DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

OPEN-FILE REPORT
79-430

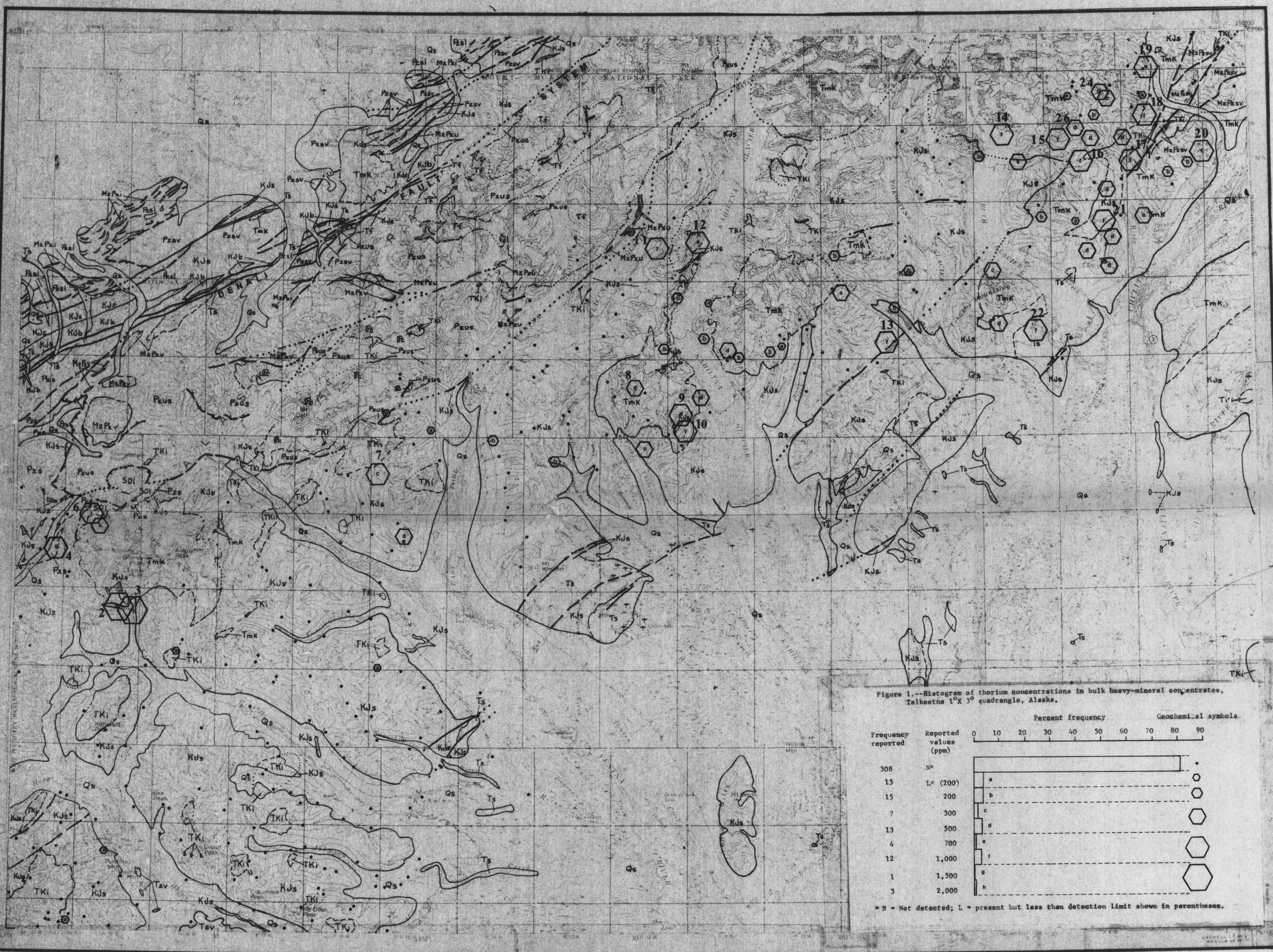


Figure 1.--Histogram of thorium concentrations in bulk heavy-mineral concentrates, Talkeetna 1°X 3° quadrangle, Alaska.

Frequency reported	Reported values (ppm)	Geochemical symbols
308	N*	•
15	L* (200)	a
15	200	b
7	300	c
13	500	d
4	700	e
12	1,000	f
1	1,500	g
3	2,000	h

* N = Not detected; L = present but less than detection limit shown in parentheses.

Geology generalized from Reed and Nelson, 1977

BULK HEAVY-MINERAL CONCENTRATES

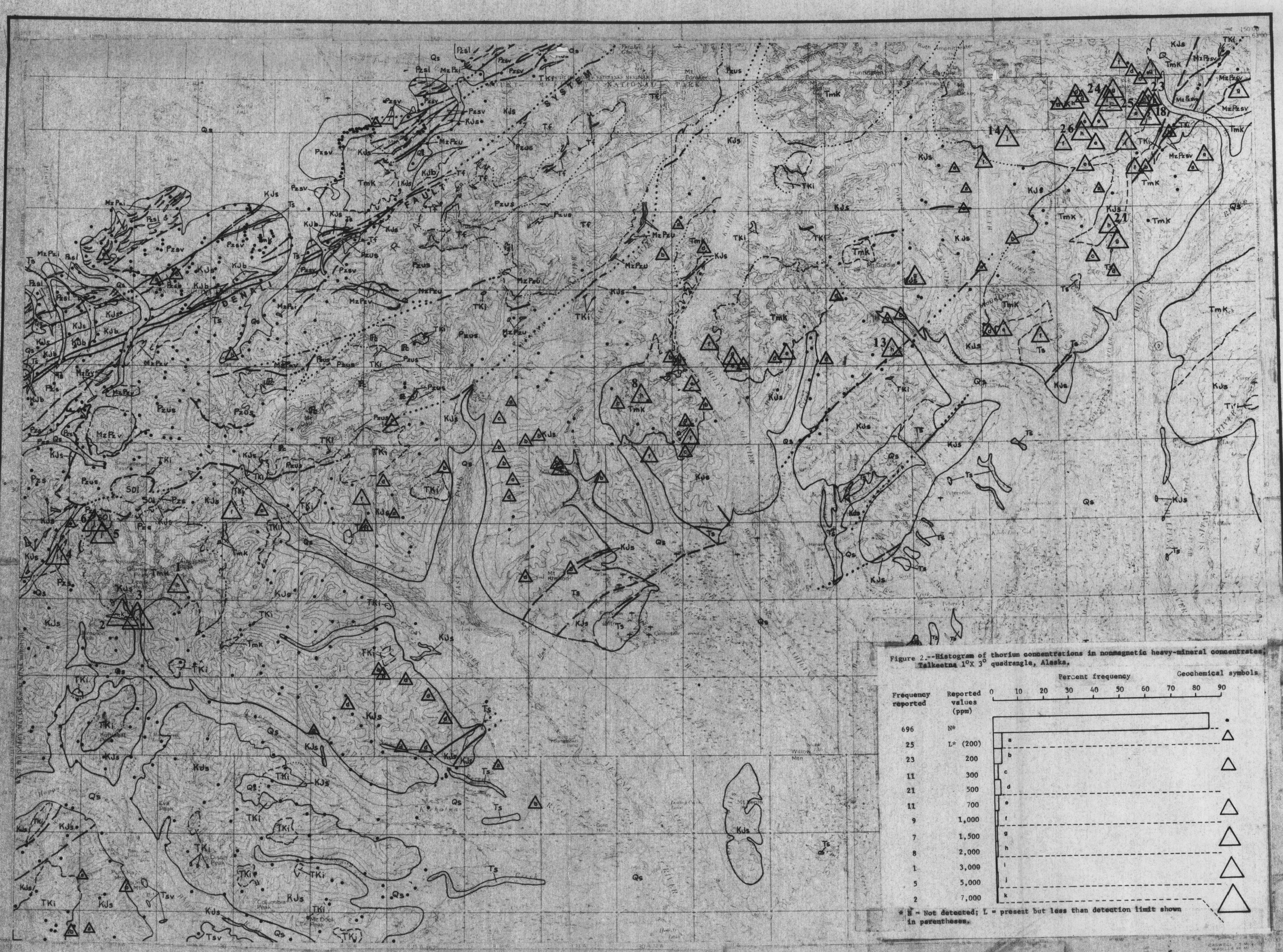


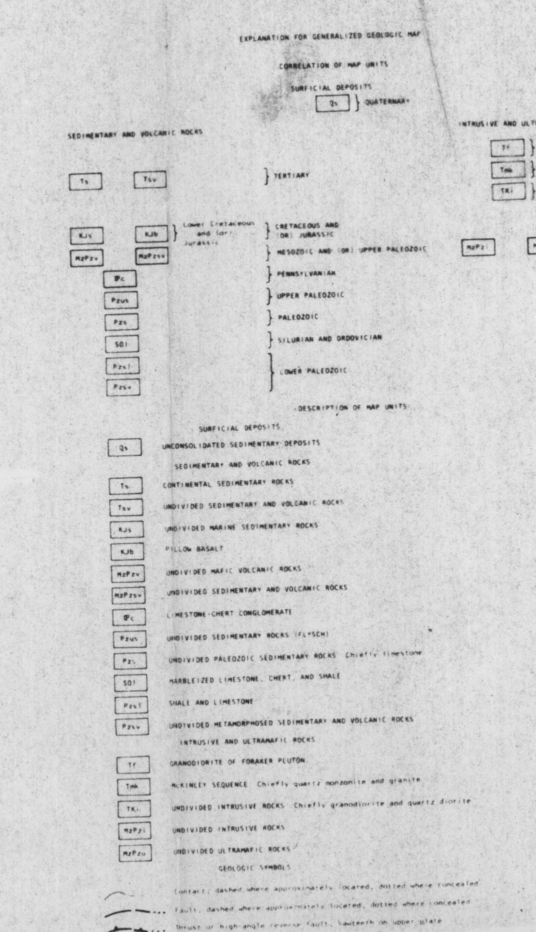
Figure 2.--Histogram of thorium concentrations in nonmagnetic heavy-mineral concentrates, Talkeetna 1°X 3° quadrangle, Alaska.

Frequency reported	Reported values (ppm)	Geochemical symbols
696	N*	•
25	L* (200)	a
23	200	b
11	300	c
21	500	d
11	700	e
9	1,000	f
7	1,500	g
8	2,000	h
1	3,000	i
5	5,000	j
2	7,000	k

* N = Not detected; L = present but less than detection limit shown in parentheses.

Geology generalized from Reed and Nelson, 1977

NONMAGNETIC HEAVY-MINERAL CONCENTRATES



EXPLANATION OF GEOCHEMICAL SYMBOLS

• BACKGROUND VALUE--Defined on histogram

ANOMALOUS VALUES--Letters correspond to letters on histograms that represent the reported anomalous values. Numbers correspond to sample numbers in table 1

Table 1.--Thorium and uranium content (in parts per million) in selected bulk and nonmagnetic heavy-mineral concentrate samples and of associated stream sediment samples. [Samples were selected on the basis of: (1) thorium values of 500 ppm and greater in the bulk heavy-mineral concentrates, (2) thorium values of 2,000 ppm and greater in the nonmagnetic concentrates, and (3) sufficient sample material for uranium analysis in groups (1) and (2). Sample numbers correspond to numbers on maps; L = detected but less than the limit of determination shown in parentheses, INS = insufficient sample for analysis, --- = not analyzed.]

Sample number	Heavy-mineral concentrates				Stream sediments	
	Bulk		Nonmagnetic			
	Thorium	Uranium	Thorium	Uranium	Thorium	Uranium
1	INS	INS	2,000	13,000	102	10
2	1,500	504	7,000	3,200	INS	71
3	2,000	140	7,000	4,600	140	39
4	1,000	INS	5,000	3,100	36	3
5	300	---	5,000	6,700	62	5
6	1,000	1,230	5,000	INS	97	5
7	700	16	500	---	108	2
8	500	280	2,000	2,200	23	13
9	700	206	500	---	24	5
10	1,000	65	1,000	---	25	2
11	1,000	29	200	---	70	6
12	700	72	500	---	56	7
13	1,000	204	2,000	35	76	2
14	1,000	INS	5,000	2,060	125	19
15	1,000	397	1,000	---	105	7
16	1,000	132	700	---	44	7
17	1,000	32	1,000	---	446	5
18	1,000	203	2,000	1,400	122	5
19	700	206	1,500	---	239	21
20	1,000	15	700	---	74	4
21	1,000	84	2,000	750	INS	2
22	1,000	65	1,000	---	75	3
23	L(200)	---	2,000	112	68	9
24	500	230	3,000	850	148	11
25	300	---	5,000	230	---	---
26	500	260	2,000	770	---	---

DISCUSSION

These maps show the distribution and abundance of thorium in heavy-mineral concentrates which were collected in the Talkeetna quadrangle in 1975 and 1976 during reconnaissance geochemical studies for the Alaskan Mineral Resource Assessment Program. Sample sites are shown on the maps by small closed circles, triangles (nonmagnetic heavy-mineral concentrates) and hexagons (bulk heavy-mineral concentrates). These symbols represent values as defined on the accompanying histograms. The small closed circles represent background values and the triangles and hexagons represent anomalous values. The letters within the triangles and hexagons correspond to reported values shown on the histograms.

Distribution and nature of the geochemical anomalies

Most of the anomalously high thorium values occur on the south flank of the Alaska Range. This terrane is composed of Jurassic-Cretaceous marine shales and siltstones that have been intruded by Cretaceous-Tertiary plutons of mainly granodiorite composition (TKi) and lower Tertiary biotite and biotite-muscovite granite plutons of the McKinley sequence (Tmk). With few exceptions, the highest values cluster around and within the granite plutons. High-value thorium samples having enough material were analyzed for uranium because the high values suggested the presence of uranothorianite similar to that found by Robinson and others (1955) in the Yentna district, in the west central part of the quadrangle. The results show in table 1 that as much as 13,000 parts per million uranium are present in the samples collected in the granite pluton (Tmk) near the western edge of the quadrangle. Small (0.1 mm diameter or less) euhedral grains were observed in the uranium bearing samples that contained enough material for mineralogic examination. These grains were identified as uraninite by X-ray diffraction.

These results do not provide an evaluation of the significance of thorium and uranium occurrences within the quadrangle. They do, however, outline possible economically favorable areas which merit further investigation.

Collection, preparation, and analysis of samples

In most places within the quadrangle, heavy-mineral concentrates and associated stream sediments were collected in the active channels of swiftly flowing mountain streams draining areas ranging from approximately 5 to 10 km^2. The sediment in most of these streams ranges in size from fine sand to pebbles and cobbles. The heavy minerals in the sediment and the sediment itself can reflect the presence of mineralized rock in the drainage basin upstream.

The heavy mineral concentrates were obtained in the field by panning to remove the bulk of the light minerals. The panned samples were sieved through a 20-mesh (0.8 mm) screen in the laboratory and the minus-20-mesh fraction was further separated with bromoform (specific gravity: 2.86) to remove any remaining light mineral grains. Magnetite and other strongly magnetic heavy minerals were removed from the heavy-mineral fraction by the use of a hand magnet. For those samples from the south flank of the Alaska Range that contained enough material (388 samples), this fraction was split and one split (labeled bulk concentrate) was pulverized and analyzed for 31 elements including thorium by optical emission spectrography (Grimes and Marranzino, 1968), and for gold by atomic absorption (Ward and others, 1969). Analytical results for all elements other than thorium are available in Open-File Report 78-146 (Curtin and others). The remaining part of the heavy-mineral split was passed through a Frantz Isodynamic Separator[1/] and a nonmagnetic fraction was obtained at a setting of 0.6 ampere. A split of this fraction was pulverized and analyzed for thorium and 30 other elements by the semiquantitative spectrographic method of Grimes and Marranzino (1968). Analytical results for the other elements are available in Open-File Report 78-143 (O'Leary and others, 1978). Uranium results for both types of heavy-mineral concentrates were obtained by a fluorimetric method (F. N. Ward, written commun., 1978).

Stream sediments to be analyzed for thorium and uranium (table 1) were first air dried and sieved with an 80-mesh (0.18 mm) screen. A split of the minus-80-mesh material was pulverized and analyzed for thorium by a colorimetric method (D. M. Hopkins, written commun., 1978) and for uranium by a fluorimetric method (F. N. Ward, written commun., 1978).

1/ The use of trade names is for descriptive purposes only and does not constitute endorsement of these products by the U.S. Geological Survey.

REFERENCES CITED

Curtin, G. C., Cooley, E. F., O'Leary, R. M., Karlson, R. C., McDanal, S. K., 1978, Spectrographic and chemical analyses of bulk heavy-mineral concentrates from the Talkeetna quadrangle, Alaska: U.S. Geological Survey Open-File Report 78-146.

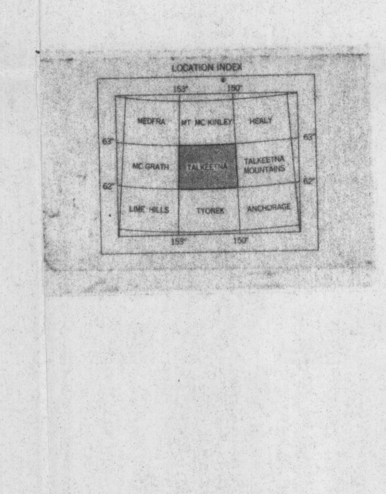
Grimes, D. J., and Marranzino, A. P., 1968, Direct-current arc and alternating-current spark emission spectrographic field methods for the semiquantitative analysis of geologic materials: U.S. Geological Survey Circular 591, 6 p.

O'Leary, R. M., Day, G. W., Cooley, E. F., Curtin, G. C., and McDougal, C. M., 1978, Spectrographic and chemical analyses of stream sediment, glacial debris, and nonmagnetic heavy-mineral concentrate samples from the Talkeetna quadrangle, Alaska: U.S. Geological Survey Open-File Report 78-143.

Reed, B. L., and Nelson, S. W., 1977, Geologic map of the Talkeetna quadrangle: U.S. Geological Survey Miscellaneous Field Studies Map, 870 A, scale 1:250,000.

Robinson, G. D., Wedow, Helmuth, Jr., and Lyons, J. B., 1955, Radioactivity investigations in the Cache Creek area, Yentna district, Alaska, 1945: U.S. Geological Survey Bulletin 1024-A, p. 1-23.

Ward, F. N., Nakagawa, H. M., Harms, T. F., and Van Sickle, G. H., 1969, Atomic absorption methods of analysis useful in geochemical exploration: U.S. Geological Survey Bulletin 1289, 45 p.



GEOCHEMICAL AND GENERALIZED GEOLOGIC MAPS SHOWING THE DISTRIBUTION AND ABUNDANCE OF THORIUM, AND DISTRIBUTION OF URANIUM IN SELECTED SAMPLES, IN THE CENTRAL ALASKA RANGE, TALKEETNA QUADRANGLE, ALASKA

By

G.C. Curtin, R.M. O'Leary, R.B. Tripp, and E.F. Cooley

1979