal springs elsewhere in the world that have been studied and are geologically related to young volcanoes, most such springs of central Alaska are associated with granitic plutons of late Mesozoic and early Cenozoic age and especially with their contact zones. Miller and others (1972) suggested that the heat for these springs may be derived from the cooling plutons, and that circulation of meteoric water in response to contact stoping appears to be consistent in the case, age, composition and magmatic history of the intrusions. Where the springs are associated with Quaternary volcanic rocks, the springs are in or near the volcanic rocks, but the volcanic rocks are highly fractured metamorphic rocks the springs have to be confined to the marginal zones of the pluton proper, probably because the permeability of the pluton is too low to allow circulation of meteoric water in the pluton except in its marginal fractured zones. In a few cases, however, analyses suggest that someone, metamorphic, or magmatic water may also have entered the plumbing system. Springs have been classified as thermal if their temperature is at least 10°C (18°F).

Springs in Yellowstone National Park, Yellowstone Lake, and Lassen Volcanic National Park are not included in this geologic map of central Alaska (Barnes and others, 1972). Yellowstone is an area of spectacular hydrothermal activity and includes areas of many igneous rocks that could not be shown due to scale. The numbering of hot springs, is in general, from west to east (1-27) and again from west to east (28-34). Chemical analyses of the springs are taken from the literature and unanalyzed from Miller (1972). Data in the table mean that no reported data are available.

The compilers acknowledge the helpful assistance of T. P. Miller and G. Donald Eberlein.

Map number	Name or location	Quadrangle	Section	Township and Range	Baseline and meridian	Reported temperature (°C)	Reported flow rate (gpm)	Chemical analysis available	Subsurface temperature (°C) (geothermometer)	Geologic setting	Development/Use	References
1	Hot springs near Nulato on Nulato River (Tenakatazha Creek)	Cosofke	25	T. 1 N., R. 1 W.	Kateel River	59	--	Not reported	Yes	90-150°C	Several hot springs occur in a small patch(?) of Late Cretaceous granitic rocks in a metamorphic aga that intrudes Lower Cretaceous andesite	Recreation (bathing)	Martin, 1927; Patton, 1967; Patton and others, 1966; Miller and others, 1972; Miller and others, 1972; Miller and others, 1972; Miller, written commun., 1976
2	Hot spring on Hawk River	Shungnak	35	T. 19 N., R. 5 W.	do.	>50 (estimate)	--	do.	No		Bedrock relations obscured by alluvium. Spring is in a small area of Late Cretaceous granitic rocks (probably alkali feldspar granite and other felsic rocks present) and very near pass intersection fault	None reported	Patton and others, 1966; Miller, 1970; Miller, 1972; Miller and others, 1972; Miller, written commun., 1976
3	Warm springs near Purcell Mountain	do.	2	T. 17 N., R. 5 W.	do.	15-20 (estimate)	--	do.	No	--	Spring issues from Late Cretaceous quartz latite porphyry near Late Cretaceous granite	do.	Martin, 1927; Patton and others, 1966; Miller, 1970; Miller, 1972; Miller and others, 1972; Miller and others, 1973
4	Several springs near southeast of South Bendeleben	do.	27	T. 9 N., R. 5 W.	do.	>50 (estimate)	--	do.	Yes	90-150°C	Springs issue from Late Cretaceous quartz monzonite and granite near contact with Lower Cretaceous andesite. Springs are approximately on premonian Thrusmont	do.	Patton and others, 1966; Miller, 1970; Miller, 1972; Miller and others, 1972; Miller and others, 1973
5	Ruby Springs (Kanuti River, Service Bridge)	do.	17	T. 13 N., R. 5 W.	do.	50-60 (estimate)	--	do.	No	--	Springs issue from Lower Cretaceous andesite near contact with Late Cretaceous granitic quartz monzonite pluton of Late Cretaceous age	Lower spring being used for bathing	Patton and others, 1966; Miller, 1970; Miller, 1972; Miller and others, 1972; Miller and others, 1973
6	Hot springs near Hughes (Hughes Service Bridge)	McKinley	29	T. 5 N., R. 5 W.	do.	50-60 (estimate)	--	do.	No	--	Spring is in an area of widespread thermally metamorphosed rocks (hornfels and marble) and subsurface pluton or an upper Cretaceous granitic stock. Rocks are Upper Cretaceous andesite cut by numerous quartz latite porphyry dikes	None reported	Patton and others, 1966; Miller, 1970; Miller, 1972; Miller and others, 1973
7	Tuxedni Lake hot spring	Hughes	8	T. 5 N., R. 5 W.	do.	Not reported	Not reported	No	--	--	Hot spring occurs in alluvial deposits but probably conducted by Cretaceous granodiorite and andesite. Springs issue from Cretaceous rocks nearby approximately 4 km (2.5 mi) east of springs	do.	Patton and others, 1966; Miller, 1970; Miller and others, 1973; Miller and others, 1973
8	Reported warm springs near Alatna River	Bettles (Southeast corner of A-1 Quadrangle)	T. 17 N., R. 17 E.	do.	Warm	Large	No	--	--	Springs are in metamorphosed rocks; no definite springs were observed, but a large quantity of water issues from gravel bed	do.	Martin, 1927; Miller, 1973
9	Hot springs near Dulbi River	McKinley	Southeast corner of A-1 Quadrangle	T. 1 N., R. 17 E.	do.	52	--	Not reported	No	--	Springs are from Mesozoic granitic and volcanic rocks of Cretaceous age; several small plutons occur within 2 to 10 mi (3 to 16 km)	None	Miller, 1970; Miller and others, 1972; Chapman, written commun., 1974; Miller and others, 1973
10	Reliance hot springs (Nenlichin hot springs)	do.	23	T. 23 N., R. 21 E.	do.	55	500	130	Yes	90-150°C	Hot spring occurs in quartz monzonite pluton of Late Cretaceous age. Springs issue from Late Cretaceous granitic rocks. Springs are in a small area of Late Cretaceous granitic rocks (Tg on map) from the contact with Upper Cretaceous andesite (Ka)	Cabin, bathhouse, bathing	Martin, 1927; Miller, 1970; Miller and others, 1972; Miller and others, 1973
11	Hermer hot springs	Ruby	4	T. 19 N., R. 22 E.	do.	30-40	120	--	65	Yes	--	Springs issue from Precleavel granite of a small pluton (probably Cretaceous) in contact with Lower (?) Cretaceous andesite	Bathing, cabin, fishing possible	Martin, 1927; Patton and Hoare, 1968; Miller and others, 1972; Miller and others, 1972; Miller and others, 1973
12	Little Melozitna hot springs	Melozitna	30	T. 21 N., R. 20 E.	do.	do.	100.4	230	60	Partial	90-150°C	Springs issue from a small Mesozoic granitic pluton (probably Late Cretaceous) in contact with andesite (Lower(?) and (or) Cretaceous)	Bathing, cabin	Martin, 1927; Miller and others, 1972; Miller and others, 1973
13	Ella hot springs	Tanana	2	T. 15 N., R. 19 E.	Fairbanks	52	120	Moderate	No	--	Springs issue from quartz monzonite of probable Cretaceous age at contact with gneiss. Springs are in a small area of Late Cretaceous and Paleozoic rocks	Bathing, cabin, gardening	Martin, 1927; Chapman and Tuaeff, 1972; Miller, 1973; Miller and others, 1973; Miller and others, 1973; Miller, written commun., 1976
14	Hot springs on upper Kaiyuh Slough (Hot springs)	Tanana	10	T. 21 N., R. 21 W.	do.	43	--	--	Yes	--	Springs occur in river bank probably at contact between Late Cretaceous granitic rocks and gneiss (Paleozoic(?) and (or) Paleozoic)	None reported	Grosvel and others, 1973; Chapman and Tuaeff, 1972; Miller, 1973; Miller and others, 1973; Patton and others, 1973; Chapman and others, 1973; Miller, written commun., 1976
15	Hot springs on lower Hay River	Tanana	6	T. 13 N., R. 21 W.	do.	61	--	--	Yes	--	Several hot springs in river gravels that cover contact between quartz monzonite intrusion of Late Cretaceous age and gneiss (Paleozoic(?) and (or) Paleozoic) age	do.	Grosvel and others, 1973; Chapman and Tuaeff, 1972; Miller, 1973; Miller and others, 1973; Chapman and others, 1973; Miller and others, 1973
16	Kanuti hot springs	Bettles	21	T. 18 N., R. 23 W.	do.	60	--	--	Yes	90-150°C	Bedrock is concealed, but springs probably issue from quartz monzonite rocks of Mesozoic, Triassic(?), and Paleozoic(?) ages. Springs are in a small area of Late Cretaceous granitic rocks. Hot springs pluton of Cretaceous age	Bathing, cabin	Grosvel and others, 1973; Miller, 1973; Miller and others, 1973; Miller and others, 1973; Miller, written commun., 1976
17	Reported hot spring near Chena River (Hot Springs)	Beaver	T. 1 N., R. 1 W.	do.	do.	--	--	--	--	--	Area of reported hot spring is underlain by partly Mesozoic(?) and Paleozoic(?) rocks and Tertiary(?) and Quaternary(?) rocks and Tertiary(?) and Quaternary(?) rocks	None reported, known earlier	Grosvel and others, 1973; Miller, 1973; Miller and others, 1973; Brosgé and others, 1970; Chapman, written commun., 1974
18	Warm springs on upper Tanana Creek	Tanana	36	T. 5 N., R. 1 W.	do.	--	70	--	--	--	Warm springs issue from bedrock of quartzite, siltstone, and graphitic schist of probable Cretaceous age. Springs are in a small area of Cretaceous rocks approximately 12 mi (by mi) to the contact	None reported	Chapman, written commun., 1973; Chapman and others, 1973
19	Reported warm springs on Sanbaldin Creek (upper Sukakpak Creek)	do.	27	T. 5 N., R. 1 W.	do.	--	--	--	--	--	Springs are in an area underlain by Triassic(?), Paleozoic(?), and Cretaceous(?) rocks (Ka on map) (Ka(?) on map) in the southeast. Probably Cretaceous	None reported, known earlier	Chapman, written commun., 1973; Chapman and others, 1973
20	Meshep hot springs (Sweet hot springs)	do.	17	T. 5 N., R. 1 W.	do.	59	136	580	145	Yes	90-150°C	Principal springs occur in valley of Sandman Creek near contact of quartzitic sandstone and Cretaceous granitic rocks. Springs are in a small area of the granite of Cretaceous and (or) Tertiary age	Hotel (formerly in 1970), campsite, bathing, fishing, dairy, greenhouse	Martin, 1927; Martin, 1931; Brosgé and others, 1970; Miller and others, 1972; Miller and others, 1973; Chapman and others, 1973; Miller and others, 1973; Miller, written commun., 1976
21	Reported hot spring near Little Minook Creek	Livengood (Southeast corner of A-1 Quadrangle)	T. 5 N., R. 1 W.	do.	do.	--	--	Small	--	--	Reported hot spring is in area underlain by complex Cretaceous and Cenozoic of Paleozoic age and Quaternary(?) and Tertiary(?) rocks. Springs are in a small area of Cretaceous granitic rocks of Cretaceous and (or) Tertiary age	Reported only	Martin, 1927; Miller, 1973; Miller and others, 1973; Chapman and others, 1973; Miller and others, 1973; Miller, written commun., 1976; Miller and others, 1973
22	Hot springs near Livengood	Livengood	34	T. 5 N., R. 1 W.	do.	43	114	--	50	Yes	--	Springs issue from quartzite of probable Jurassic age (Ka on map) (Ka(?) on map) in contact with (?) and (quartzite) of granitic plutons of Cretaceous and (or) Tertiary age	Bathhouse, cabin, small golfer	Martin, 1927; Brosgé and others, 1970; Chapman and others, 1973; Miller and others, 1973; Miller and others, 1973; Miller and others, 1973

EXPLANATION

Quaternary and/or Tertiary volcanic rocks, mainly basaltic and andesitic flows and associated pyroclastic rocks.

Tertiary and/or Cretaceous granitic rocks, mainly rocks ranging in composition from granite to quartz diorite, with local aplites, alaskite, and pegmatite.

Mesozoic granitic rocks, mainly granodiorite and quartz diorite with subordinate granite, syenite, quartz monzonite, and diorite and associated fine-grained hypabyssal equivalents of Triassic to Cretaceous age, and includes extensively migmatic granodiorite bodies.

Paleozoic granitic rocks, mainly biotite granite and quartz monzonite of Carboniferous age.

Fault, approximately located. Dotted where concealed or inferred, arrows indicate relative net horizontal movement.

Thermal Spring

SCALE 1:1 000 000

Map number	Name or location	Quadrangle	Section	Township and Range	Baseline and Meridian	Reported temperature (°C)	Reported flow rate (gpm)	Chemical analysis available	Subsurface temperature (°C) (geothermometer)	Geologic setting	Development/Use	References
23	Tolovana Hot springs	Livengood	7	T. 5 N., R. 2 W.	Fairbanks	60	140	Small	Yes	90-150°C	Springs issue from mudstone of Jurassic and (or) Cretaceous age approximately 2.4 km (1.5 mi) from contact between rocks of Cretaceous and (or) Tertiary age	Bathing	Martin, 1927; Brosgé and others, 1970; Chapman, written commun., 1973; Miller, 1973; Miller and others, 1973; Miller and others, 1973; Miller, written commun., 1976
24	Chena Hot springs	Circle	25	T. 2 N., R. 1 E.	do.	57	150	840	220	Yes	90-150°C	Springs occur in area of Cretaceous or Tertiary granitic rocks (probably Cretaceous) (Ka and (or) Tg on map)	Resort (cabins, bathhouse, hotel), bathing	Martin, 1927; Miller, 1973
25	Circle Hot springs	do.	A. 1 C. 1	T. 1 N., R. 21.20 E.	do.	54	134	560	134	Yes	90-150°C	Thermal springs occur in area underlain by Cretaceous granitic rocks (probably Late Cretaceous) and have issued through contact, fault	Bathing, resort, hotel, boating	Martin, 1927; Miller, 1973
26	Reported hot springs on Big Creek	do.	24 A. 1 C. 1	T. 1 N., R. 1 E.	do.	Hot		Moderately large	--	--	A group of hot springs occur along the contact between mafic granitic rocks, and sulfide ore country rocks of probable Lower Paleozoic age	Large game	Martin, 1927; Miller, 1973
27	Reported hot springs on Flat Creek	Charley River	26 A. 1 B. 1 C. 1 D. 1	T. 2 N., R. 1 E.	do.	Warm	--	--	--	--	Springs issue from Cretaceous granitic rocks and are in a small area of Cretaceous and Tertiary granitic rocks	None reported	Martin, 1927; Miller, 1973
28	Hot springs near Tatalina River	Mountain Village	1	T. 19 N., R. 35 W.	Kateel River	Hot	--	--	--	--	Hot springs occurs at contact between a small stock of mid-Cretaceous quartz-bearing and lower Cretaceous andesite and Paleozoic(?) and Mesozoic complexes	Bathing	Martin, 1927; Miller, 1973
29	Hot springs near Lake Clark (Nr. Lake Clark)	do.	21, 22	T. 12 N., R. 35 W.	do.	--	150	Moderate	Yes	120°C	Hot springs occurs in Pleistocene siltstone at contact between mid-Cretaceous quartz monzonite and Paleozoic(?) and Mesozoic complexes. Springs are adjacent to a small area of Late Cretaceous rocks	Bathing, space heating	Martin, 1927; Miller, written commun., 1976
30	Hot springs on Kuskokwim River	Tikchik	Near corner	T. 19 N., R. 40 W.	do.	--	--	--	--	--	Hot springs near a large lake emerge on contact between Late Cretaceous granitic rocks (Ka on map) and partly metamorphosed volcanic rocks of Paleozoic age	None?	Cady and others, 1955; Miller, 1973
31	Reported warm springs on Sanbaldin Creek	Iditarod	--	T. 5 N., R. 1 W.	do.	Warm	--	--	--	--	Springs issue from outcrop of graphite (Paleozoic age) near Late Cretaceous granitic rocks	Reported only	Martin, 1927; Miller, 1973
32	Reported hot springs on tributary of Tanana River near mouth of Kotlik Creek	Nulato	--	T. 13 N., R. 24 W.	do.	Hot	Considerable flow	--	--	--	Geologic relations unknown	None reported	Martin, 1927; Miller, 1973; Miller and others, 1973
33	Reported hot springs west of Glacier	Mount McKinley	--	T. 13 N., R. 24 W.	Fairbanks	Warm	--	--	--	--	Springs issue from Quaternary deposits in topographically depressed area, which probably overlies Cretaceous granite. Springs are in a small area of Late Cretaceous rocks	Migratory birds, large game	Martin, 1927; Miller, 1973
34	Reported hot springs between Yukon River and Dikeena	do.	--	T. 13 N., R. 15 W.	do.	Warm	--	--	--	--	Springs issue in an area characterized by unknown Cretaceous and Cenozoic of Paleozoic age and between Late Cretaceous granitic rocks (Ka on map) (which name designated the plutonic thermal springs) and Tertiary dike to largely covered by gallery stratigraphic	Reported only	Martin, 1927; Miller, 1973

MAP AND TABLE SHOWING DISTRIBUTION OF KNOWN THERMAL SPRINGS IN SELECTED IGNEOUS ROCKS IN CENTRAL ALASKA

COMPILED BY JUDITH S. GASSAWAY AND BETH S. ABRAMSON

1978

This report is preliminary and has not been edited or reviewed for conformity with Geological Survey standards and nomenclature.