UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

AIRBORNE RADIOACTIVITY AND TOTAL INTENSITY MAGNETIC SURVEY OF THE SOUTHERN KOBUK-SELAWIK LOWLAND, WESTERN ALASKA

By

Thomas P. Miller and Lennart A. Anderson

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This report is preliminary
and has not been edited or
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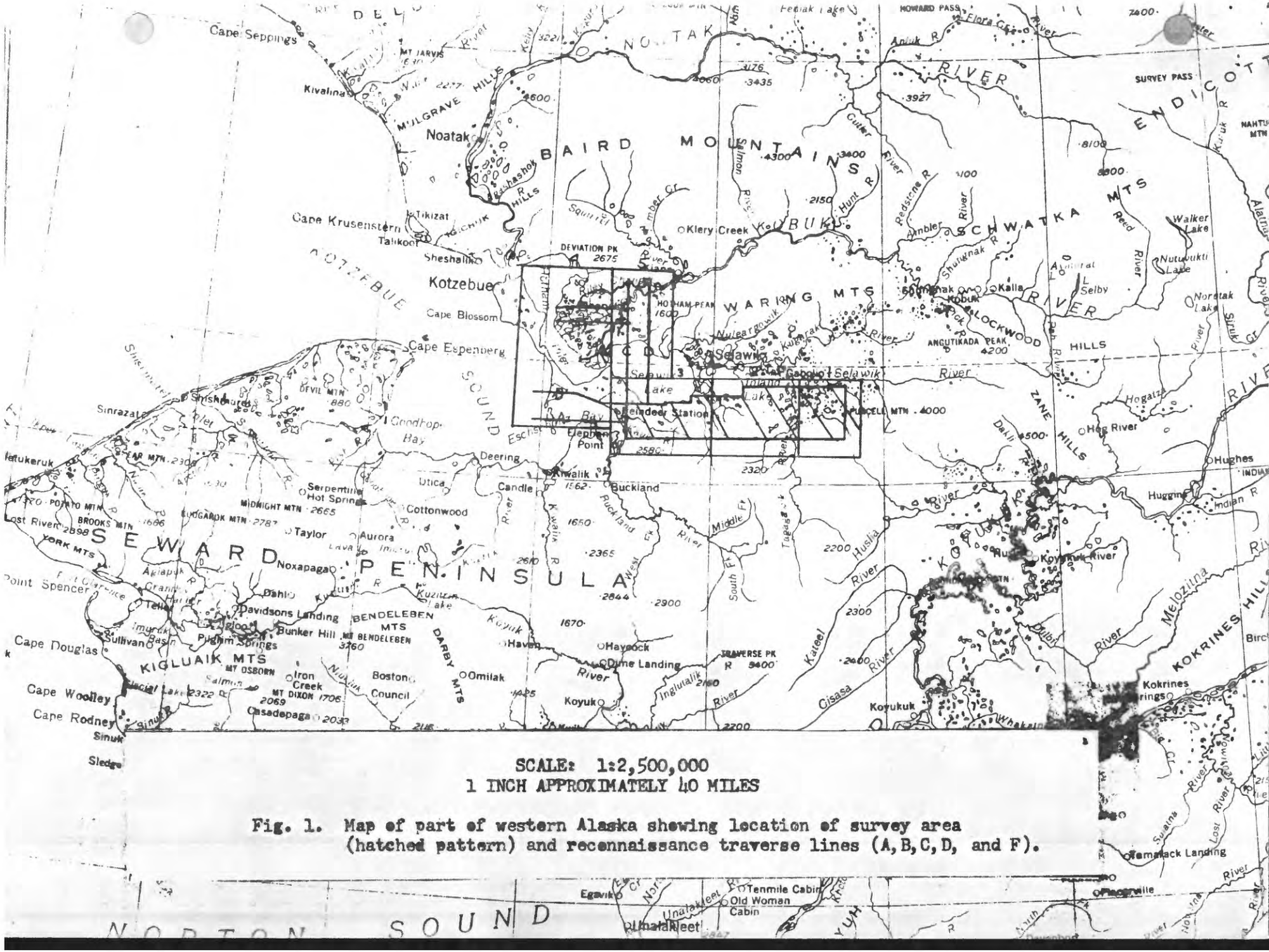
INTRODUCTION

An aeromagnetic and radioactivity survey was made in 1968 of a 1,320 square mile area in the southern Kobuk-Selawik Lowland of western Alaska (fig. 1). The area covered includes parts of the Selawik and Shungnak 1:250,000-scale quadrangles. The survey was flown and compiled by Lockwood, Kessler, and Bartlett, Inc., under contract to the U.S. Geological Survey.

The purpose of the survey was to obtain information on the size, shape, and distribution of several poorly exposed nepheline syenite intrusive complexes that occur in the southern Kobuk-Selawik Lowland. These rocks typically have a high radioactivity background and commonly include magnetite-rich rock types resulting in associated magnetic and radioactivity anomalies. These rare and unusual rocks are of economic interest elsewhere in the world because a wide variety of mineral deposits have been found associated with them. Anomalous amounts of molybdenum, uranium, and silver have been found in a nepheline syenite-bearing stock near Granite Mountain 60 miles to the south (Miller and Elliott, 1969).

GEOLOGIC SUMMARY

Bedrock in the southern Kobuk-Selawik Lowland is poorly exposed due to a covering mantle of unconsolidated Quaternary deposits. In general, however, the area is underlain by deformed Upper Jurassic(?)-Lower Cretaceous andesitic volcanic rocks and Lower Cretaceous sedimentary rocks intruded by mid-Cretaceous felsic plutonic rocks. The plutonic rocks include quartz monzonite, monzonite-syenite, and various types of the aforementioned nepheline syenite. The nepheline syenite crops out in four small intrusive rock complexes ranging in area from 5 to 12 square miles.



SCALE: 1:2,500,000
1 INCH APPROXIMATELY 40 MILES

Fig. 1. Map of part of western Alaska showing location of survey area (hatched pattern) and reconnaissance traverse lines (A, B, C, D, and F).

Recent geologic maps at 1:250,000-scale covering the survey area have been published by Patton and Miller (1968) and Patton, Miller, and Tailleur (1968).

AEROMAGNETIC AND RADIATION SURVEYS

The airborne survey consisted of 21 parallel east-west flight lines from 34 to 90 miles long and spaced 1 mile apart. The mean flight elevation was 400 feet above the terrain. Six additional aeromagnetic reconnaissance traverses, totalling 231 miles, were flown west and northwest of the Kobuk-Selawik Lowland survey area (fig. 1) at an elevation of 500 feet above ground level.

The radioactivity data were obtained with continuously recording scintillation detection equipment. Gross radioactivity was recorded in counts per second and corrected to the 400 foot datum, thereby compensating for vertical deviations from the prescribed flight elevation.

The contoured radioactivity data are shown on figure 2, sheets 1, 2, and 3 at a horizontal scale of 1:63,360 and a contour interval of 50 counts per second (cps). The indicated contour value must be increased by a factor of 10 to obtain the corrected radioactivity in cps. The bedrock geology of the survey area has been superimposed on the radioactivity data.

Prominent radioactivity highs are found over the nepheline syenite complexes and, to a lesser degree, over the other intrusive rocks exposures. Where intrusive rocks of different compositions are in contact with, or near each other, the nepheline syenite generally has a higher degree of radioactivity than the other rocks. Examples of this are in the north-central part of sheet 3 and near the southwest corner of sheet 1. Locally,

where radiation anomalies are not prominent over nepheline syenite outcrops, the gamma radiation may be masked by a thin covering of surficial deposits. A radiation anomaly 2 miles southeast of the exposed plutonic rocks in the center of sheet 3 occurs over an area in which no rock is exposed. The intensity of the anomaly suggests that plutonic rocks are present very close to the surface in this area.

Linear belts of high radioactivity along the southern margins of sheets 2 and 3 are over stream channels and are probably caused by concentrations of radioactive minerals in the gravels of streams draining the Selawik Hills to the south.

The magnetic data were recorded using a Gulf fluxgate magnetometer and contoured at a 20 gamma or 100 gamma interval depending upon the magnetic gradient. Magnetic values are total intensity relative to an estimated datum of 55,500 gammas and have not been corrected for the earth's magnetic field intensity which increases approximately 5.5 gammas per mile in a northeasterly direction.

The contoured magnetic data are shown on figure 3, sheets 1, 2, and 3. Sheet 3, along with sheets 4 and 5, also shows the location and magnetic profiles of the reconnaissance traverses extending west and north of the principal survey area. The bedrock geology of the survey area has been superimposed on the magnetic data.

The poor rock exposures together with effects of topography on the magnetics makes correlation between the magnetic anomalies and the geology difficult. In general, however, the andesitic volcanic rocks, thought to form much of the bedrock in the southern Kobuk-Selawik Lowland, would normally have a higher magnetic susceptibility than the intrusive rocks and would exert the greatest influence on the local magnetic field. In

those localities where intrusive rocks appear to be absent, such as in the west part of figure 3, sheet 3, the magnetic contours are relatively smooth and form definite linear trends reflecting the continuous nature of the volcanic rocks. Similar north-south trends can be noted on the central and eastern part of figure 3, sheet 3. Where intrusive rocks are present, the magnetic pattern appears to be characterized by a multitude of small positive and negative anomalies. This observation may be important in separating those areas containing the intrusive rocks which may be economically important from those areas underlain by the andesitic volcanic rocks only.

The most prominent magnetic feature within the surveyed area is the triangular-shaped contour pattern on the west and east edges of sheets 1 and 2, respectively. This large-scale cluster of magnetic anomalies surrounded by contours of equal magnetic intensity is possibly caused by a tabular feature such as a flat-lying volcanic flow in contrast to the deformed andesitic volcanic rocks. The configuration and intensity of the anomaly suggests that the flow emanated from the Selawik Hills to the south and fanned out across an area of low relief. The volcanic rock unit may be related to Quaternary-Tertiary basalt exposed in the Selawik Hills to the south (Patton and Miller, 1968). A relatively undeformed flat-lying mafic rock would be expected to possess the magnetic qualities observed over this particular feature.

SUMMARY

Correlations between the bedrock geology and the gross magnetic features are speculative but it is suggested that the elongated contours

indicate the presence of volcanic rocks while clusters of small granitic anomalies indicate underlying plutonic rocks.

The radiation maps show good correlation with the exposed nepheline syenite and other intrusive rocks.

REFERENCES CITED

Miller, T. P., and Elliott, R. L., 1969, Metalliferous deposits near Granite Mountain, eastern Seward Peninsula, Alaska: U.S. Geol. Survey Circ. 614, 19 p.

Patton, W. W., Jr., and Miller, T. P., 1968, Regional geologic map of the Selawik and southeastern Baird Mountain quadrangles, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-530, scale 1:250,000.

Patton, W. W., Jr., Miller, T. P., and Tailleur, I. L., 1968, Regional geologic map of the Shungnak and southern part of the Ambler River quadrangles, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-554, scale 1:250,000.