DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

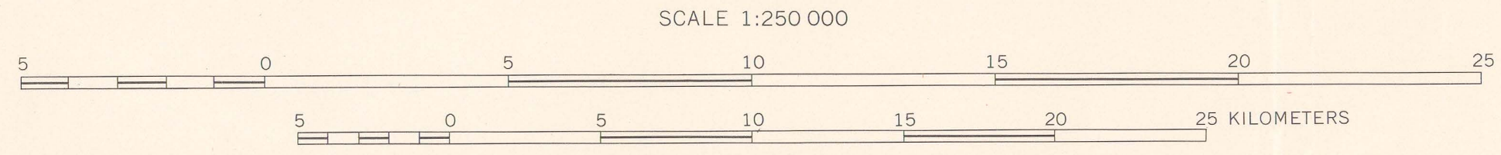
FOLIO OF THE TANACROSS QUADRANGLE, ALASKA

MAP MF-767A

SHEET 2 OF 2

GRISCOM--AEROMAGNETIC MAP AND INTERPRETATION

BASE BY U.S. GEOLOGICAL SURVEY, 1964



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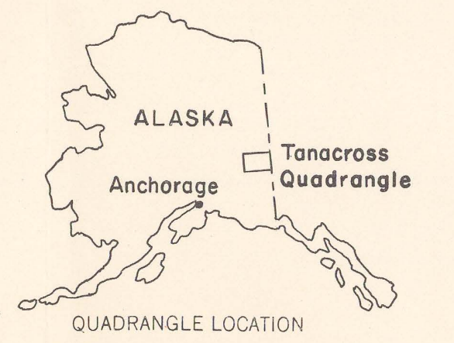


QUADRANGLE LOCATION

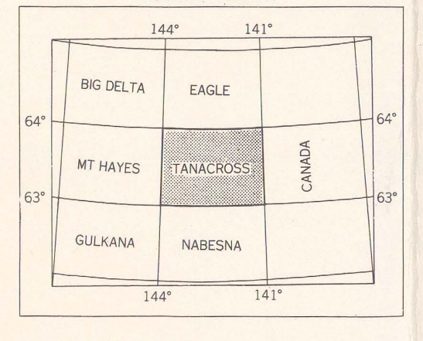
AEROMAGNETIC MAP AND INTERPRETATION OF THE TANACROSS QUADRANGLE, ALASKA

BY

ANDREW GRISCOM

1976

LOCATION INDEX



EXPLANATION

GEOLOGY GENERALIZED FROM FOSTER (1970)

CORRELATION OF MAP UNITS

UNCONSOLIDATED DEPOSITS

Qsu] QUATERNARY

SEDIMENTARY ROCKS

Kr] CRETACEOUS(?)
KJm] CRETACEOUS OR JURASSIC

IGNEOUS AND METAMORPHIC ROCKS

QTb] QUATERNARY AND TERTIARY
Tm Tf] TERTIARY(?)
TMzg TMzgb] TERTIARY OR MESOZOIC
MzPzu] MESOZOIC OR PALEOZOIC
Pzd] PALEOZOIC(?)
PzpЄm] PALEOZOIC AND (OR) PRECAMBRIAN

DESCRIPTION OF MAP UNITS

	UNCONSOLIDATED DEPOSITS
Qsu	UNCONSOLIDATED SEDIMENTARY DEPOSITS
	SEDIMENTARY ROCKS
Kr	DETRITAL ROCKS (CRETACEOUS?)
KJm	MENTASTA ARGILLITE OF RICHTER (1967) (JURASSIC OR CRETACEOUS)
	IGNEOUS AND METAMORPHIC ROCKS
QTb	BASALT
Tm	MAFIC VOLCANIC ROCKS
Tf	FELSIC TUFF, WELDED TUFF, LAVA, AND HYPABYSSAL INTRUSIVE ROCKS
TMzg	GRANITIC ROCKS, UNDIVIDED
TMzgb	GABBRO
MzPzu	ULTRAMAFIC ROCKS
Pzd	DIORITE
PzpЄm	METAMORPHIC ROCKS, UNDIVIDED

GEOLOGIC SYMBOLS

CONTACT, APPROXIMATELY LOCATED

U D FAULT, DASHED WHERE APPROXIMATELY LOCATED, DOTTED WHERE CONCEALED. U, UPTHROWN SIDE; D, DOWNTHROWN SIDE

FAULT OR LINEAMENT FROM AERIAL PHOTOGRAPHS

EXPLANATION FOR AEROMAGNETIC INTERPRETATION MAP

IV

Fault inferred from aeromagnetic data; dashed where approximately located, Roman numeral IV is a label for discussion of fault in text.

Boundary between magnetic and less magnetic rocks; dashed where approximately located. Assumed to be near surface or to crop out unless labeled "Covered".

R

Magnetic anomaly caused by rock with reverse remanent magnetization.

D

Magnetic anomaly believed to be caused by diorite.

M, M_6

Magnetic anomaly believed to be caused by a mass of metamorphosed layered rocks. Subscript is a label for discussion purposes in text.

P, P?, P_{12}

Magnetic anomaly believed to be caused by a mass of plutonic rocks; queried where uncertain. Subscript is a label for discussion purposes in text.

U_6

Magnetic anomaly believed to be caused by ultramafic rocks. Subscript is a label for discussion purposes in text.

V, V_6

Magnetic anomaly believed to be caused by volcanic rocks. Subscript is a label for discussion purposes in text.

Trend of axis of magnetic high.

Trend of axis of magnetic low.

DISCUSSION

AEROMAGNETIC DATA AND INTERPRETATION

The aeromagnetic map (sheet 1) of the Tanacross quadrangle was prepared in 1971 and subsequently released by the State of Alaska as an open-file map (Alaska Div. Geology and Geophysics, 1973). The data were collected along north-south traverses spaced at 1.6-km intervals and from an altitude of 300 m above the ground. Compilation was originally in the form of 30 by 15-minute quadrangles at a scale of 1:63,360; these quadrangles have been combined and reduced to form the present map at a scale of 1:250,000. Contour interval is 10, 20, 100, or 500 gammas, depending upon the steepness of local gradients in the Earth's magnetic field.

The local topographic relief in the Alaska Range in the southwest corner of the quadrangle is as great as 1,000 m, and under such circumstances the fixed-wing aircraft that performed the survey could not maintain a constant altitude of 300 m above ground. In areas of substantial local relief the aircraft flew approximately 300 m above the ridge crests and 500 to 1,000 m above the valley floors. Continuous recording altimeter data are available for each traverse. Where an area of high relief is underlain by magnetic rocks, a local magnetic anomaly is generated by the topography. Magnetic anomalies caused by topography may be superimposed upon even larger magnetic anomalies generated by the same magnetic rocks extending to unknown depths below the surface. Thus within broad magnetically high areas there may be local magnetic highs and lows over ridges and valleys, respectively. In the southwest corner of the quadrangle the aircraft was forced by the extreme relief to maintain a height above ground that averaged well over 300 m. Because the rocks here are only weakly magnetic, the resulting effect is an overall smoothing of the magnetic field. This smoothing is a result of the increase in distance from the ground, thereby attenuating the magnetic anomalies having short wavelengths.

The magnetic anomalies and patterns on the aeromagnetic map are caused by variations in the amount of magnetic minerals, commonly magnetite, in the various rock units and are therefore closely related to geologic features. Probably about 95 percent of the magnetic anomalies in this quadrangle are caused by igneous rocks, plutonic and volcanic, or by serpentinized ultramafic rocks. As discussed below, a small but uncertain number of the anomalies are probably cuased by the metamorphic rocks, schist and gneiss, that are the older country rocks of this quadrangle. The aeromagnetic interpretation map (sheet 2) was compiled by the following procedure: a preliminary interpretation map was constructed using only the magnetic map and not referring to the geologic map, then the interpretation was compared with the geologic map and refined by modification of boundaries and by addition of a few more anomaly boundaries. The areas of magnetic metamorphic rocks were originally interpreted as volcanic (with doubts because of linearity of anomalies) and were relabeled after comparison with the known geology and discussions with H. L. Foster. To estimate the attitudes of dipping boundaries between magnetic and relatively nonmagnetic rocks, a set of two-dimensional magnetic profiles was calculated across a series of model contacts having various dips and strikes. The top of the models is 300 m below the level of the calculation, and the thickness of the models is 6 km. This atlas of 117 calculated profiles provided the estimates of dips given in this report. At these magnetic latitudes, boundaries between magnetic and relatively nonmagnetic rock units are in general located on the flanks of the magnetic anomaly, approximately at the steepest gradient. The aeromagnetic interpretation map (sheet 2) contains many such interpreted boundaries drawn around characteristic magnetic anomalies. Some of these boundaries correspond approximately to mapped geologic contacts on the generalized geologic map of the Tanacross quadrangle (sheet 2). Other boundaries may represent rock units that have not yet been located by geologic mapping. In addition, many of the boundaries are concealed by extensive glacial and alluvial deposits in this region, particularly in the vicinity of the Tanana River, where the interpretation map is especially useful in explaining the covered bedrock geology. If the magnetic anomalies are narrow and of low amplitude, the interpretation map shows a lineament symbol. Long linear magnetic boundaries, which may truncate other magnetic lineaments, are interpreted as faults and are so indicated on the interpretation map. Minor discrepancies between mapped geology and aeromagnetic interpretation are to be expected at this map scale; they may arise from errors in aircraft location, from the semiquantitative nature of the magnetic interpretation, and from the reconnaissance nature of the geologic mapping.

Certain magnetic lows on the map are interpreted to be the result of reverse remanent magnetization of the associated rock units and are indicated by a capital letter "R". These lows are relatively isolated and are considered to be below the local background level of the magnetic field, which is arbitrary and approximately 4,900 to 5,000 gammas on the magnetic map (sheet 1). Lows of this sort are almost invariably caused by volcanic rocks. Other magnetic lows, especially those on the north and northeast sides of the major magnetic highs, are the result of edge effects and have nothing to do with reverse remanent magnetization.

VOLCANIC ROCK UNITS

Some magnetic anomalies or distinctively patterned magnetic areas are interpreted to be caused by volcanic rocks, and the term includes hypabyssal intrusive rocks as well as extrusive rocks. These areas are labeled with the letter "V" on the interpretation map (sheet 2), and where necessary a subscript has been added for purposes of discussion in the text. The volcanic areas are numbered in sequence from west to east across the central part of the map, then from west to east across the north edge of the map. Characteristics of magnetic anomalies caused by volcanic rocks include: relatively small distances between highs and lows, irregular patterns of highs and lows with few linear features, relatively narrow gradients on the flanks of anomalies, and magnetic lows caused by reverse remanent magnetization. Most of the smaller unidentified subcircular magnetic highs, which are steep-sided and caused by magnetic masses 1-3 km in diameter, are believed to be the magnetic expression of volcanic rocks, hypabyssal plugs in particular.

Anomalies V_1 through V_4 are small steep-sided magnetic anomalies caused by relatively young basaltic volcanic rocks (QTb). The association of anomaly V_3 with a small hill of basalt indicates that the flows, although almost entirely concealed, must have a lateral extent of approximately 8 km to the northwest and may continue another 6 km farther northwest to include the anomaly labeled "V?".

Anomaly V_5 is associated with a substantial body of Tertiary volcanic rocks forming Sixtymile Butte. A central magnetic high, caused in part by the topography of the butte, is surrounded for more than 200° of circumference by an arcuate magnetic low caused by a magnetic rock unit with reverse remanent magnetization. This low may be the expression of an individual volcanic unit or possibly a ring dike concentric with the central magnetic high. The topography, the central magnetic high, and the arcuate low indicate the possibility that this feature is an eroded volcano that may have been involved in an episode of caldera formation. The geologic data neither support nor contradict this conclusion. Between the southern positions of anomalies V_5 and V_6 is a large area that contains no magnetic boundaries. The magnetic pattern in this area, although subdued, is complex, containing many small anomalies that are for the most part probably caused by volcanic rocks. The patterns and geology of this area are too complex to be able to draw meaningful magnetic boundaries.

The area of anomaly V_6 and the associated anomalies (V_7, P_{20}, M_2) is considered to be the magnetic expression of a volcanic complex that has had at least one and perhaps two major episodes of caldera formation. The patterns indicate that much of the adjacent alluviated area is underlain by these volcanic rocks. In general the mafic flows cause far more intense anomalies than the felsic ones. Various faults cutting the volcanic rocks are inferred from the magnetic data, and other faults are indicated on the geologic map. Anomaly V_7 lies within V_6 but the source of V_7 is totally concealed by alluvium. Like the central anomaly of V_5, anomaly V_7 is surrounded by curvilinear magnetic lows which are caused by rocks with reverse remanent magnetization. It is possible that anomaly V_7 represents the central part of a caldera. A major caldera in the center of V_6 is suggested by anomaly P_{20}, which is caused by an intensely magnetic stock, partly of syenite (Foster, 1970), that appears to intrude the volcanic rocks, according to the magnetic data. This stock and the associated patch of nonmagnetic metamorphic rocks (M_2) on its south side are evidence for a late episode of resurgence at the center of the extrusive complex.

Near the southeast extremity of V_7 is anomaly V_8. This anomaly appears to be of volcanic origin as do the reversed anomaly (labeled "R") on its south side and the circular anomaly, also labeled V_8, to the southeast beyond the area of magnetically reversed rocks. This series of three anomalies connects two mapped areas of volcanic rocks (QTb and Tf), and the connection suggests that the volcanic rock units may be continuous with each other although of somewhat differing ages. The larger part of anomaly V_8 may be caused by a hypabyssal intrusion. Although metamorphic rocks are shown on the geologic map for this rea, it is so covered that almost no reliable geologic information is available (H. L. Foster, written commun., 1976).

Anomaly V_9 is clearly caused by the basalt flow (QTb) that extends southeast from Prindle Volcano. The central part of anomaly V_{10} is probably caused by this same flow where it trends southeast along the valley of the East Fork Dennison River. The extensions of V_{10} to the northeast and southwest are more puzzling because there is little evidence that additional flows from Prindle Volcano are concealed beneath the alluvium (H. L. Foster, oral commun., 1976). Furthermore, the associated anomaly V_{11} is the result of reverse remanent magnetization, and it is unlikely (H. L. Foster, oral commun., 1976) that flows from Prindle Volcano would be as old as 690,000 years, the age of the end of the Matuyama reversed polarity epoch (Cox, 1969). Although it is possible that the central third of anomaly V_{11} is an edge effect of the adjacent anomaly V_{12}, the two ends cannot be edge effects, and therefore the entire feature is deduced to be reversed. It is concluded that much of anomaly V_{10} and all of anomaly V_{11} are underlain by volcanic rocks older than those of Prindle Volcano. Felsic volcanic rocks (Tf) crop out at the extreme north and south ends of anomaly V_{11}, thus supporting this magnetic interpretation.

Anomaly V_{12} is somewhat complex and may represent a variety of magnetic rocks, including magnetic metamorphic rocks. The smaller anomalies within V_{12} have the irregular appearance of anomalies caused by volcanic rocks although the anomalies are rather linear at the north end. A comparison of the north contact of the area with the atlas of computed profiles indicates that the magnetic boundary here dips north at about 50°. Such a dip direction suggests that the magnetic anomalies may be caused by hypabyssal intrusions, some of which may be concealed at shallow depth beneath the outcropping metamorphic rocks. Felsic hypabyssal rocks (Tf) crop out on ridge crests where the strongest magnetic anomalies occur at the north and south sides of anomaly V_{12}, and porphyry copper mineralization is associated with the northern anomaly.

At the east border of the mapped area a belt of volcanic rocks trends east-west and displays a characteristic magnetic pattern (anomaly area V_{13}). This feature appears to be on the same trend as anomaly V_8, radial to the suggested caldera of anomaly V_6; thus V_{13} may be the expression of an east-west belt of intrusive activity and faulting radial to the caldera, and a possible locus of mineralization.

The area labeled V_{14} is in the alluviated basin of Mosquito Flats in the northwest quadrant of the map area (sheet 2). There is some doubt whether all of V_{14} is the expression of volcanic rocks, but the magnetic highs at the east end of V_{14} are certainly underlain by basaltic rocks (QTb). In addition several areas of rocks with reversed remanent magnetization are indicated around the borders of V_{14}. Metamorphic rocks have been mapped along the extreme west border of V_{14} but the metamorphic rocks shown nearer the central part of V_{14} are only inferred from aerial reconnaissance (H. L. Foster, oral commun., 1976). Anomaly V_{15} is considered an eastern extension of V_{14} and is the expression of reverse remanent magnetization of mapped basaltic rocks (QTb).

Anomaly V_{16} is associated with a small patch of mafic volcanic rocks.

PLUTONIC ROCKS

A large number of magnetic anomalies on the magnetic map are believed to be caused by large masses of plutonic igneous rocks, which mostly are composed of quartz monzonite or granodiorite. These anomaly areas are labeled "P" on the interpretation map, and a subscript has been added for purposes of discussion in the text. The subscript numbers are in several sequences from left to right across the map, starting at the south end of the quadrangle. Characteristics of these magnetic anomalies include the following: irregular elliptical outlines, generally at least 10 km long; magnetic gradients on the anomaly flanks tend to be more than 2 km wide, indicating, according to the atlas of computed profiles, that the boundaries of the magnetic masses dip outward (for a survey height of 300 m above ground); magnetic minima are commonly absent on the north sides of the anomalies, implying outward dips of less than 50° for the magnetic boundaries, according to the computed profiles; the magnetic anomalies caused by plutonic rocks are much wider than those associated with volcanic rocks.

Many of the granitic rocks of the Tanacross quadrangle are relatively nonmagnetic and have no characteristic magnetic expression on the aeromagnetic map, particularly in the northwest and southeast corners of the map area. Furthermore, it is evident that the boundaries of the plutonic-rock magnetic anomalies may not follow the mapped contacts of the granitic rocks very faithfully although there is commonly an approximate correlation. The reasons for these discrepancies are not understood in each instance but probably include some or all the following: (1) the granitic rocks vary irregularly in their magnetite content because of variations in iron content or partial pressure of oxygen during crystallization; (2) there are several ages of granitic plutons, the youngest of which are the most magnetic, because the magnetic anomalies invariably imply outward-dipping contacts that do not appear to be interrupted or cut off; (3) contact metamorphic effects may locally increase the magnetization of the country rocks (Griscom, 1975) or conversely may decrease the magnetization of the granitic rocks near their contacts; (4) some of the granitic plutons are near the surface but do not crop out over substantial areas (the symbol "Covered" is used on the interpretation map for such situations); (5) the aeromagnetic interpretation or the reconnaissance geologic mapping may locally be incorrect. There may in some cases be a lithologic gradation between the plutonic rocks (anomalies labeled "P") and certain hypabyssal equivalents (anomalies labeled "V"); in such situations the label is somewhat arbitrary and is discussed more fully in the text.

The row of anomalies, P_1 to P_7, forms the southwest limit of plutons in the quadrangle. The southwest boundaries of these anomalies correspond approximately to the Tanana River valley except for P_3, which extends southwest of the valley for about 10 km. The southwestern limit of magnetic plutons is irregular and is not a major fault boundary, and the plutons appear to be continuous at depth, their southwest contacts dipping southwest at angles calculated to be in general less than 60°. Two small granitic plutons farther south (T. 17 N., R. 11 E.; T. 16 N., R. 11 E.) are not magnetic and appear to be separate rock types (H. L. Foster, oral commun., 1976). Pluton P_2 is apparently differentiated because it has a magnetic rim and a less magnetic center. Such differentiated plutons may be sources of mineral deposits.

Anomalies P_8 through P_{15} reflect another irregular row of plutons, also probably connected at depth, which extend entirely across the quadrangle on the north side of the Tanana Valley. Pluton P_8 is cut by fault II that has an apparent left-lateral offset of 4 km. Pluton P_1 is not offset by fault II, implying that P_1 and P_2 are younger than P_8. In this series P_{11} is unique in that it appears to be especially large and complex and branches off in a northeasterly direction for about 40 km. This northeast branch consists of two major elongate sections that parallel each other and that are separated by a narrow continuous magnetic low, also trending northeast. This low is not fully explained although the southwest end of it represents nonmagnetic metamorphic rocks and the central part is associated with a northeast-trending stream valley and a possible fault. An occurrence of porphyry copper mineralization is located in P_{11} near a sharp magnetic high and near a patch of volcanic rock (Tf) in T. 18 N., R. 15 E. Anomaly P_{14} is located in an area of intensely metamorphosed granitic gneiss and may represent either a much older matamorphosed pluton or, more likely, a concealed younger pluton.

Anomalies P_{16} through P_{20} are in the north center of the quadrangle. Anomaly P_{17} straddles an interpreted fault (II) and indicates that the southeast side has been uplifted and that there may be a small amount of left-lateral strike-slip movement on the fault. Anomaly P_{18} is puzzling in that the wide magnetic gradients on the south and northeast sides suggest very low outward dips of the magnetic boundaries. A porphyry copper prospect is located near the circular magnetic high on the west border of T. 21 N., R. 14 E. The sharp linear magnetic high on the northwest end of P_{18} may be caused by a hypabyssal intrusion with a fault (IV) or a steep contact on its north side. The pluton at the northwest end of P_{19} is evidently very close to the surface because the ridge of metamorphic rocks there is cut by numerous granitic dikes (Foster, 1970). The southeast extension of pluton P_{19} is covered with volcanic rocks that are relatively nonmagnetic and thin, judging by the absence of small anomalies in this area. Anomaly P_{20} is caused by the relatively young stock (69 m.y.) at Mount Fairplay and is discussed in greater detail in the previous section on anomaly V_6.

Anomalies P_{21} through P_{30} are located along the north edge of the Tanacross quadrangle. Extending across the middle of anomaly P_{21} is a local sharp linear anomaly (labeled "V") which at its southeast end is associated with a small patch of volcanic rocks and a porphyry copper prospect. Magnetic anomalies P_{22} and P_{23} and the magnetic low between them represent a large syenite intrusion (Foster, 1970) that judging by the magnetic data appears to be compound. The very intense anomaly P_{24}, with a local amplitude over 1,000 gammas, is associated with a large mass of gabbroic rocks (Foster, 1970). Anomaly areas P_{25} through P_{27} roughly define a large granitic pluton, whose extreme east end appears to be nonmagnetic and which is also associated with a puzzling area with reverse remanent magnetization. Anomaly P_{28} is associated with two bodies of hypabyssal and volcanic rocks and probably represents a near-surface intrusion from a deeper concealed pluton causing P_{29}. At the west end of P_{29} are several sharp anomalies that may also represent near-surface hypabyssal plutons, other upward extensions of the P_{29} pluton. The pluton associated with anomaly P_{30}, on the other hand, seems to be entirely covered but might be a source for the relatively nonmagnetic volcanic rocks that crop out above it at the surface.

In the extreme southwest corner of the quadrangle is anomaly P_{31}, caused by granodioritic rocks on the south side of the Denali fault (XIX). These plutonic rocks characteristically have a much stronger magnetic expression (Griscom, 1975) than the plutonic rocks north of the fault.

ULTRAMAFIC ROCKS

A few magnetic anomalies have been identified, usually by comparison with mapped geology, which appear to be caused by ultramafic rocks. These anomalies are very sharp and local, sometimes with closely associated magnetic minima which imply steeply dipping or overhanging sides and limited vertical extent.

Seven such magnetic anomalies are indicated in the southwest corner of the quadrangle (sheet 2) with the letter "U". Anomalies U_1, U_2, and U_4 are associated with known masses of ultramafic rocks. Anomalies U_3, U_6, and U_7 are interpreted to reflect probable ultramafic masses. Anomaly U_5, although associated with a mass mapped as diorite (Pzd), is more likely to represent ultramafic rocks because other diorite masses, even where large, are not especially magnetic. This outcrop was observed from a distance and not actually visited in the field (H. L. Foster, oral commun., 1976).

Two ultramafic masses are interpreted to be present in the northeast corner of the quadrangle on the basis of their magnetic expression, U_8 and U_9. Dikes of ultramafic rocks have been observed near each anomaly (H. L. Foster, oral commun., 1976).

METAMORPHIC ROCKS

The metamorphic rocks (PzpЄm) of the Tanacross quadrangle are in general only weakly magnetic and produce a rather smooth and featureless magnetic field. A few anomalies in areas of metamorphic rocks are labeled "M" and given a subscript for purposes of discussion. The numbers are in sequence from west to east across the center of the quadrangle.

Anomaly area M_1 contains various small magnetic highs including a sharp 10 km linear feature, associated with a pair of ridges mapped as metamorphic rocks. The specific rock causing the anomalies is unknown.

Anomaly area M_2 is a broad magnetic low, signifying the presence of nonmagnetic rocks within the volcanic rock complex causing V_6. This feature is further discussed in the earlier section V_6. Anomaly areas M_3 and M_4 represent other similar masses of nonmagnetic metamorphic rocks isolated within areas of magnetic plutonic and volcanic rocks.

Along the east edge of the quadrangle are several areas of magnetic anomalies (M_5 and M_9) that occur over mapped metamorphic rocks and have characteristics intermediate between those of plutonic- and volcanic-rock anomalies. Many or most of the individual anomalies within these areas are thought to be caused by metamorphic rocks although it is possible that unknown volcanic rocks may contribute to a few of the anomalies. The magnetic low labeled "R" in area M_6 is an example of a feature most likely caused by volcanic rocks with reversed remanent magnetization. Within anomaly area M_9 and possibly within M_8 are exposures of amphibolite and greenstone (H. L. Foster, oral commun., 1976) that may well be sufficiently magnetic to cause the observed anomalies.

DIORITE INTRUSIONS

Numerous small intrusions of diorite occur in the southwest part of the map area, southwest of the Tanana River valley. These intrusions are roughly correlated with some small linear magnetic anomalies that are outlined on the map and labeled "D", but there are exceptions where intrusions show no anomaly and where anomalies appear to have no associated intrusion. These discrepancies are unexplained, but the magnetic anomalies themselves are interrupted in a way that is best interpreted as a set of northeast-trending faults.

FAULTS

Interruptions of magnetic features, especially where the interruption is a steeply-dipping linear boundary, are interpreted as faults. Faults on the interpretation map are labeled with Roman numerals and numbered from west to east across the map in three sets: a set north of the Tanana Valley, a set in the valley, and a set southwest of the valley.

Inferred faults I and II correspond to similar faults on the geologic map. Fault II transects anomaly P_{17} in a way that indicates the southeast side was uplifted and which indicates that there may be a small amount of left-lateral strike-slip movement on the fault. The extension of fault II northeast to meet fault III is somewhat conjectural but reasonable. The southwest portion of fault II clearly offsets pluton P_8 a distance of 4 km in a left-lateral sense but fails to offset anomaly P_1, the covered western extension of anomaly P_2. Anomaly P_2 is in turn cut by fault IX that must therefore be younger than fault II.

Fault IV appears to form a northern termination to anomaly P_{18} but may merely represent a steeply-dipping contact on the north side of a linear hypabyssal intrusion.

The plutonic-volcanic complex at V_6 probably has many associated faults. Three faults (labeled V) are identified from the aeromagnetic data, and others are shown on the geologic map.

In the east half of the map a series of inferred faults (VI, VII, VIII) strike northeast along a pronounced northeast grain in the magnetic pattern. Fault VII tends to be associated with linear valleys and must be relatively young because it appears to offset anomalies V_8, V_{10}, and V_{11}.

The plutonic rocks of the Tanana River valley are offset by a series of normal faults (IX, X, XI, XII), several of which are parallel to the valley. Fault IX corresponds to a fault on the geologic map.

A set of northeast-trending faults (XIII through XVIII) southwest of the Tanana River valley has been inferred from interruptions in the small magnetic anomalies (D) that seem to be associated with diorite intrusions. Some of these faults, in particular XIV, are located in major tributary valleys that drain to the northeast into the Tanana River valley. Faults XIII, XIV, and XVI correspond to faults indicated on the geologic map.

A short segment of the Denali fault (XIX) runs through the extreme southwest corner of the Tanacross quadrangle. This fault is a major transcurrent fault and can be inferred from aeromagnetic data in the Nabesna quadrangle (Griscom, 1975) to the south.

MINERAL DEPOSITS

Four occurrences of porphyry copper mineralization have been mentioned above; three (in P_{21}, P_{11}, and V_{12}) are near sharp magnetic highs, adjacent to known outcrops of volcanic rocks (possibly hypabyssal rocks); the fourth is near a sharp magnetic high in anomaly P_{18}. It would seem that sharp magnetic highs may be a prospecting guide to porphyry copper mineralization in this area, if they are associated with suitable hypabyssal or plutonic rocks. This association with magnetic highs is different from the associations noted in the Nabesna quadrangle where porphyry copper mineralization is found at local magnetic lows which in turn are located within much larger magnetic highs caused by intensely magnetic granitic rocks (Griscom, 1975).

The identification of anomaly area V_6 and central pluton P_{20} as a probable resurgent caldera with various associated faults and containing an additional eruptive center (V_7) concealed beneath alluvium offers a large target area for possible localized mineralization. The geochemical results indicate anomalous amounts of lead and zinc in samples from this area (Curtin and others, 1976a, 1976b).

The northeast-trending zone of faults and magnetic anomaly patterns in the east half of the quadrangle is associated with volcanic and hypabyssal rocks, especially fault VII near anomaly areas V_8, V_{10}, V_{11}, and V_{12}. This sort of environment is a likely site for mineral deposits and indeed porphyry copper mineralization is found in the vicinity of V_{12} together with altered zones rich in tourmaline (H. L. Foster, oral commun., 1975). The geochemical studies in the vicinity of V_{12} (Curtin, Day, Carten, and others, 1976; Curtin, Day, O'Leary, and others, 1976a-c) have outlined a northeast-trending area containing anomalous amounts of lead, zinc, copper, and molybdenum in secondary stream-sediment oxides.

Another area that may be of economic interest, on the basis of its magnetic patterns, is the large area of concealed volcanic rocks associated with V_{14} and associated plutons: the granitic pluton of anomaly P_{21} with porphyry copper mineralization near the outcrops of hypabyssal rocks, the syenite of anomalies P_{22} and P_{23}, and the gabbro of P_{24}. The geochemical results show that stream sediments and peat ash in Mosquito Flats contain anomalous values of zinc, copper, and molybdenum while the plutonic areas to the north and northwest contain anomalous values of molybdenum, zinc, and lead (Curtin, Day, Carten, and others, 1976; Curtin, Day, O'Leary, and others, 1976a-c) especially in peat ash and secondary stream-sediment oxides.

Various concealed or partly covered plutons and hypabyssal intrusions are described above. Apical parts of stocks or of larger plutons are classic locations for mineral deposits. For example, anomaly P_{28} is interpreted as the apex of a stock extending up from a concealed pluton (P_{29}). (A claim staked on July 18, 1975 at anomaly P_{28} suggests the existence here of a mineral deposit.) The two sharp magnetic highs in T. 15 N., R. 23 E. suggest local occurrences of hypabyssal or volcanic rocks within this granitic terrain and offer a possible explanation for the claims staked in this area.

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