STATE OF ALASKA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF GEOLOGICAL AND GEOPHYSICAL SURVEYS

This report is preliminary and has not been edited or reviewed for conformity with Alaska Geological and Geophysical Surveys standards.

Resource Evaluation Section

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Alaska Open File Report 34

EVALUATION OF D2 LAND AREA NABESNA QUADRANGLE, ALASKA USING AEROMAGNETIC AND GEOCHEMICAL DATA

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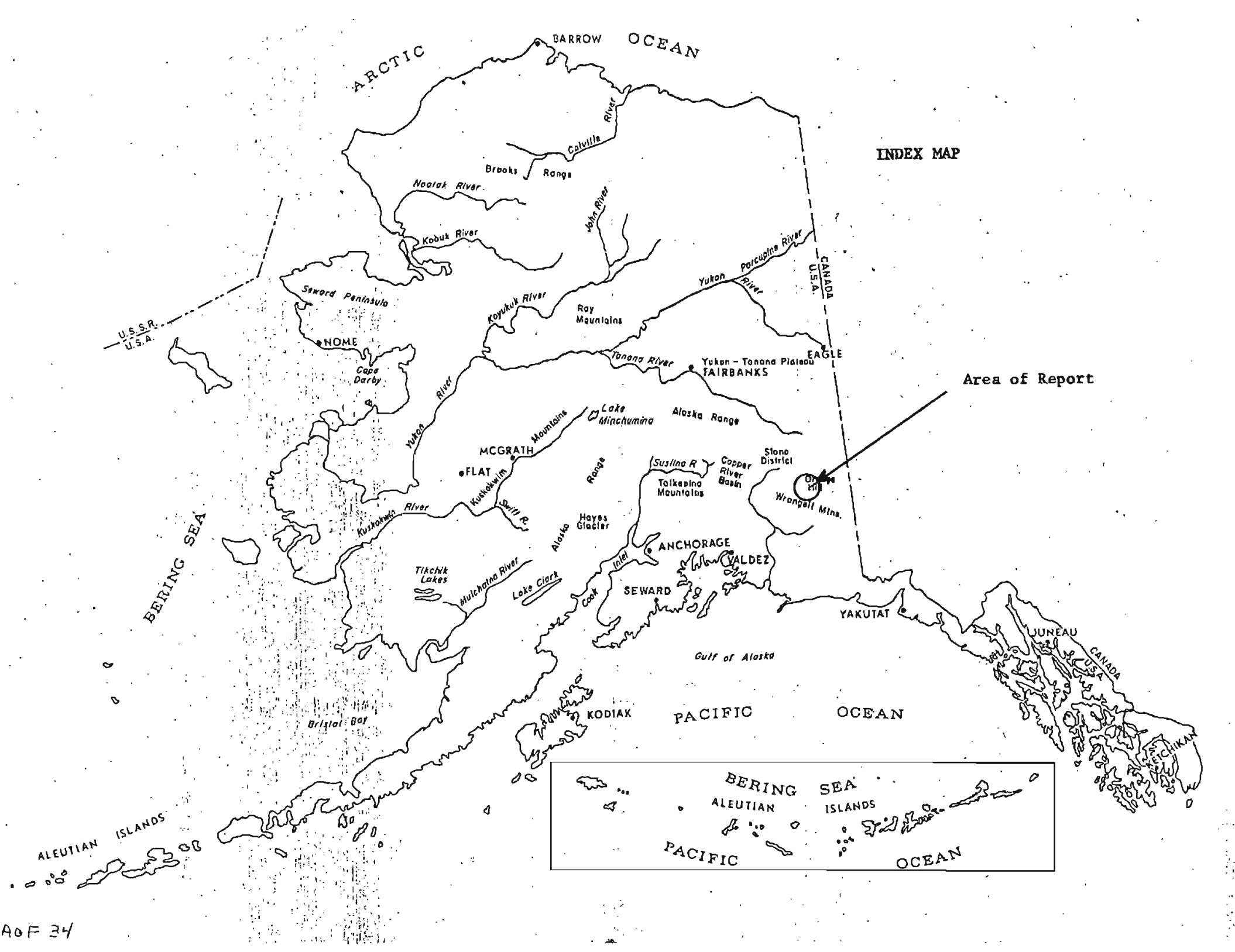
INDEX MAP
Area of Report
ARCTIC OCEAN
BARROW
Colville River
Brooks Range
Noatak River
Kobuk River
John River
Seward Peninsula
U.S.S.R.
U.S.A.
NOME
Cape Darby
Koyukuk River
Ray Mountains
Yukon River
Porcupine River
CANADA
U.S.A.
EAGLE
Tanana River
Yukon - Tanana Plateau
FAIRBANKS
Yukon River
Lake Minchumina
Alaska Range
MCGRATH
McGrath Mountains
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Wrangell Mtns.
BERING SEA
Tikchik Lakes
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Inlet
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ALEUTIAN ISLANDS
PACIFIC OCEAN

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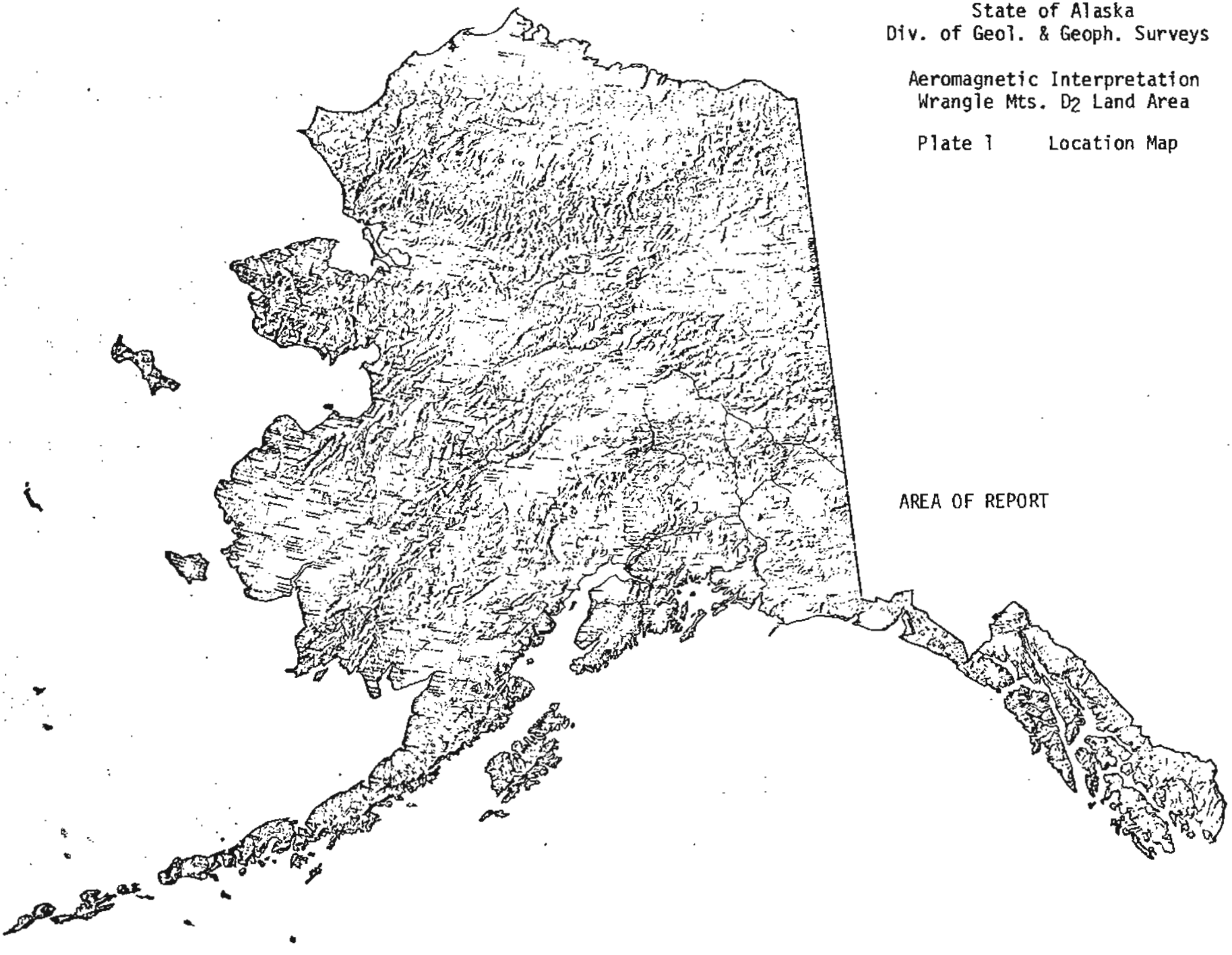
Aeromagnetic Interpretation
Wrangle Mts. D_2 Land Area

Plate 1 Location Map



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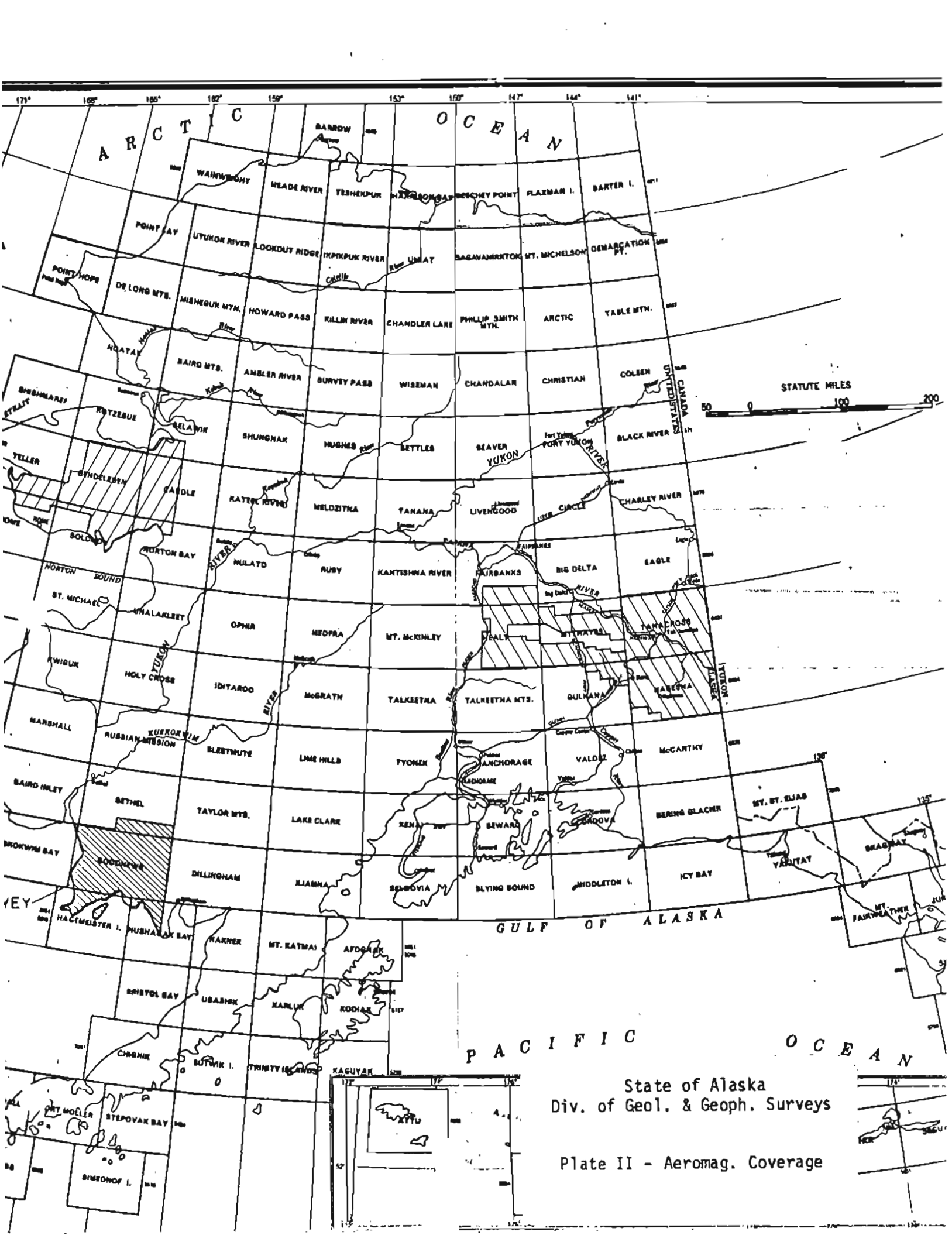
ARCTIC OCEAN
BARROW
WAINWRIGHT
MEADE RIVER
TEshekpuk
HUMPHREY POINT
FLAXMAN I.
BARTER I.
POINT LAY
UTUKOK RIVER
LOOKOUT RIDGE
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BAIRD MTS.
AMBLER RIVER
SURVEY PASS
WISEMAN
CHANDALAR
CHRISTIAN
COLEEN
CANADA
UNITED STATES
STATUTE MILES
50 0 100 200
SHISHMAREF
KOTZEBUE
SELAWIK
SHUNGNAK
HUGHES
SETTLES
BEAVER
FORT YUKON
YUKON RIVER
BLACK RIVER
YELLER
GUNDELEEN
CASCLE
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ARCTIC CIRCLE
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SOLOMON
NORTON BAY
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RUBY
KANTISHNA RIVER
FAIRBANKS
BIG DELTA
EAGLE
ST. MICHAEL
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MEDFRA
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CANYON
MT. HAYES
TANACROSS
YUKON
KWIGUK
HOLY CROSS
IDITAROD
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GULKANA
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MT. KATMAI
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BRISTOL BAY
USASHIK
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CHIGNIK
SUTWIK I.
TRINITY ISLANDS
KAGUYAK
PACIFIC OCEAN
MT. MOELLER
STEPOVAK BAY
SIMEONOF I.
ATTU
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Plate II - Aeromag. Coverage

INTRODUCTION AND SUMMARY

An interpretation of the Alaska Division of Geological and Geophysical Surveys' aeromagnetic data has been undertaken to assist in the natural resource evaluation of lands withdrawn for possible addition to or creation as units of the National Park, Forest, Wildlife Refuge and Wild and Scenic Rivers System (D-2). Aeromagnetic coverage does not extend south of 62° latitude in the study area, therefore the report is limited to the D-2 lands in the southwest corner of the Nabesna quadrangle. Surface geology and aeromagnetic interpretation indicates that the Nabesna granite or granitic type intrusives appear to have a very high susceptibility contrast with the predominant volcanic terrain of the area. These granites are associated with known mineral deposits and are considered worthy of additional study. A map is submitted showing a zone of D-2 land that may have prospective mineral deposits on the basis of aeromagnetics. Available geochemical data also indicates a high density of anomalies in this zone. It is recommended that this zone not be considered for inclusion in one of the 4 systems because of possible mineral potential.

REGIONAL GEOLOGY

The rocks of this region are both sedimentary and igneous in origin, and range in age from Permian to Quaternary. The Permian rocks consist of andesitic lavas and calcareous tuffs, but include a large amount of limestone and subordinate shale. The Triassic rocks consisting of massive limestones and shales (Nabesna limestone) and the Permo-Triassic Nikolai Greenstone (volcanics) were deposited unconformably on the older Permian rocks. Large emplacements of granitic and dioritic rock (Nabesna and Klein Creek Batholiths) were intruded during the mountain-building disturbances

of the late Mesozoic and continued into the Tertiary. The rocks deposited during Jurassic and Early Cretaceous time consist largely of thin-bedded shales and argillite with some arkosic sandstones. During Tertiary time renewed uplift of the Wrangell Mountains brought about the outpouring and deposition of the Wrangell lavas which are andesitic in composition. Structurally the region is bounded on the east by the Totschunda and Cross Creek faults which are right-lateral splays of the Denali Fault. All of the bedded rocks, from the oldest metamorphic to the youngest Tertiary, show folding to some degree. West of the Nabesna Glacier the structure is relatively unknown, although the Wrangell lavas probably were deposited unconformably over the older Permian rocks. There are many smaller faults between the Cross Creek Fault and the Nabesna Glacier. The origin of these smaller faults is unclear, but they may be related to the larger systems to the east and possibly to the emplacement of the granitic intrusions of the area.

KNOWN MINERAL RESOURCES

The mineralized area with the best commercial possibilities within this region is Orange Hill. Orange Hill is a rounded isolated knob on the east side of the Nabesna River near the terminus of the Nabesna Glacier. Geologically Orange Hill is part of a mass of quartz diorite of probable Jurassic age intruded into the group of Permian bedded rocks that includes basic lava flows, graywacke and a thick deposit of limestone. The predominant sulfide minerals include bornite, chalcopyrite, molybdenite, and sphalerite. The ore reserves of Orange Hill are considered to be of a large magnitude (several hundred million tons of ore that ranges from .3 to .5 percent copper).

To the northeast of Orange Hill a large mineralized area along the margin of the Nabesna batholith was discovered in the early 1960's and is

now held by a number of unpatented mining claims. This area is now known as the Bond Creek porphyry copper-molybdenum deposit. The deposit consists of disseminated iron and copper sulfides with minor molybdenite in granodiorite, and includes some contact sulfide deposits.

GEOCHEMICAL INVESTIGATIONS

Geochemical investigations of the Nabesna A-2, A-3, and A-4 quadrangles were conducted by D. H. Richter and N. A. Matson Jr. during 1969-70 field season, and released as U.S.G.S. Open File Reports no. 365, 397, and 398. For the purpose of this report, the elements are considered anomalous if they are present in concentrations greater than 3 times the mean background. The mean background in the quadrangle closely approximates the average crustal abundance, i.e., copper, 55 ppm; lead, 12.5 ppm; zinc, 70 ppm; and molybdenum, 1.5 ppm. Only the anomalous geochemical locations have been plotted on Plate IV so that aeromagnetic and geochemical anomalies may be compared. Three concentrations of anomalies are apparent: (a) There is a strongly anomalous area about 3 miles south of Orange Hill that consists of a number of hydrothermally altered porphyry dikes, and small masses of quartz diorite with disseminated chalcopyrite and pyrite occur in this area. The copper values in this area are between 200 and 700 ppm; (b) The upper portion of the Bond Creek drainage shows anomalous values for copper ranging from 300 ppm to 1000 ppm; and (c) Near the headwaters of Nikonda Creek there are six anomalous samples with values of 150 to 200 ppm copper, with one sample showing a zinc value of 200 ppm.

MAGNETIC INTERPRETATION

Aeromagnetic coverage is shown on Plate II. The State of Alaska survey completed in 1971 did not extend south of 62° latitude and therefore the interpretation has been limited to a small D-2 land area of the Nabesna quadrangle. Geological maps by Richter were available in the Nabesna A-2, A-3, A-4, and B-4 quadrangles. Geochemical data were not available west of 143° longitude.

Examination of the aeromagnetic data versus surface geology maps indicates that 4 rock formations comprise the key magnetic horizons in the southwest Nabesna quadrangle. These rock types are shown on Plate III. High susceptibility, positive-anomaly formations, are the Wrangell lava and the Nikolai Greenstone occurring west of the Cross Creek Fault and plutonic rocks of pyroxene diorite occurring east of the fault. Negative-anomaly Cretaceous granites of the Nabesna Batholith occur west of the fault and are considered prospective for minerals.

A distinctive low-frequency negative area south of the Nabesna Batholith is interpreted to be underlain by granitic terrain. Three strong negative anomalies, two on or near the surface and one at a depth of approximately 5000 feet, are considered to be granitic type intrusives in this zone. Geochemical anomalies are concentrated around magnetic anomalies 1 and 2 which are near the surface. Anomalies 1 and 2 are topographic highs, and the depth estimate to anomaly 3 is approximately 5000 feet to the top of the magnetic anomaly.

East of the Cross Creek Fault, geochemical anomalies appear to be associated with the negative granitic anomalies and not the positive pyroxene diorite. Depth calculations are shown on three positive anomalies assumed to be similar to the strong pyroxene diorite anomaly outlined on the map.

PLATE III

NABESNA SOUTHWEST KEY FORMATIONS (AEROMAGNETIC)

Formation Name	Age	Generalized Rock Type	Geological Symbol	Magnetic Susceptability	Magnetic Symbol
Wrangle Lava	Quaternary	Basaltic Andesite	Qtw	High	V
Nikolai Greenstone	Perm-Triassic	Amygdaloidal Basalt	Trn	High	V
(Plutonic Rock UN)	Tertiary or K?	Pyroxene Diorite	Tkd	Very High	P
Nabesna Batholith	Cretaceous	Biotite-hornblende granodiorite	Kg	Negative or Very Low	G

Negative anomalies beneath glaciers are not reliable since they could result from the absence of surface volcanics caused by glacial scouring. Both the Nabesna and Chisana Glaciers have strong negative anomalies and the smaller mountain glaciers also appear to interfere with the magnetic patterns.

The area west of 143° longitude exhibits the typical high-frequency patterns of surface or near-surface volcanic terrain. Determinations of prospective anomalies in this area is not reliable without surface geological data and additional processing of the magnetics.

RECOMMENDATIONS

It is recommended that the area comprising anomalies 1 thru 3 be exempted from D-2 land status since they merit further study on the basis of possible economic mineral potential. The aeromagnetic data should be processed thru digital programs to determine regional trends and filtered to eliminate high-frequency surface volcanics.

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