STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

Bill Sheffield — *Governor*

Esther Wunnicke — *Commissioner*

Ross G. Schaff — *State Geologist*

May 1983

This report is a preliminary publication of DGGS. The author is solely responsible for its content and will appreciate candid comments on the accuracy of the data as well as suggestions to improve the report.

Report of Investigations 83-13
PRELIMINARY GEOLOGY OF THE
NORTHEASTERN IDITAROD C-3 QUADRANGLE,
ALASKA

By
T.K. Bundtzen and G.M. Laird

STATE OF ALASKA
Department of Natural Resources
DIVISION OF GEOLOGICAL & GEOPHYSICAL SURVEYS

According to Alaska Statute 41, the Alaska Division of Geological and Geophysical Surveys is charged with conducting 'geological and geophysical surveys to determine the potential of Alaska lands for production of metals, minerals, fuels, and geothermal resources; the locations and supplies of ground waters and construction materials; the potential geologic hazards to buildings, roads, bridges, and other installations and structures; and shall conduct other surveys and investigations as will advance knowledge of the geology of Alaska.'

In addition, the Division shall collect, evaluate, and publish data on the underground, surface, and coastal waters of the state. It shall also file data from water-well-drilling logs.

DGGS performs numerous functions, all under the direction of the State Geologist---resource investigations (including mineral, petroleum, and water resources), geologic-hazard and geochemical investigations, and information services.

Administrative functions are performed under the direction of the State Geologist, who maintains his office in Anchorage (3001 Porcupine Dr., 99501, ph 274-9681).

This report is for sale by DGGS for $2. It may be inspected at any of the four DGGS information offices: Alaska National Bank of the North Bldg., Geist Rd. and University Ave., Fairbanks; 3601 C St. (10th Floor), Anchorage; 230 So. Franklin St. (4th Floor), Juneau; and the State Office Bldg., Ketchikan. Mail orders should be addressed to DGGS, P.O. Box 80007, College, AK 99708.

CONTENTS

TABLES

PLATE

PRELIMINARY GEOLOGY OF THE NORTHEASTERN IDITAROD C-3 QUADRANGLE, ALASKA

By
T.K. Bundtzen and G.M. Laird

INTRODUCTION AND ACKNOWLEDGMENTS

The northeastern Iditarod C-3 Quadrangle lies on the eastern edge of the Kuskokwim Mountains, a maturely dissected upland of accordant, rounded ridges and broad, sediment-filled lowlands. Elevations range from 1,000 ft near the Moore Creek gold mine to 3,009 ft on VABM Willow.

This report constitutes a preliminary release of data collected during August 1982. Approximately 85 mi^2 of mapping was conducted 'on foot' from spike camps in the Moose and St. Patrick Creek drainages. Work on the petrology of igneous rocks, geochemical-sample coverage, and Quaternary deposits continues.

We thank Don Harris of McGrath for discussions of the Moore Creek gold placers, the Broken Shovel silver-gold deposit, and the general mining history of the map area. M.K. Polly, M.R. Ashwell, T.A. Benjamin, and N.C. Veach, Division of Geological and Geophysical Surveys (DGGS) Minerals Laboratory, provided timely geochemical and major-oxide analyses of rock samples from the study area. We appreciate the thoughtful review of D.N. Solie (DGGS).

SUMMARY OF GEOLOGY

The oldest bedrock units in the map area consist of poorly exposed sandstone, shale, and siltstone of the Kuskokwim Group (Cady and others, 1955), which ranges in age from late Early to Late Cretaceous. The relatively clean quartzose sandstone, abundant plant-fossil remains, and absence of turbidity-current indicators suggest that both the sandstone (Kss) and the undifferentiated sedimentary rock units (Kus) represent shallow marine or nonmarine deposits correlative with units near the top of the Cretaceous sedimentary section described in the Iditarod D-1 Quadrangle to the north (Bundtzen and Laird, 1983a).

Overlying the Cretaceous clastic rocks are subaerial volcanic rocks that range from 1,000 to 1,500 ft thick. The volcanic pile is part of a 200-mi^2 volcanic field that is best exposed in the Beaver Mountains to the north (Bundtzen and Laird, 1982). Five mappable units range in composition from rhyolite to basalt, but porphyritic to nonporphyritic varieties of pyroxene andesite predominate. More complete lithologic descriptions are shown on plate 1. The basal altered andesite-dacite unit (Kvt) contains interbedded sublithic sandstone and shale identical to lithologies in the underlying lithic to sublithic sandstone (Kss), which suggests conformity between the Kuskokwim Group and overlying volcanic rocks. The Kvt unit is successively overlain by intermediate volcanic rocks (Kvi), porphyritic andesite (Kvpi), volcanic agglomerate (Kva), and mafic volcanics, mainly olivine-augite basalt (Kvm).

Three small (1-2 mi^2) monzonite plutons intrude the volcanic rocks near Maybe, Willow, and Moore Creeks. Hornfelsed aureoles extend approximately 1/4 mi from the contact zones between the plutons and enclosing host rocks. All three plutons are conspicuously aligned in a 7-mi-long, north-trending zone that extends from the Nixon-Iditarod fault zone at Moore Creek to the Maybe Creek lineament (pl. 1), which suggests emplacement control along a cross-fracture system.

Major-oxide analyses and CIPW norms for igneous rocks in the map area (table 1) are similar to previously published data to the north (Moll and others, 1981; Bundtzen and Laird, 1982, 1983a, 1983b). Andesite, rhyolite, and quartz-monzonite show broad calc-alkaline trends, and the monzonitic stocks and plutons are subalkaline and undersaturated. Basalt and basaltic andesite have a higher than average alkali content and usually contain both normative and modal olivine and occasionally normative nepheline. Corundum-normative rhyolite to alaskite domes or sills intrude the Nixon-Iditarod fault zone both in and north of the map area. Petrologic work on the igneous suite continues.

Potassium-argon mica and whole-rock ages that range from 60-70 m.y. have been obtained from coeval volcanic and plutonic units in the Medfra and Innoko-Takotna areas, respectively (Moll and others, 1981; Bundtzen and Laird, 1982, 1983a).

Quaternary deposits are subdivided on the basis of photogeology and ground reconnaissance. Most of the study area was not glaciated during Pleistocene time; however, the 2,700- to 3,000-ft-high upland at the head-waters of Maybe and Moose Creeks was probably occupied by at least two small cirque glaciers. Modified cirque morphology suggests correlation with the early Wisconsinan Bifurcation Creek glaciation in the nearby Beaver Mountains (Bundtzen, 1981).

Tertiary-Quaternary uplift along the Nixon Iditarod fault accelerated erosion of old pediment surfaces and terrace alluvium. On Fourth of July and Willow Creeks, extensive aprons of alluvium and colluvium were deposited where the streams emerge from upland source areas. Evolution of a fan-terrace complex (Qft) along the trace of the Nixon-Iditarod fault may have important significance for concentration of heavy-mineral placers near Moore Creek. Widespread deposits of organic silt are accumulating over lowland areas, and thermokarst processes are modifying these and various undifferentiated Quaternary deposits in the study area.

STRUCTURAL GEOLOGY

The extensive Quaternary cover in the map area prevents detailed analysis of structural features. Volcanic and sedimentary units have been folded into broad, open, northeast-trending synclines and anticlines with amplitudes of 1 to 3 mi; plunge directions of these fold structures are unknown. Columnar jointing in some outcrops of andesite and basalt indicates that volcanic flows were deposited in a subaerial environment that post-dated marine deposition of Kuskokwim Group sedimentary rock units. The Nixon-Iditarod fault, a major strike-slip feature in western Alaska, juxtaposes the volcanic rocks against

Table 1. Major-oxide analyses and CIPW norms of igneous rocks, northeastern Iditarod C-3 Quadrangle, Alaska.

Map number	1	2	3	4	5	6	7	8	9	10	11	12	13
Field number	82CL105	82CL107	82BT397	82BT396	82CL121	82BT409	82BT415	82BT410	Camp 2	82CL136	82BT428	82BT439	82BT437
Rock type	Augite basalt	Andesite	Quartz monzonite	Olivine basalt	Rhyolite	Altered dacite(?)	Altered andesite	Andesite	Andesite	Olivine basalt	Silicified monzonite	Andesite	Monzonite
SiO_2	54.44	59.66	63.53	53.77	72.14	50.67	51.07	57.07	56.27	51.49	80.63	57.01	57.13
Al_2O_3	10.83	14.11	14.47	11.63	14.71	10.69	11.29	13.59	14.40	10.57	8.39	18.03	15.16
Fe_2O_3	2.90	1.47	1.27	1.09	0.41	2.76	2.23	3.25	4.38	1.80	1.83	3.94	1.60
FeO	5.68	5.25	3.84	7.54	0.78	3.71	4.16	3.64	2.39	7.32	2.18	1.97	3.99
MnO	0.16	0.14	0.11	0.16	0.01	0.31	0.11	0.33	0.06	0.17	0.03	0.09	0.14
MgO	11.06	6.16	4.00	12.68	0.25	6.49	6.95	8.17	6.53	13.10	1.45	0.80	3.37
CaO	7.66	4.92	3.61	6.66	0.72	5.71	4.21	6.41	6.76	8.93	0.43	5.02	5.29
Na_2O	1.69	2.63	2.65	2.02	3.59	0.23	0.34	2.25	2.50	1.63	0.96	3.57	2.39
K_2O	3.07	3.74	3.72	2.73	4.35	4.67	3.57	3.28	3.12	2.95	1.37	3.91	3.64
TiO_2	0.64	0.77	0.70	0.73	0.12	0.64	0.76	0.66	0.76	0.69	0.78	1.27	0.71
P_2O_5	0.35	0.28	0.21	0.28	0.04	0.28	0.27	0.28	0.27	0.34	0.11	0.54	0.31
H_2O	0.44	0.44	0.21	0.19	0.10	0.21	0.26	0.53	0.91	0.23	0.19	0.37	0.17
LOI	1.46	1.10	0.67	1.54	1.53	14.94	15.31	2.00	2.18	0.60	2.51	2.43	5.80
Total	100.38	100.67	98.94	101.02	98.75	101.31	101.52	101.26	100.53	99.77	100.86	98.95	99.70
Quartz	2.56	9.24	18.49	0.00	32.40	11.27	15.18	7.61	9.12	0.00	66.46	10.85	12.43
Orthoclase	18.14	22.10	21.98	16.13	25.70	27.59	21.09	19.38	18.44	17.43	8.09	23.10	21.50
Albite	14.29	22.25	22.42	17.09	30.38	1.95	2.88	19.03	21.15	13.79	8.12	30.20	20.22
Anorthite	12.89	15.64	16.46	14.60	3.31	14.34	18.71	17.29	18.86	12.68	1.42	21.37	19.88
Nepheline	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Diopside	18.19	5.60	0.06	13.35	0.00	9.66	0.33	10.02	10.05	23.57	4.87	0.00	3.52
Hypersthene	26.15	20.04	14.98	27.53	1.54	15.29	21.07	18.77	11.60	12.18	0.00	1.92	11.76
Olivine	0.00	0.00	0.00	6.96	0.00	0.00	0.00	0.00	0.00	14.37	0.00	0.00	0.00
Magnetite	4.20	2.13	1.84	1.58	0.59	4.00	4.68	4.71	5.67	2.61	2.65	2.96	2.32
Ilmenite	1.21	1.46	1.33	1.39	0.23	1.21	1.44	1.25	1.44	1.31	1.48	2.41	1.34
Corundum	0.00	0.00	0.00	0.00	2.88	0.00	0.00	0.00	0.00	0.00	4.80	0.09	0.00
Differentiation index	35.01	53.59	62.89	33.22	88.47	40.81	39.01	46.03	48.71	31.22	82.67	64.16	54.16

LOI - Loss on ignition

Kuskokwim Group clastic units. Relative amounts of lateral or vertical offset along the fault are unknown, but airphoto analysis indicates that a prominant escarpment cuts Quaternary fan-terrace and undifferentiated deposits from Moore to Fourth of July Creek, which strongly suggests Holocene activity.

MINERAL RESOURCES

The only known mineral deposit of economic significance in the map area is the placer-gold deposit at Moore Creek, which has yielded over 50,000 troy oz of gold since 1910. The Moore Creek placers occur in fan-terrace, alluvial terrace, and modern stream alluvium. The bedrock source of the Moore Creek placers is a deeply dissected monzonitic plug that crops out on a hillside 1 to 1½ mi north-northwest of Moore Creek camp (pl. 1). The monzonite plug hosts crosscutting sulfide-quartz vein mineralization, including the Broken Shovel silver-gold deposit (pl. 1). Gullies draining the monzonite were mined for placer gold during earlier years.

Placer gold has also been found and developed on Fourth of July Creek, and recent exploration-development activity continues. The Fourth of July deposits appear to be in Holocene alluvium. The source of gold on Fourth of July Creek appears to be the southern rim of the Maybe Creek pluton. Heavy-mineral concentrates in both Moore and Fourth of July Creeks consist of chromite, cinnabar, scheelite, and placer gold.

Monzonitic stocks and associated volcanic-hypabyssal rocks that are exposed from Flat to the Cripple Mountains are important sources of placer gold, which suggests that streams draining the three mapped plutons (unit Km) in the study area [including Maybe (hence the name), Moose, and Willow Creeks] deserve at least cursory examination for heavy-mineral placer potential. We plan to conduct further research on placer deposits.

Analytical results of a reconnaissance chip-sampling program are reported in table 2; samples are from ferricrete gossan zones in volcanic and plutonic map units in the study area. We emphasize that the geochemical sampling was neither uniform nor representative. Gossan zones of the altered andesite-dacite unit (Kvt) contain subtle mercury, silver, and lead anomalies. The pervasive alteration in this unit may be wholly stratigraphic in origin or may be related to the plutons on Maybe and Willow Creeks.

REFERENCES CITED

Bundtzen, T.K., 1981, Multiple glaciation in the Beaver Mountains, western interior Alaska, in Short notes on Alaskan geology 1979-80: Alaska Division of Geological and Geophysical Surveys Geologic Report 63, p. 11-16.

Bundtzen, T.K., and Laird, G.M., 1982, Geologic map of the Iditarod D-2 and eastern D-3 Quadrangles, Alaska: Alaska Division of Geological and Geophysical Surveys Geologic Report 72, 1 pl.

__________, 1983a, Geologic map of the Iditarod D-1 Quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 78, 1 pl.

__________, 1983b, Geologic map of the McGrath D-6 Quadrangle, Alaska: Alaska Division of Geological and Geophysical Surveys Professional Report 79, 1 pl.

Table 2. Analytical results of selected rock-chip samples, northeastern Iditarod C-3 Quadrangle, Alaska (anomalous concentrations underlined).[1]

Map no.	Field no.	Cu	Pb	Zn	Ag	Au	Mo	Sb	Sn	W	Hg	As	Co	Ni	Cr	Remarks
		ppm									ppb	ppm				
1	82GL1106	24	ND	38	ND	ND	2	ND	ND	2	15	ND	23	163	260	Ferricrete-stained fractures in mafic agglomerate.
2	82BT385	51	5	60	0.2	ND	2	ND	ND	3	3700	ND	25	105	378	Ferricrete gossan in altered dacite and andesite; abundant blue chalcedony.
3	82BT404	52	76	17	5.1	ND	2	13	ND	10	5000	33	18	68	438	Same as above.
4	82BT405	36	9	33	0.2	ND	1	ND	ND	2	260	ND	28	120	380	Same as above.
5	82GL115	29	ND	10	0.2	ND	2	8	ND	2	1300	32	13	114	340	Hornfels-tourmaline breccia zone adjacent to monzonite stock.
6	82GL119	31	17	64	0.5	ND	2	ND	ND	2	580	12	23	70	398	Ferricrete gossan in altered andesite.
7	82GL118	19	3	19	0.2	ND	1	ND	ND	3	100	ND	16	48	271	Ferricrete gossan with blue chalcedony.
8	82GL117	25	2	43	0.1	ND	1	ND	ND	2	700	ND	37	201	328	Same as above.
9	82GL113	42	2	60	0.3	ND	2	ND	ND	2	50	ND	16	48	234	Hornfels zone in Cretaceous sandstone.
10	82GL112	27	4	35	0.2	ND	2	ND	8	3	170	102	16	65	398	Fracture filling in monzonite near contact zone.
11	82BT396	43	7	45	ND	ND	2	ND	ND	2	40	ND	28	99	340	Epidotized fracture filling in basalt.
12	82BT398	44	9	29	0.5	ND	2	ND	ND	3	1300	ND	25	65	265	Ferricrete gossan in monzonite-hornfels contact zone.
13	82GL121	6	6	77	0.1	ND	1	ND	6	2	190	ND	ND	ND	127	Ferricrete zone in alaskite.
14	82GL123	10	15	60	0.8	ND	1	ND	ND	3	210	ND	ND	ND	124	Same as above.
15	82GL130	19	12	64	0.3	ND	1	ND	ND	3	40	ND	24	111	474	Iron-stained fracture filling in augite basalt.

[1]Analyses by M.K. Polly, M.R. Ashwell, and T.A. Benjamin, DGGS Laboratory, and by Bondar-Clegg Ltd., Vancouver, Canada. Cu, Pb, Zn, Ag, Au, Mo, Sb, Co, Ni, and Cr analyses by inductively coupled plasma spectrophotometry. As by atomic-absorption spectrophotometry; Hg, Sn, and W by X-ray fluorescence.

Cady, W.M., Wallace, R.E., and Webber, E.J., 1955, The central Kuskokwim region: U.S. Geological Survey Professional Paper 268, 131 p.

Moll, E.J., Silberman, M.S., and Patton, W.W., Jr., 1981, Chemistry, mineralogy, and potassium-argon ages of igneous and metamorphic rocks of Medfra Quadrangle: U.S. Geological Survey Open-file Report 80-811C, 19 p.