Geologic Interpretation of Reconnaissance Aeromagnetic Survey of Northeastern Alaska

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CONTRIBUTIONS TO GENERAL GEOLOGY

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Magnetic profiles indicate that northeastern Alaska may be divided into five areas, each of which has a distinctive magnetic character

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GEOLOGIC INTERPRETATION OF RECONNAISSANCE AEROMAGNETIC SURVEY OF NORTHEASTERN ALASKA

By William P. Brosgé, Earl E. Brabb, and Elizabeth R. King

ABSTRACT

Aeromagnetic reconnaissance of northeastern Alaska in 1965 covered approximately 100,000 square miles, from lat 64° N. to the Arctic Ocean and from the Alaska-Yukon boundary to long 148°30′ W. A magnetic contour map was compiled from data from the 1965 survey and earlier surveys. On the basis of these data, northeastern Alaska may be divided into five areas, each having a distinct magnetic character. A study of specific anomalies within these areas led to the tracing of such features as the Tintina fault zone, Ruby uplift, and Kobuk trench for more than 100 miles. Other features, such as inferred north-trending faults and serpentine belts, had not been identified previously by surface geologic methods. The probable extension of volcanic rocks beneath the Yukon Flats limits the size of a possible Tertiary petroleum basin. Discovery of large magnetic anomalies in the Yukon-Tanana Upland provides new possibilities for exploration for mineral deposits associated with ultramafic rocks.

INTRODUCTION

The geology of northeastern Alaska, like that of many other parts of the State, is not well known, and geophysical exploration has not been extensive. From 1888 to 1940, reconnaissance geological studies were restricted largely to areas near a few major navigable rivers. Modern, regional geologic quadrangle maps at a scale of 1:250,000 or larger cover less than one-third of the area. The geologic work that has been done, however, indicates that northeastern Alaska is underlain by a variety of igneous, metamorphic, and sedimentary rocks of different ages. Nearly every geologic system, as well as the Precambrian, is represented. Most of the rocks have been complexly folded and faulted.

The choice of the proper geophysical techniques for exploring such large and poorly mapped areas is always difficult. However, widely spaced aeromagnetic profiles have proved useful for delineating the more important tectonic units and for planning more detailed surveys in such areas as the Cook Inlet area of Alaska (Grantz and others, 1963) and the Arctic Archipelago of Canada (Gregory and others, 1961). Even in an area where the geology was better known, widely spaced aeromagnetic profiles along a transcontinental strip from Washington, D.C., to San Francisco, Calif., proved very useful in indicating unsuspected gross geologic structures (Zietz and others, 1966). Accordingly, it was decided that further experiments be made with such reconnaissance profiles in Alaska.

The aeromagnetic reconnaissance of northeastern Alaska was initiated and planned by Isidore Zietz in 1965 and was supervised in the field by Randolph W. Bromery. J. L. Vargo compiled the aeromagnetic data as profiles, and J. R. Kirby combined these profiles with earlier data obtained by Andreasen (1960a, b) to form a preliminary contour map. This contour map was later modified by E. R. King; she also provided most of the geophysical interpretation for this report. These magnetic data were turned over to Brosgé and Brabb, who had done geologic mapping in the area; they provided most of the geologic interpretation.

The authors were helped by discussions with Isidore Zietz, Ernest Lathram, Andrew Griscom and D. F. Barnes. The writers are especially grateful to Barnes for his extensive technical review of the manuscript and for his many constructive criticisms. They are also grateful to A. S. MacLaren of the Geological Survey of Canada who sent them detailed aeromagnetic maps of the Yukon Territory (Canada Geological Survey, 1966) adjacent to the southeast corner of the map.

PREVIOUS AEROMAGNETIC SURVEYS IN NORTHEASTERN ALASKA

Some of the pioneering work in the application of aeromagnetic data to the solution of geologic problems was done in the Naval Petroleum Reserve and in the surrounding region just west of the area shown on plate 1 (see index map on pl. 1 and Woolson and others, 1962).

Several total intensity aeromagnetic profiles, primarily over the Yukon Flats (the central part of the area shown on pl. 1), were obtained by the U.S. Geological Survey in 1954 and 1958 and were released for public inspection in 1960 (Andreasen, 1960a, b). Most of these profiles were flown north and south at a barometric elevation of 2,500 feet, or slightly higher at the north ends; some of the profiles in the western part were flown at 4,000 to 8,000 feet above sea level. The north-south profiles are incorporated in this report and published here for the first time. Six northwest-trending profiles parallel to the

Yukon River between long 147° and 144° W. (see index map on pl. 1) were not included in this report. An aeromagnetic survey of a 900-square-mile area near Fairbanks (pl. 1; Andreasen and others, 1964), is the only other published aeromagnetic report for northeastern Alaska.

PRESENT SURVEY

The experimental aeromagnetic reconnaissance of northeastern Alaska was made in July and early August of 1965. It covered an area of approximately 100,000 square miles, extending from lat 64° N. to the Arctic Ocean and from the Alaska-Yukon boundary to long 148° 30′ W. (pl. 1). The flight elevation was 5,000 feet above sea level, except in the mountainous areas where it was slightly higher. Twenty-one north-south flight lines were flown 10 miles apart except at the western edge of the area where the spacing was increased to 20 miles; and two east-west base lines were flown near the northern and southern boundaries of the survey. Only nine of the north-south lines extended to the Arctic Ocean; unfavorable weather conditions made it necessary to break off the other flight lines south of the Brooks Range. The locations of the flight lines are shown on plates 1 and 3.

A flux-gate magnetometer that recorded continuously was used for the measurements; many of the surveying and processing techniques were those described by Balsley (1952). However, the aircraft's equipment included some new experimental components designed for eventual digital processing of magnetic data, and position control of this survey was obtained by Doppler navigation as well as strip-film camera records. The published 1:250,000-scale Alaskan topographic maps were used for navigation and initial data compilation, although this proved difficult in areas with topography as complex as the Brooks Range. Furthermore, just reconnaissance versions of these maps were available for the Eagle and Big Delta quadrangles at the southeastern corner of the survey area. Position accuracy was generally better than was needed for the 1:1,000,000 scale of the published maps and profiles, but a few position errors of 1 to even 4 miles could have occurred in places where Doppler equipment failures coincided with poor strip-film camera records or inadequate maps.

The magnetic profiles are all relative to an arbitrary datum and include any instrumental or diurnal drift that occurred in the recording interval. Daily phone checks were made with the U.S. Coast and Geodetic Survey magnetic observatory at College, Alaska, and flights were canceled on days when magnetic disturbances larger than 50 gammas were expected.

In the auroral zone magnetic disturbances show large variations within short distances (Morley, 1953; Westcott, 1960), and a few local variations with magnitudes as large as 100 gammas could be caused by ionospheric rather than geologic sources. However, almost all the observed anomalies correlate with the known geology or with anomalies on adjacent traverses and are probably geologic rather than transient.

The profiles from both the 1965 survey and the earlier surveys in 1954 and 1958 are shown on plate 2 at a horizontal scale of 1:1,000,000 corresponding to plate 1. The profiles all decrease to the south with a uniform gradient of 1.5 to 2 gammas per mile. This gradient, which is clearest on the parts of the profiles with fewest magnetic anomalies, such as north of lat 68° in the Brooks Range and Arctic Costal Plain and in parts of the Yukon Flats, is the component of change of the earth's main magnetic field along the flightpath.

MAGNETIC CONTOUR MAP

The magnetic contour map (pl. 3) was compiled by John R. Kirby from the 1965 data augmented by several of the north-south lines from the earlier surveys (line 8–B, Andreasen, 1960a; lines 1, 2, 11, 36, 44, 45, and 47, Andreasen, 1960b). Although the lines were too widely spaced for a detailed contour map, Kirby was able to delineate most of the larger magnetic features, particularly with the use of the earlier data to give a closer spacing in the more magnetic areas.

The values on each profile are relative to an arbitrary datum. The profiles were adjusted to this datum by means of the base lines at the north and south ends of the surveyed area and by a group of six northwest-trending profiles flown previously. (Andreasen, 1960b; and index map on pl. 1.) Data from a test line flown before and after each day's work were also used to tie the profiles to a uniform datum and remove drift. Most of the supplementary profiles were recorded 2,500 feet lower than the 1965 data and have correspondingly higher amplitudes and more numerous small anomalies, but the 20-gamma contour interval is sufficiently large so that a coherent pattern is obtained. The errors in datum, as well as errors from mislocation, and differences caused by variations in elevation tend to elongate contours along the flight lines so that north-south features and trends are not as reliable as those that are transverse to the flight lines.

In general, the magnetic pattern shown by the contoured data east of Fairbanks and south of the Brooks Range is more reliable than that for the western margin of the map and in the area north of the Brooks Range where the data are widely spaced. This seems to be partially offset, however, by the much more open character of the magnetic field in the north.

The contoured data as originally drawn were strongly affected by the earth's field which slopes to the southwest at 3 to 4 gammas per mile, and it was necessary to remove this gradient in order to show the significant anomalies, particularly in the smoother sections of the map. The gradient removed was represented by linear contours trending N.25° W. so spaced that the gradient decreased from about 4-gammas per mile at the southwest corner of the map to about 3 gammas per mile at the northeast corner.

The magnetic contour map was compiled on sheets of the U.S. Army Map Service World Series (1:1,000,000 scale); it has been adjusted to fit the 1:1,000,000-scale base of the geologic map (pl. 1) that had been compiled by the U.S. Geological Survey. Because the two base maps are on different projections, the position of the contours on the new base is in error by as much as 1 mile in some places.

Some of the limitations of the reconnaissance aeromagnetic survey can be noted by comparing the area along the northern part of traverse 70 on plate 3 with a small area of overlap along the eastern edge of plate 4 of Woolson and others (1962). A sharp, northeast-trending anomaly on the Woolson map in the vicinity of the lower Shaviovik River is only a subtle feature of unknown orientation on the present contour map.

INTERPRETATION OF THE MAGNETIC DATA

The magnetic profiles (pl. 2) show numerous anomalies caused by variations in magnetization of the rocks, principally the mafic and ultramafic varieties, but also some granitic and metamorphic rocks. This magnetization is a combination of that induced by the present earth's field and the remanent magnetization—the latter tending to be largest in the mafic volcanic rocks. In some cases the direction of the remanent magnetization is reversed to give a negative anomaly. Several of these negative anomalies that cross basaltic dikes or serpentine bodies can be seen on profiles from the southern part of the area. Narrow steep anomalies on the magnetic profiles are caused by rocks at or very near the surfaces, whereas some of the broader, smoother anomalies are probably caused by rocks at considerable depths. Sedimentary rocks are generally nonmagnetic; consequently they produce relatively flat magnetic profiles.

The strike of most of the major tectonic units shown on plate 1, as well as many of the minor structures in the surveyed area, is approximately east-west and at right angles to the direction of the profiles. Many anomalies can be easily traced from profile to profile for long distances, but other correlations are highly speculative. The orientation of the profiles that are tansverse to the predominant geologic trends, together with the distinctive character of many of the magnetic anomalies, permits reasonably accurate coverage with widely spaced profiles.

The geologic map (pl. 1) shows areas of exposed magnetic crystalline rocks, which are known from reconnaissance or regional geologic mapping, and shows the inferred extension of these rocks beneath a cover of surficial deposits, sedimentary rocks, and other relatively nonmagnetic rocks. The rock types in areas with no outcrops are mapped by correlating the pattern of the profiles with those of exposed rocks nearby. Some very large, broad anomalies in the vicinity of the Kandik basin and Tintina trench may indicate deeply buried crystalline basement rocks of Precambrian age, but the rocks could be younger intrusives.

MAJOR MAGNETIC FEATURES

The magnetic profiles indicate that northeastern Alaska may be divided into five broad areas each of which has a distinctive magnetic character. These areas are shown on plate 3 and are described below.

Area A.—The eastern Brooks Range and small parts of the Arctic Foothills, Arctic Coastal Plain, and Porcupine Plateau geomorphic subdivisions (Wahrhaftig, 1965) compose area A. The magnetic profiles are generally flat, only a few minor anomalies apparently reflecting small areas of magnetic rocks at or near the surface. The profiles also have a few extremely broad low-amplitude undulations, which could represent magnetic rocks at great depth.

The published magnetic contour map of Naval Petroleum Reserve No. 4 and adjoining areas (Woolson and others, 1962, pl. 4) indicates that the area of low magnetic relief continues northwestward from area A to the lower Colville River, but does not continue westward to the Umiat area, which is characterized by closely spaced circular and ovoid anomalies. The area of low magnetic relief is also replaced eastward by more pronounced anomalies along the Alaska-Yukon border, as shown on profiles 87 and 88 (pl. 2).

The rocks exposed in area A are chiefly sedimentary and low-grade metamorphic rocks of Paleozoic age. Their low magnetic relief indicates that no major units of magnetic crystalline basement rocks occur at shallow depth in the area and that the sedimentary section is probably quite thick. The small size of the magnetic anomalies in area A suggests that detailed and well-controlled magnetic surveys would be needed to define its geologic structures, but present knowledge of the area's mineral potential does not justify such surveys.

Area B.—Lying between the Yukon-Porcupine Rivers and the eastern Brooks Range, area B includes parts of the central Brooks

Range, Porcupine Plateau, Ambler-Chandalar Ridge and Lowland, Kokrine-Hodzana Highlands, and Yukon Flats. Most of the area is characterized by highly magnetic rocks as indicated by sharp anomaly peaks. The eastern part of area B is underlain by volcanic and other mafic and felsic crystalline rocks of Mesozoic and probable Paleozoic age; the western part is mainly underlain by schist of presumed Paleozoic age and granitic rocks of Mesozoic age. The sharp nearly linear change in magnetic character between profiles 45 and 75 suggests that between the East Fork of the Chandalar and the Coleen Rivers, part of the north boundary of area B is a major fault or series of faults. Similar evidence also suggests that the south boundary of area B coincides at least in part with another fault. A north-trending fault is also believed to cut the west end of the large body of Jurassic mafic rocks described by Reiser, Lanphere, and Brosgé (1965) near the East Fork of the Chandalar River. The large magnetic anomalies, together with the metallic mineralization already known to exist in area B, suggest that additional systematic geophysical surveys here would be geologically informative and economically profitable.

Area C.—Parts of the Yukon Flats, Porcupine Plateau, Ogilvie Mountains, Rampart Trough, and the Yukon-Tanana Upland are included in area C. The magnetic profiles show moderate peaks that tend to be located in sharply defined areas along otherwise flat profiles. The area is bounded on the south by what appears to be a westward extension of the Tintina fault.

The area is underlain by a variety of sedimentary and mafic igneous rocks of Precambrian through Tertiary age, but it is largely blanketed by Quaternary alluvial deposits. Aeromagnetic surveys have already shown that extensive, shallow volcanic rocks limit the probable extent of petroleum-bearing rocks beneath the Yukon Flats (Zietz and others, 1960) so that other types of geophysical investigations will be needed to provide better information about the few areas where sedimentary rocks underlie the Quaternary cover.

Area D.—The Yukon-Tanana Upland constitutes area D. The magnetic anomalies are diverse and most of them cannot be traced from one profile to another. Most of the anomalies in this region are narrow and have steep gradients. Therefore, they appear to be related to the surface rocks. The area is underlain principally by metasedimentary and meta-igneous rocks of Paleozoic and Precambrian(?) age, by serpentine of Paleozoic(?) age, and by granitic rocks of Mesozoic age. These rocks are differentiated on plate 1 largely on the basis of surface geologic mapping. If a more detailed survey were made, it might better differentiate the serpentine and igneous rocks from the metamorphic rocks in this mineralized area.

Area E.—Small parts of the Porcupine Plateau, Yukon Flats, Yukon-Tanana Upland, and Ogilvie Mountains, and the extension of the Tintina Valley in Alaska are included in area E. The area is characterized by broad anomalies as much as 50 miles in width and of moderate amplitude. These anomalies probably indicate the presence of large bodies of magnetic rocks at considerable depth beneath the surface. Sedimentary rocks of Paleozoic and Mesozoic age underlie most of the area. However, the Tintina Valley and the Yukon Flats are underlain by nonmarine rocks of Late Cretaceous to late Cenozoic age, and the Hard Luck Creek area in the Ogilvie Mountains is underlain by the Tindir Group of late Precambrian age. Most of the Tindir Group consists of sedimentary rocks, but it also contains extrusive and intrusive mafic rocks; these are reflected on the magnetic profiles by steeper and greater anomalies superimposed on the broad anomalies of moderate amplitude.

DESCRIPTION OF SPECIFIC ANOMALIES

Specific anomalies within these five large areas are discussed in turn from north to south. The numbers for each feature refer to locations on the geologic map (pl. 1), the magnetic profiles (pl. 2), and the magnetic contour map (pl. 3), where they appear in parentheses.

1. Magnetic anomalies in the vicinity of the Romanzof uplift of Payne (1955) suggest that both the granitic and mafic rocks in that area have about the same magnetic intensity. These rocks intrude the metamorphic basement rocks and are apparently among the oldest intrusive rocks in the Brooks Range. The magnetic anomalies associated with these rocks are small, and trends of the individual anomalies are hard to establish because of the wide spacing of the profiles. However, the anomalies are probably significant because they persist in a narrow belt of considerable east-west extent. The rocks in this belt could connect with the northwest-striking magnetic rocks that are indicated beneath the Colville basin on the detailed aeromagnetic map of the Naval Petroleum Reserve (Woolson and others, 1962). Thus, these rocks in the northeastern Brooks Range may be part of the older terrane whose regional strike is transverse to the east-west strike of the younger rocks in the Brooks Range and Colville basin.
2. The north-trending magnetic high, shown by the contours on plate 3, could be explained by poor datum control between the flight lines, but it could also suggest an uplift of magnetic basement rocks along a fracture at considerable depth.
3. Two belts of major magnetic anomalies coincide with exposures of granite, schist, and metamorphosed mafic rocks in the southern

Brooks Range (pls. 1 and 2). The northern belt probably represents the granite that may form the southern limit of the flatter magnetic profiles found in area A. The southern belt is characterized by sharp peaks, a few of which represent exposed metamorphosed mafic rocks. The entire southern anomaly could be due to similar mafic rocks at depth.

The granite, schist, and mafic rocks are replaced eastward by Paleozoic sedimentary rocks near the East Fork of the Chandalar River. There is unfortunately a wide gap in this area between magnetic profiles 71 and 75. Two pairs of intermediate profiles (72 and 73, and 14A and 14B) do not extend far enough north to eliminate the possibility that some of the magnetic rocks extend across the unsurveyed interval beneath the sedimentary rocks. However, although they were flown at different elevations and although there may be location problems, the contrast between profiles 72 and 73 and adjacent profiles 14A, 71, and 75 suggests a gap in the magnetic rocks; this is indicated by the geologic contacts and the possible fault drawn on plate 1. However, the magnetic contour map in plate 3 shows an alternative interpretation in which the magnetic rocks are extended across the unsurveyed interval beneath the exposed Paleozoic sedimentary rocks. Similar interpretation problems also occur farther east between profiles 11 and 87, where geologic mapping indicates another discontinuity.

4. A linear negative anomaly that strikes east-west along the south boundary of the Brooks Range schist more or less coincides with the Ambler-Chandalar Ridge and Lowland section of Wahrhaftig (1965). This linear physiographic belt lies along the Cenozoic Kobuk tectonic trough of Payne (1955) and the north part of the Mesozoic Kobuk trough of Miller, Payne, and Gryc (1959). It has recently been described as the Kobuk trench by Grantz (1966). The outcrops along the anomaly consist of Paleozoic(?) and Mesozoic(?) phyllite, subgraywacke, chert, and volcanic rocks that strike generally parallel to the anomaly, but are cut by it in some places. These rocks extend as far east as the Middle Fork of the Chandalar River, where they terminate against the schist along a northeast-striking structural trend. However, the magnetic feature itself continues eastward across the schist as far as the East Fork of the Chandalar River where it also takes on a northeast trend between profiles 70 and 71.
5. A distinctive magnetic high, which extends northeast from granitic rocks in the vicinity of the Ray Mountains almost to the Old Crow Granite of Baadsgaard and others (1961), coincides with the Ruby "geanticline" of Payne (1955). Most of the rocks along the part

of this structural feature that was crossed by magnetic profiles are either covered or unmapped, but presumably they are mostly granitic. The Ruby uplift seems to cut across the strike of the rocks exposed on its flanks. Its east end coincides with a fault that Brosgé and Reiser have mapped (Grantz, 1966, U.S. Geological Survey, 1965, p. A103) as separating geosynclinal sequences of the Brooks Range to the north from shelf sequences of the Porcupine River area to the south. This fault is believed to extend southwestward, separating granitic (?) rocks of the Ruby uplift from volcanic and sedimentary rocks of the Yukon Flats area; it marks the approximate boundary between the magnetic patterns of areas B and C.

6, 7. The mafic rocks in the Yukon Flats are shown on the map (pl. 1) to be widespread. All are grouped in a single general category in the absence of exposures other than the volcanics on the margins. Most of the magnetic anomalies could be caused by sheets of volcanic rock at a shallow depth overlying or within a sedimentary sequence. Two high-amplitude anomalies, one at 143°–144° (6) and one west of 147° (7), indicate the presence of more massive bodies of possibly more magnetic rock; they may indicate source areas for the extrusive material.

8. The Yukon Flats area was considered a possible petroleum province in a sedimentary basin of Tertiary age by Miller, Payne, and Gryc (1959, p. 87–88). The aeromagnetic profiles suggest, on the contrary, that the Paleozoic or Mesozoic volcanic rocks that are exposed around the periphery of the Yukon Flats probably extend beneath the flats at relatively shallow depth (Zietz and others, 1960). A magnetic low (8, pls. 1 and 3) occupies the Porcupine Plateau just east of the flats and could represent the thickest section of sedimentary rocks. However, reconnaissance of the Black River area (Brabb, 1969), indicates that the rocks in the vicinity of the magnetic low are probably Paleozoic or Precambrian rather than Tertiary and are outside the basin.

9. The major anomalies along the eastern border of the map between the Yukon and Porcupine Rivers may be separated from the volcanic terrane beneath the Yukon Flats by a major structural break in the Precambrian(?) basement rocks. This inferred structural break is shown as a fault in the geologic map (9, pl. 1). No major north-trending faults have yet been mapped in that area, but a well-developed north-trending joint or fault system has been observed on aerial photographs of the Yukon-Tanana Upland south of Eagle.

10. The Tintina fault zone is a major structural and topographic feature that marks the boundary between regionally metamor-

phosed rocks of Paleozoic and Precambrian(?) age in the Yukon-Tanana Upland and sedimentary and volcanic rocks of Precambrian and Phanerozoic age in the Kandik Basin (Brabb, 1962). Folded and faulted nonmarine clastic rocks of Cretaceous and Tertiary age extend along the fault zone itself.

Grantz (1966) and Roddick (1967) postulate that there has been about 75 to 220 miles of right-lateral displacement along the Tintina fault zone since late Mesozoic time.

The Tintina fault zone lies along a pronounced magnetic gradient that decreases southward. Detailed aeromagnetic maps (Canada Geol. Survey, 1966) on the Canadian side of the border also show that the Tintina fault zone coincides with either a distinct southward magnetic gradient or with the crest of a belt of linear high magnetic anomalies.

11. The northwestern part of the Tintina fault zone between lines 77 and 79 coincides with a broad deep-seated magnetic anomaly which seems to die out toward the northwest. This broad high has a distinct linear trend that almost parallels the fault zone except in the east where it swings north and gradually broadens. The form of the anomaly suggests a deep intrusive, the emplacement of which may have been structurally related to the fault zone. However, the wider eastern part of the anomaly (11, pl. 3) coincides with most of the known outcrops of the Precambrian Tindir Group and therefore may represent an uplift of Precambrian basement rocks beneath the Tindir Group.

The association of the magnetic high with a late Mesozoic and Cenozoic nonmarine sedimentary section in the Tintina Valley is similar to the association noted by Grantz and Zietz (1960) of magnetic highs with larger sedimentary basins. However, the width and length of the Tintina anomaly in relation to the narrower and shorter Tintina sedimentary outcrop decreases the similarity.

12. Several small, sharp anomalies in the Yukon-Tanana Upland coincide with mapped pods or masses of serpentine in two belts previously described by Mertie (1937). Magnetic patterns in this part of the map indicate that the serpentine is more extensive than had been mapped, and detailed aeromagnetic surveys may reveal additional serpentine pods. Serpentine is a mineral "target" because it is associated with asbestos deposits in a similar geologic terrane near Dawson, Yukon Territory (Green and Godwin, 1964, p. 19–22). The 1,100-gamma anomaly at Mount Sorensen, the largest recorded anomaly in the present aeromagnetic survey, and another large anomaly in the headwaters of the Salcha River should also be investigated for mineral deposits.

CONCLUSIONS

The experiment of using widely spaced aeromagnetic profiles to determine gross structural features in northeastern Alaska seems to have been valuable. The survey was hampered by bad flying weather and by failures of newly installed navigation equipment on the aircraft. The instrumental modifications have already been made, however, and future reconnaissance surveys could be planned with sufficient controls to produce a better coverage and a generalized contour map of more uniform quality. Some features, such as the Tintina fault zone, Ruby uplift, and Kobuk trench, were traced for distances of more than 100 miles by characteristic magnetic anomalies, and where the line spacing did not exceed 10 miles, they could be traced beyond their known geologic exposures. Other features, such as the inferred north-trending faults and the serpentine belts, had not been previously identified by surface geologic methods. The probable extension of volcanic rocks beneath the Yukon Flats limits the size of a possible Tertiary petroleum basin and demonstrates the need for additional geophysical data in the parts of the flats where volcanic rocks were not revealed. Furthermore, the data will be useful for planning and stimulating future magnetic surveys in other areas. The discovery of large magnetic anomalies in the Mount Sorensen and Salcha River areas opens up new possibilities for the exploration for mineral deposits associated with ultramafic rocks and should help to stimulate additional detailed aeromagnetic surveys in the Yukon-Tanana Upland.

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