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UNITED STATES DEPARTMENT OF THE INTERIOR

GEOLOGICAL SURVEY

AEROMAGNETIC MAPS OF PART OF THE SOUTHERN ALASKA RANGE

By

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Open-file report

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E R R A T U M

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Page 3, line 9 - Delete "proton-precession type" and substitute "Gulf fluxgate."

INTRODUCTION

An aeromagnetic survey, flown by Lockwood, Kessler and Bartlett, Inc. under contract to the U.S. Geological Survey, was made in the southern Alaska Range in 1968 as part of the U.S. Geological Survey Heavy Metals program. The surveyed area lies between Two Lakes and the headwaters of the Big River (Fig. 1). The aeromagnetic maps are shown on two sheets at a scale of 1:63,360 (Figs. 2 and 3). The southern sheet (Fig. 2) includes the Lime Hills A-3, A-4, B-3, and B-4 quadrangles; the northern sheet (Fig. 3) includes all or parts of the Lime Hills C-2, C-3, C-4, D-2, D-3, D-4, and McGrath A-2, A-3 quadrangles.

This region is one of rugged topography; relief ranges between 2,000 and 8,000 feet. Alpine glaciers abound, and exposures are relatively good. Because of the topography it was necessary to separate the survey into three sectors flown at three altitudes. The northern, central, and southern sectors were flown at 7,500, 10,000, and 7,000 feet above sea level, respectively (Figs. 2 and 3). Locally, topography required flying at higher altitudes.

The contacts between the observed plutonic rocks and country rocks were mapped from airphotos and a brief helicopter reconnaissance of the area in 1968 by Reed and Marvin A. Lanphere. The localities sampled and the classification of the igneous rocks from these localities is given on the accompanying maps. The rocks were classified by examination of thin sections and stained rock slabs.

GEOLOGIC SUMMARY

The aeromagnetic maps (Figs. 2 and 3) show the approximate contacts between the granitic plutonic rocks (I) and the surrounding country rocks (U). The plutonic rocks comprise a north-south-trending two-pronged batholith that is exposed over an area of about 730 square miles. Smaller, perhaps related, intrusive bodies occur north and northwest of the east prong of the batholith. The quartz diorite and diorite bodies on the east side of the east prong (Lime Hills C-3 quadrangle, Fig. 3) may be related to a north-trending body of diorite/quartz diorite east of the survey area.

The plutonic rocks are in large part leucocratic and of granitic composition. The color index (chiefly biotite) ranges, in general, between 3 and 10. Coarse-grained to very coarse-grained biotite granite and biotite quartz monzonite are the chief rock types noted. The two samples of biotite granite from the southeast and northwest borders of the intense magnetic anomaly (Lime Hills B-3 and C-4 quadrangles, Figs. 2 and 3) are interesting in that they contain abundant accessory allanite. These samples also contain monazite and/or xenotime, which are also characteristic accessory minerals in granite and quartz monzonite samples from the main batholitic mass.

The batholith is regionally concordant and locally discordant. It trends parallel to the north-south structural grain of the enclosing rocks, but local crosscutting relationships were noted. Bordering country rocks consist chiefly of dark weathering argillite, sandstone, minor limestone and, locally, metavolcanic rock. The north-trending septum of country rock lying between the two prongs of the batholith (Fig. 3) is possibly a large pendant within the main igneous body. Structural features within this

pendant trend in general north-south, although locally they become quite complex. The narrow northwest-trending septum of country rock shown on the southern sheet (Lime Hills B-3 quadrangle, Fig. 2) may, in part, be related to a northwest-trending linear feature (fault?) that cuts the batholith and extends northwest into the Lime Hills C-4 quadrangle.

AEROMAGNETIC SURVEY

The aeromagnetic survey covers approximately 1,670 square miles and consists of 71 east-west traverses spaced 1 mile apart. Continuous total-flight traverses were obtained with a proton-precession type magnetometer. The magnetic data were compiled as a total-intensity magnetic contour map by Lockwood, Kessler, and Bartlett, Inc. The magnetic map is contoured on a 10 gamma interval and has not been corrected for the earth's total magnetic gradient; the total magnetic field intensity in this region increases approximately 5.5 gammas per mile in a northeasterly direction.

DISCUSSION OF AEROMAGNETIC DATA

The boundary line indicating the change in flight elevation from 7,000 to 10,000 feet is shown in Figure 2. In the southern 7,000-foot sector, the magnetic susceptibility of the granitic rocks is sufficient to cause a slight increase in the total magnetic field intensity. Regionally, the magnetic contours show this increase to be approximately linear, suggesting that the rocks are magnetically homogeneous. The contours are notably distorted by the intrusive body in the southeast corner of the map and locally by topographic effects.

The south portion of the central sector flown at 10,000 feet is shown at the top of Figure 2. The regional magnetic pattern is interrupted by a

solitary anomaly near the top center of the map and the north-south contour alinement on the right edge of the map. These magnetic features continue into Figure 3.

The nearly concentric magnetic anomaly at the top of Figure 2 is a prominent magnetic feature within the surveyed area. The amplitude of the anomaly is approximately 300 gammas, and its major axis trends northwestward. A depth determination made graphically from a profile constructed through the anomaly in line with the earth's magnetic field places the top of the magnetic body about 7,500 feet below the aircraft. Since the elevation of the terrain in the vicinity of the center of the anomaly is about 2,500 feet above sea level, the feature responsible for the anomaly is thought to be very near the surface. The relatively high magnetic susceptibility suggests that this feature may be a stock of more mafic composition, or a more mafic phase of the surrounding granite and quartz monzonite. The linear magnetic pattern in the northeast corner of Figure 2 is probably caused by quartz diorite and mafic metavolcanic rocks which lie off the east edge of the map.

The northern half of the aeromagnetic survey is shown on Figure 3. The boundary line marking the change in flight elevation from 10,000 to 7,500 feet is also indicated on the figure.

The granitic rock which forms the west prong of the mapped intrusive appears to have a magnetic mineral content similar to the intrusive rock mapped on Figure 2. Local magnetic anomalies and distortions associated with the west prong of the batholith are related to areas of high relief. The negative anomaly near the southeast corner of the Lime Hills D-4 quadrangle coincides with a peak called "North Buttress" and may reflect a younger inversely polarized dike.

The east prong of the north-trending batholith shows a magnetic pattern signifying a change in the magnetic character of the rock that apparently is related to a higher concentration of ferro-magnesian minerals.

In the Lime Hills D-3 quadrangle and the northern half of the Lime Hills C-3 quadrangle the magnetic contours show a definite correlation with the mapped intrusive rocks. Most of the localized magnetic anomalies scattered near the northeast corner of Figure 3 are topographic effects. However, some of these anomalies are associated with exposed intrusive rocks and others may indicate the location of intrusive rocks covered either by sedimentary rocks or surficial deposits. The isolated intrusives near the top of Figure 3 are well delineated by the magnetic contours and appear to be magnetically similar to the rocks of the east prong of the batholith. These intrusives are possibly an arcuate northwest extension of the east prong.

Other localized magnetic anomalies can be observed in Figure 3 which cannot be explained on the basis of the present geologic knowledge of the area. One of these anomalies is in the northwest corner of the Lime Hills C-4 quadrangle. This anomaly lies close to a ridge having moderate topographic relief. The magnetic source is possibly a rock similar to that of the main batholithic mass. Another unexplained magnetic feature is the anomaly found at the south end of the country rock in the western part of the Lime Hills C-3 quadrangle. This anomaly is centered over an area of low topographic expression and appears to be the south culmination of a magnetic lineament which trends north and then turns northeast into the east branch of the batholith. The cause and significance of this magnetic feature is unknown.

SUMMARY

This part of the Alaska Range is underlain by a north-south-trending batholith of granitic composition which cuts country rocks composed of argillite, sandstone, limestone and, locally, metavolcanic rock. The granitic rocks are, in large part, leucocratic biotite granites and quartz monzonites, and carry monazite and/or xenotime as characteristic accessory minerals. The magnetic intensity over parts of the batholith indicates that magnetic susceptibility changes occur within the pluton. To the north, the batholith divides into east and west prongs that are magnetically different. The east prong may be related to the chain of northwest-trending isolated intrusive bodies north of the prong.

A prominent and possibly significant feature of the aeromagnetic map is a large magnetic anomaly located near the left center of the surveyed area. This anomaly overlies an area of low elevation and may be a stock of more mafic composition, or a more mafic phase of the surrounding granitic rocks.

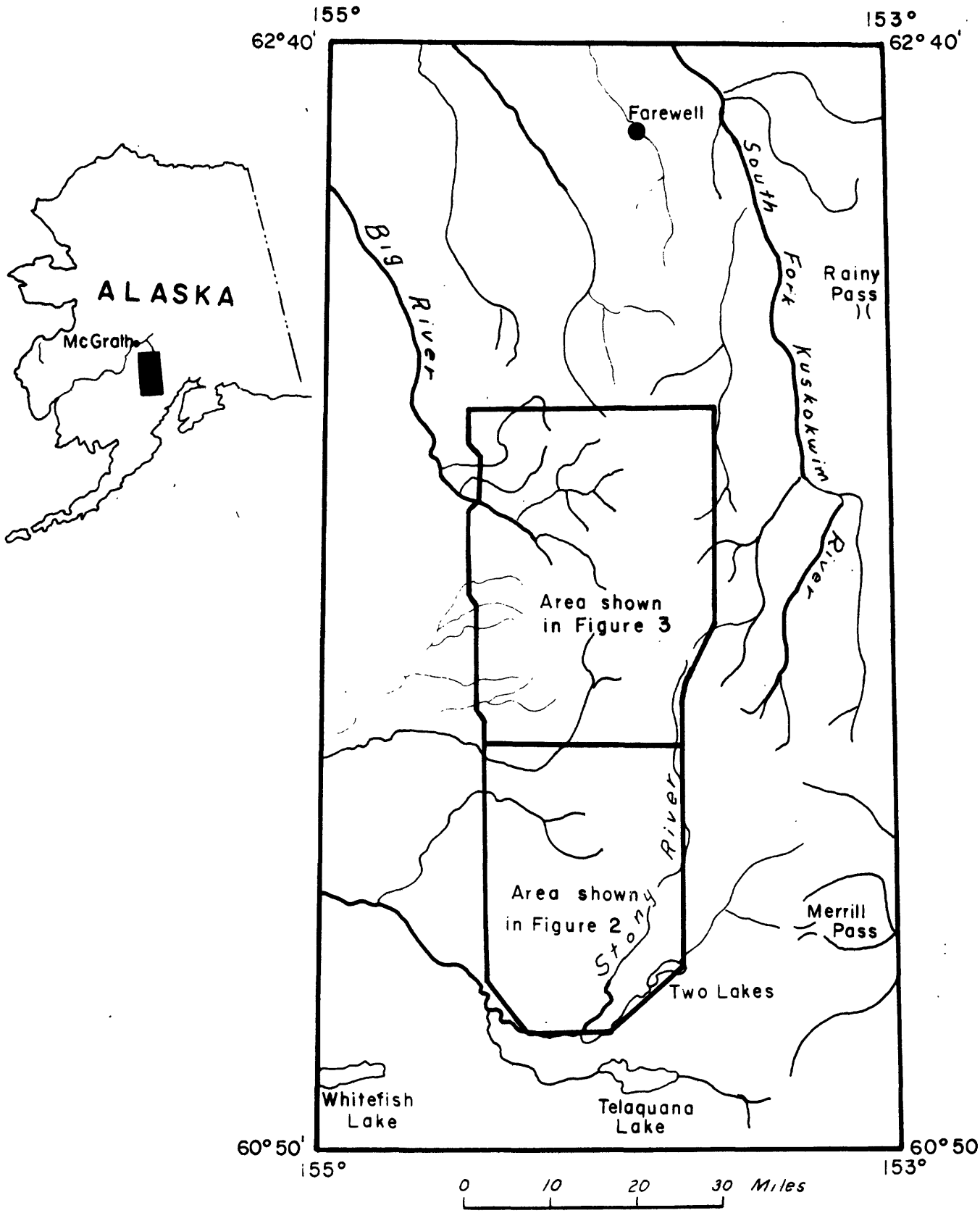

Figure 1.--Index map showing location of aeromagnetic maps.