UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

MAGNETIC SUSCEPTIBILITIES OF CRYSTALLINE ROCK SAMPLES, YUKON RIVER-PORCUPINE RIVER AREA, EAST-CENTRAL ALASKA

By

W. P. Brosgé and Arthur Conradi, Jr.

Open-file report

1971

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

Magnetic susceptibilities of crystalline rock samples, Yukon River-Porcupine River area, east-central Alaska

By

W. P. Brosgé and Arthur Conradi, Jr.

Paleozoic, Mesozoic and Tertiary granitic rocks and Precambrian to Cenozoic mafic volcanic rocks crop out along the margins of the Yukon Flats and Porcupine Plateau. Profiles from airborne magnetometer surveys show that magnetic anomalies occur above the outcrops of many of these rocks. Similar magnetic anomalies also occur above the mantle of surficial deposits in the Yukon Flats, leading to the interpretation that a large part of the Flats is underlain at shallow depth by volcanic rocks and possibly also by granitic rocks (Andreasen, 1960; Zietz and others, 1960; Brosgé and others, 1970). To aid in further interpretation of these magnetic anomalies, the available data on magnetic susceptibilities of igneous and metamorphic rocks in the area around the Flats are reported below (Table 1; Fig. 1).

Samples and measurement method

Grab samples were collected by E. E. Brabb, W. P. Brosgé, R. M. Chapman, Michael Churkin, Jr., T. P. Miller, W. W. Patton, Jr., H. N. Reiser, and BP Exploration Co. (Alaska). The samples include specimens from most of the major igneous rock units around the Yukon Flats; however, they do not represent all the lithic varieties within these units. The susceptibility measurements were made by Arthur Conradi, Jr., on unoriented cylindrical plugs about one inch long and one inch in diameter cut from the samples. The susceptibility was measured by an induction-type apparatus

which compares the field induced in a sample with that of a reference solenoid. The present apparatus was developed by W. F. Hanna from earlier systems which have been briefly described (Hanna, 1968).

Geologic references

Samples are grouped in Table 1 according to the time-rock units used in the regional mapping. Descriptions and locations of these units are available on 1:250,000-scale geologic maps for the eastern and northern parts of the sampled area (Brabb and Churkin, 1969; Brabb, 1970; Brosgé and Reiser, 1969, 1962, 1964). Similar maps are in preparation for the southern and western parts (Chapman and Weber; Patton and Miller), and reconnaissance maps at 1:500,000 and smaller scales are available for the Yukon Flats and its southern and western margins (Eakin, 1916; Mertie, 1937; Williams, 1962; Patton and Miller, 1970). Some of the Rampart Group and Circle mafic rocks on the south side of the Flats have been described separately (Brosgé and others, 1969; Churkin, 1970, p. 60).

The age of the largest mass of mafic rocks on the north edge of the Yukon Flats has been revised to Jurassic (Reiser and others, 1965), and accordingly some of the mafic rocks shown on available maps as Devonian(?) (Brosgé and Reiser, 1962, 1964) are shown as Jurassic(?) in Table 1.

References cited

Andreasen, G. E., 1960, Total intensity aeromagnetic profiles of the Yukon Flats-Kandik area, Alaska: U.S. Geol. Survey open-file rept., 7 sheets.

Brabb, E. E., 1970, Preliminary geologic map of the Black River quadrangle, east-central Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-601, 1:250,000.

Brabb, E. E. and Churkin, Michael, Jr., 1969, Geologic map of the Charley River quadrangle, east-central Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-573, 1:250,000.

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, p. F1-F14.

Brosgé, W. P., Lanphere, M. A., Reiser, H. N., and Chapman, R. M., 1969, Probable Permian age of the Rampart Group, central Alaska: U.S. Geol. Survey Bull. 1294-B, p. B1-B18.

Brosgé, W. P. and Reiser, H. N., 1962, Preliminary geologic map of the Christian quadrangle, Alaska: U.S. Geol. Survey open-file map, 1:250,000.

_____1964, Geologic map and section of the Chandalar quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-375, 1:250,000.

_____1969, Preliminary geologic map of the Coleen quadrangle, Alaska: U.S. Geol. Survey open-file map, 1:250,000.

Chapman, R. M., Weber, F. R., and Taber, Bond, Preliminary geologic map of the Livengood quadrangle, Alaska: U.S. Geol. Survey open-file map, 1:250,000 (in prep.).

Churkin, Michael, Jr., 1970, Paleozoic rocks of Alaska and their role in its tectonic history: U.S. Geol. Survey open-file rept.

Eakin, H. M., 1916, The Yukon-Koyukuk region, Alaska: U.S. Geol. Survey Bull. 631, 88 p.

Hanna, W. F., 1968, Preliminary analysis of an induction-type apparatus for measuring magnetic susceptibility [abs.]: Am. Geophys. Union Trans, v. 49, no. 4, p. 673.

Mertie, J. B., Jr., 1937, The Yukon-Tanana region, Alaska: U.S. Geol. Survey Bull. 872, 276 p.

Patton, W. W., Jr., and Miller, T. P., 1970, Preliminary geologic investigations in the Kanuti River region, Alaska: U.S. Geol. Survey Bull. 1312-J, p. J1-J10.

_____, Reconnaissance geologic map of the Bettles and southern Wiseman quadrangles: U.S. Geol. Survey open-file map, 1:250,000 (in prep.).

Reiser, H. N., Lanphere, M. A., and Brosgé, W. P., 1965, Jurassic age of a mafic igneous complex, Christian quadrangle, Alaska, in Geological Survey research 1965: U.S. Geol. Survey Prof. Paper 525-C, p. C68-C71.

Williams, J. R., 1962, Geologic reconnaissance of the Yukon Flats district, Alaska: U.S. Geol. Survey Bull. 1111-H, p. 289-331.

Zietz, Isidore, Andreasen, G. E., and Grantz, Arthur, 1960, Regional aeromagnetic surveys of possible petroleum provinces in Alaska: U.S. Geol. Survey Prof. Paper 400-B, p. B75-B76.

Table 1. Magnetic susceptibility of crystalline rock samples, Yukon-Porcupine River area, Alaska.

Map number (Fig. 1)	Field number of sample	Magnetic susceptibility in c.g.s. units $\times 10^{-4}$	Quadrangle	Latitude North	Longitude West	Remarks
Cenozoic volcanic flows:						
25	60ARr 470	.88	Chan.	67° 05'	147° 14'	vesicular olivine basalt.
26	60ARr 469	3.50	Chan.	67° 05'	147° 06'	vesicular basalt.
59	67ABe 408	30.6	Col.	67° 19'	142° 05'	vesicular olivine basalt.
66	64ABe 51A	4.28	Col.	67° 19'	141° 31'	vesicular olivine basalt; 40 ft. flow.
66	64ABe 51B	5.08	Col.	67° 19'	141° 31'	olivine basalt; 85 ft. flow; overlies 51A.
66	64ABe 51C	3.37	Col.	67° 19'	141° 31'	basalt; 50 ft flow; overlies 51B.
66	64ABe 51D	9.58	Col.	67° 19'	141° 31'	50 ft flow; overlies 51C.
67	64ABe 69A	2.58	Col.	67° 10'	141° 42'	olivine basalt.
68	KPO 199	1.66	Bl. R	66° 52.0'	142° 53.1'	basalt.
69	61ABa 1581	1.69	Bl. R	66° 38.0'	143° 08.7'	vesicular olivine basalt.
70	61ABa 1591	1.68	Bl. R	66° 38.0'	143° 11.1'	vesicular olivine basalt.
75	70APa 298B	16.1	Bett.	66° 08'	150° 07'	basalt.
76	70AMm 306	2.58	Bett.	66° 01'	150° 16'	basalt.
88	70ACh 203	1.67	Live.	65° 47'	149° 27'	basalt.
Tertiary and Upper Cretaceous granitic rocks:						
71	70ACh 125	1.66	Tan.	65°43'06"	151° 10'	porphyritic qtz-monz.
72	70ACh 139	<.1	Tan.	65° 41'	151° 15'	porphyritic qtz-monz.
74	70ACh 72	<.1	Tan.	65° 41'	150° 57'	quartz-monzonite.
85	69ACh 96	<.1	Live.	65° 22'	149° 35'	quartz-monzonite.
96	70ACh 8	<.1	Live.	65° 29'	147° 07'	syenite.
Cretaceous granitic rocks:						
1	67APa 82	28.7	Bett.	66° 56'	150° 22'	
3	70AMm 402	13.4	Bett.	66° 58'	150° 12'	
4	70AMm 403	14.4	Bett.	66° 56'	150° 15'	
5	59ABe 497p	3.37	Chan.	67° 03'	149° 39'	porphyritic qtz-monz.
6	60ABe 431	3.37	Bver.	66° 59'	149° 06'	porphyritic qtz-monz.
7	59ARr 563	6.75	Chan.	67° 10'	148° 50'	porph. biotite granite.
8	60ABe 423	3.44	Chan.	67° 06'	148° 42'	syenite.
9	60ABe 433B	<.1	Chan.	67° 01'	148° 50'	biotite granite.
12	60ABe 437	.88	Chan.	67° 00'	148° 20'	biotite granite.
24	60ARr 472	5.06	Chan.	67° 06'	147° 19'	biotite granite.
27	60ARr 466	5.15	Chan.	67° 01'	147° 28'	biotite granite.
28	63ABe 177C	<.1	Chrs.	67° 12'	146° 50'	syenite.

Migmatite and contaminated granite:

2	67APa 83A	18.5	Batt.	66°55'	150°22'	
11	60ABe 439	<.1	Chan.	67°01'	148°19'	hornblende granite
12	60ABe 437X	<.1	Chan.	67°00	148°20'	biotite-epidote quartz-monzonite
16	60ABe 451	63.8	Chan.	67°03'	147°59'	greenstone; lit-par-lit.
16	60ABe 451X	.88	Chan.	67°03'	147°59'	biotite granite

Jurassic mafic intrusive and extrusive rocks:

32	63ABe 203	10.3	Chrs.	67°18'	145°47'	basalt; magnetite 2%±
33	63ABe 223	8.39	Chrs.	67°12'	145°52'	rhyolite (Jur?)
34	63ABe 224	34.9	Chrs.	67°11'	145°52'	andesite
35	63ABe 204	13.6	Chrs.	67°27'	145°40'	basalt.
38	63ABe 209D	<.1	Chrs.	67°29'	145°26'	andesite? breccia
41	63ABe 215	58.0	Chrs.	67°28'	145°22'	h'blende gabbro; magnetite 5%±
42	63ARr 55	74.5	Chrs.	67°37'	144°48'	basalt.
43	63ARr 56	68.5	Chrs.	67°39'	144°44'	amygdaloidal basalt.
44	63ARr 59	45.7	Chrs	67°46'	144°13'	qtz-gabbro; magnetite 5%±
45	63ABe 102	<.1	Col.	67°55'	143°53'	quartz diorite.
46	67ABe 78A	.89	Col.	67°51'	143°05'	gabbro.
47	67ABe 117	.88	Col.	67°46'	143°02'	h'blende gabbro.
48	67ABe 61C	34.6	Col.	67°36'	143°38'	basalt; magnetite 5%±.
49	63ARr 13	5.97	Col.	67°24'	143°40'	gabbro.
50	63ARr 16	.88	Col.	67°21'	143°41'	gabbro.
51	63ABe 56	<.1	Chrs.	67°17'	144°05'	diabase.

Jurassic leucogabbro and ultramafic rocks:

36	63ARr 151.1	>77.	Chrs.	67°26'	145°31'	diabase inclusion; magnetite 5%±.
37	63ARr 156.1	76.6	Chrs.	67°26'	145°32'	gabbro; magnetite 5%±
39	63ABe 212	<.1	Chrs.	67°30'	145°17'	anorthosite.
40	63ABe 210C	52.0	Chrs.	67°29'	145°19'	peridotite

Jurassic(?) mafic intrusive and extrusive rocks:

10	60ABe 440	19.1	Chan.	67°03'	148°19'	andesite.
13	60ABe 438	12.7	Bver.	66°56'	148°18'	basalt.
14	60ABe 487	1.70	Chan.	67°16'	147°54'	andesite.
15	60ABe 488	<.1	Chan.	67°14'	147°52'	andesite.
19	60ABe 449	2.57	Bver.	66°58'	148°02'	basalt.
56	67ABe 400	17.0	Col.	67°17'	142°30'	greenstone.
60	67ABe 446	.89	Col.	67°16'	141°50'	vesicular basalt.
61	64ABe 60C	18.4	Col.	67°10'	141°59'	andesitic basalt.
62	64ABe 63	9.24	Col.	67°10'	141°58'	basalt.
65	64ABe 17	20.5	Yu.Ter.	67°25.5'	140°52'	greenstone.

R

Rampart Group (Permian?) and associated (Triassic?) mafic intrusive rocks:

77	70ACh 70	1.68	Live.	65°59'45"	149°48'	diorite.
78	70ACh 61	15.2	Live.	65°52'	149°48'	diabase.
79	65ABe 97C	.88	Tan.	65°40.7'	150°00.5'	vitric andesitic basalt tuff.
80	65ABe 101A	.89	Tan.	65°40.3'	150°06.4'	gabbro.
81	65ABe 105B	13.5	Tan.	65°39.7'	150°07.7'	tholeiitic diabase.
82	65ABe 106C2	>77.	Tan.	65°39.1'	150°08.8'	tholeiitic diabase.
87	70ACh 192	53.2	Live.	65°49'	149°31'	diabase
89	69ACh 134	32.3	Live.	65°46'	149°13'	gabbro.
90	69ACh 143	.88	Live.	65°46'	148°26'	basalt.
91	69ACh 201	1.68	Live	65°51'	148°08'	diabase.
92	68ACh 247	2.57	Live	65°48'	148°13'	diorite-gabbro.

Circle volcanic rocks (Paleozoic?), and associated mafic intrusive rocks:

97	68ACn 1161	30.7	Circle	65°47'	145°06.0'	gabbro.
98	60ABa 1175	1.64	Ch. R.	65°45.2'	144°00.3'	gabbro.
99	68ACn 1532A	<.1	Circle	65°46.5'	144°03.0'	h'blnde biotite granodiorite.
100	68ACn 1502	.87	Circle	65°45.0'	144°03.2'	mafic intrusive.
101	68ACn 1482	1.67	Circle	65°38.1'	144°00.5'	mafic intrusive.
102	60ABa 1161	.85	Ch. R.	65°34.7'	143°55.0'	gabbro.
102	68ACn 1451	.88	Ch. R.	65°34.3'	143°53.7'	gabbro.

Paleozoic granitic rocks and associated rhyolite dikes:

54	67ABe 55.1	<.1	Col.	67°32'	142°19'	rhyolite.
55	67ABe 56B	1.2	Col.	67°31'	142°18'	rhyolite.
57	67ARr 363	<.1	Col.	67°38.5'	141°38'	quartz monzonite.
58	67ABe 201A	<.1	Col.	67°36'	141°32'	granite.
63	67ABe 207	<.1	Col.	67°38'	141°19'	quartz monzonite.
64	67ABe 236A	<.1	Col.	67°31'	141°15'	granite.

Woodchopper volcanic rocks (Devonian):

103	61ABa 1812	1.28	Ch. R.	65°25.7'	143°37.9'	amygdaloidal basalt.
104	61ABa 1793	.86	Ch. R.	65°25.2'	143°32.6'	basalt
105	61ABa 1781	<.1	Ch. R.	65°24.3'	143°29.4'	basalt
106	61ABa 1761	1.66	Ch. R.	65°22.4'	143°35.4'	basalt.
107	68ACh 1322	.88	Ch. R.	65°23.5'	143°19.5'	columnar basalt.
108	61ABa 1741	.86	Ch. R.	65°22.1'	143°14.2'	amygdaloidal basalt.
109	61AMc 622	1.17	Ch. R	65°20.5'	143°10.3'	basalt.
110	61ABa 1734	.90	Ch. R.	65°20.9'	143°14.0'	basaltic tuff.
111	60ABa 1061	1.63	Ch. R.	65°21.2'	143°09.4'	amygdaloidal basalt.
111	61AMc 641	.85	Ch. R.	65°21.3'	143°10.1'	basalt.

Silurian or Ordovician volcanic rocks:

93	68ACh 300	1.69	Live.	65°56'	147°04'	amygdaloidal basalt.
94	68ACh 279	39.7	Live	65°53'	147°21'	basalt.

Paleozoic(?) serpentinite:

95	69ACh 188	1.70	Live	65° 42'	147° 29'	serpentinite.

Greenstone and greenschist:

20	67ARr 172	37.8	Chan.	67°24'	147°10'	greenstone.
31	63ABe 186	<.1	Chrs.	67°17'	146°17'	andesitic? greenstone
52	67ABe 167	7.7	Col.	67°49'	141°50'	gabbro.
53	63ABe 42	9.4	Col.	67°45'	142°03'	diorite.

Mica schist:

17	60ABe 450	<.1	Chan.	67°02'	147°54'	quartzose schist.
18	60ABe 457	<.1	Chan.	67°02'	147°48'	quartzose schist.
21	67ARr 171A	.6	Chan.	67°24'	147°10'	
22	67ARr 170A	.6	Chan.	67°23'	147°10'	
23	67ARr 168B	.6	Chan.	67°23'	147°11'	
23	67ARr 168D	.6	Chan.	67°23'	147°11'	
29	63ABe 174	<.1	Chrs.	67°12'	146°44'	qtz-mica schist.
30	63ARr 117	<.1	Chrs.	67°08'	146°52'	andalusite? schist.

Hornfels:

73	70ACh 123	<.1	Tan.	65°51'10"	150°53'	metasediment.
83	69ACh 4	<.1	Live.	65°24'	149°31'	metasediment.
84	69ACh 14	1.69	Live.	65°23'	149°35'	metasediment.
86	69ACh 97	<.1	Live.	65°21'20"	149°36°	metasediment.