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GEOLOGICAL SURVEY

Aeromagnetic interpretation map of Seward Peninsula, Alaska

(Text to accompany Open-file Report 77-796G)

by

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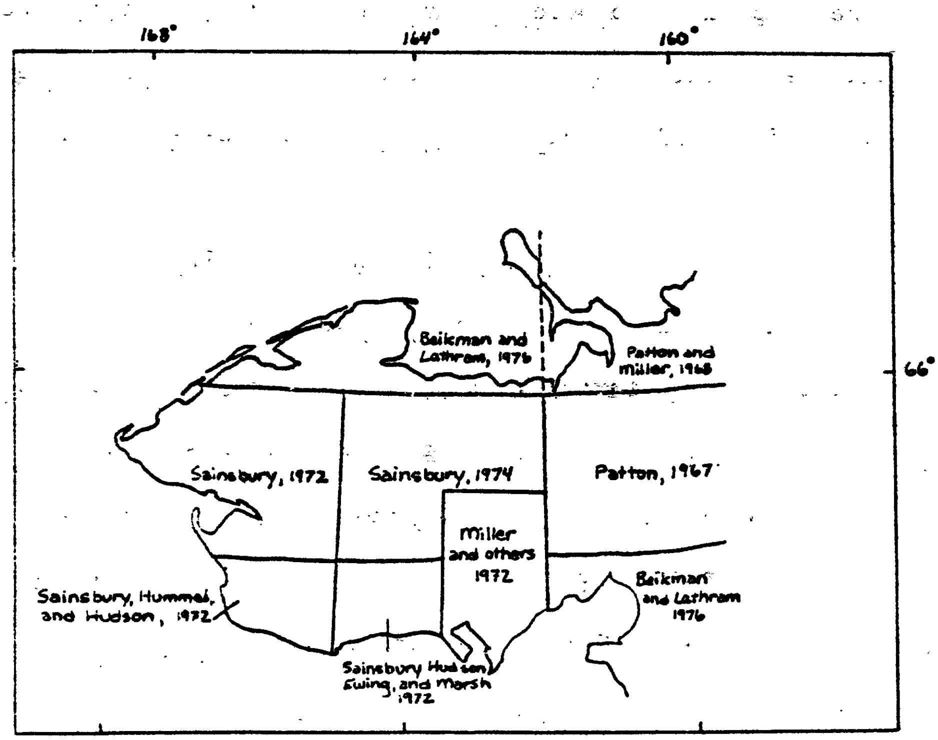
EXPLANATORY NOTE

INTRODUCTION

This report is one of a series of data components prepared as a foundation for evaluating the mineral resource potential of Seward Peninsula, Alaska. The report provides a preliminary geologic interpretation of Seward Peninsula magnetic features based on recently compiled aeromagnetic maps (Decker and Karl, 1977a, b) and previously published geologic maps (Fig. 1). No new field studies were undertaken, but results of previously published magnetic studies on Seward Peninsula (Johnson and Sainsbury, 1974, Cady and Hummel, 1976) have been incorporated.

Detailed aeromagnetic data are not available over the northwestern part of the peninsula, where outcrops are poor to non-existent and aeromagnetic data would greatly aid a geologic interpretation.

The aeromagnetic maps reflect the varying percentages of magnetic minerals, principally magnetite, in the underlying rocks. Sedimentary rocks are generally non-magnetic. On Seward Peninsula, in contrast to many other places, low grade (greenschist facies) metamorphic rocks contain some highly magnetic materials whereas higher grade (amphibolite facies) rocks are only very weakly magnetic. Some granitic rocks within the map area are highly magnetic--others are not. Quaternary basalts are magnetic, but the short wavelength anomalies which they produce do not disguise the longer wavelength and higher amplitude anomalies caused by underlying magnetic rocks. Most of the aeromagnetic lows on the map are the normal polarization lows which occur adjacent to highs due to the dipole nature of magnetic sources.



INDEX MAP SHOWING PRINCIPAL SOURCES OF GEOLOGIC DATA

FIGURE 1

METHOD OF STUDY

Anomaly trends, regions of different magnetic character, and magnetic discontinuities were identified on a colored version of the aeromagnetic map. The magnetic features were then related to mapped geology, mainly at a scale of 1:250,000, in order to identify the rock types and geologic relations apparently associated with each feature. Names and symbols of geologic units are from the companion geologic map by Hudson (1977). Except where noted, the interpretations in this report have not been field checked. They are presented in the spirit of providing multiple working hypotheses for the field geologist.

REGIONS OF DIFFERENT MAGNETIC TEXTURE

The Seward Peninsula can be divided into several regions, each with a characteristic magnetic texture. Textural features include amplitude and wavelength of anomalies, alinements of anomaly trends, and the presence or absence of closed magnetic lows. This section provides a brief overview of these regions, which are labelled T1 through T7 on the map. More detailed discussions of several of the regions are reserved for the section entitled, "Rock units and their associated magnetic anomalies".

A large portion of the Seward Peninsula over which there are detailed aeromagnetic data contains magnetic highs (those labelled A and C) with typical amplitudes between 300 and 700 gammas and typical widths of 5 to 10 km. The anomalies are elongate, widely separated from each other, and often occur in north-south trends. The region labelled T1 includes all the area of the detailed aeromagnetic map west of dash-dot line S which is not contained in regions T3 through T7.

Region T2 is the entire area east of line S. It is distinguished by a jumble of highs and lows with trends which range between north-northwest and north-northeast. Highs in region T2 have widths similar to those of region T1, but their amplitudes are greater (up to 1400 gammas) and the individual highs are more closely spaced.

Region T3, which coincides with the Kigluaik and Bendeleben Mountains, contains weak highs (typical amplitude 50 gammas). The highs almost always correlate with topographic highs.

Two regions labelled T4 contain complex patterns of highs and lows, which coincide approximately with Quaternary and Late Tertiary basalt flows.

Two regions labelled T5, which coincide with sedimentary basins, contain broad highs with amplitudes between 60 and 120 gammas, implying the presence of magnetic basement rock beneath the basins.

Region T6, over the Fish River Valley, is magnetically featureless, suggesting that the valley is underlain by a thick sequence of nonmagnetic rock.

Region T7 contains a patch of isolated, 20 to 80 gamma highs which are distinctive because they coincide with the same rock type (p€s) which, further north, gives rise to elongate high A14.

Widely spaced aeromagnetic profiles over the northwestern Seward Peninsula (Decker and Karl, 1977b) show that there is low aeromagnetic relief there, but little analysis of magnetic texture can be made from the widely spaced data. The region probably is magnetically featureless, marked by isolated magnetic highs such as that labelled 10.

ROCK UNITS AND ASSOCIATED MAGNETIC ANOMALIES

Many of the magnetic anomalies and anomaly trends correlate with mapped rock units, and the interpretation map uses these anomalies to identify regional trends in the distribution of rock units and to locate hidden portions of these rock units where concealed beneath volcanic or sedimentary cover. Some magnetic anomalies, especially in region T2, in the far eastern portion of the map area, are not readily explained by known geologic relations and map units.

The rock units and the magnetic anomalies associated with them are discussed below. The order of discussion moves generally from anomalies labelled A to anomalies labelled G - from west to east and from better understood geologic and aeromagnetic associations to more poorly understood associations. Nonmagnetic marble and limestone are discussed after the A - anomalies because they are associated with the rocks which cause the A - anomalies. The higher grade metamorphic rocks (pKmu), which lie in textural region T3, are discussed after the C-anomalies, because region T3 is partially defined by the terminations of the A- and C- anomalies.

Siliceous metasedimentary rocks (p6s) and metavolcanic rocks (p6v)

A set of aeromagnetic highs, labelled A1 through A14, commonly trend about north-south and occur over siliceous and carbonaceous metasedimentary rocks (p6s). Because the highs of this set are found over so wide an area in the Seward Peninsula, and because the highs may be caused by a rock unit which is preferentially eroded and has not been fully recognized in geologic mapping, it is useful to summarize the results of a ground magnetic study made over three of them (A1, A2, and A3) by Cady and Hummel (1976).

Surface magnetometer profiling revealed anomalies with amplitudes between 500 and 2000 gammas over peak to trough distances of 50 to 100 meters or less. From these data it was concluded that highly magnetic rocks (susceptibility 200 to 1000 X 10^{-5} gauss/oersted or total magnetization 100 to 500 X 10^{-5} gauss) are present to within 20 to 50 meters of the surface. Rock sampling was done in conjunction with the magnetometer profiling, but the rocks responsible for the surface and aeromagnetic highs could not be identified at the surface. The high susceptibility measured in surface samples was only 87 X 10^{-5} gauss. Two factors appear to be responsible for the lack of magnetic rocks at the surface. First, the magnetic highs typically occur over soil-covered slopes or grassy swales with few outcrops compared to adjacent ridges. This suggests that the rocks which are magnetic are also particularly vulnerable to erosion. Second, many of the samples contain abundant secondary iron oxide occurring as probable pseudomorphs after magnetite. This suggests that weathering has oxidized magnetite near the surface, and that unaltered magnetite, below a depth of 20 to 50 meters, causes the magnetic highs.

Johnson and Sainsbury (1974) attribute part of the anomalies over both the p€s and p€v units to small mafic intrusive bodies. A comparison of the aeromagnetic interpretation map with the geologic map (Hudson, 1977) shows that clusters of gabbro bodies do indeed coincide with small portions of highs A1, A3, A5, and A9.

These mafic bodies are probably not signficant contributors to the highs labelled A1 through A14, however, because: (1) The highs are elongate and are not localized over the small, equant mafic bodies; (2) the mafic bodies commonly occur as isolated plugs which are resistant to erosion, whereas the magnetic highs typically occur over topographic lows; and (3) ground magnetometer traverses over mafic intrusive bodies about 10 km south of Teller showed maxiumum amplitudes of 100 to 500 gammas, much lower than those measured over parts of the p€s unit (Cady and Hummel, 1976, plate 1 and p. 48, 49, profiles uu′ and yy′).

High A2 has a steep western flank and a more gentle eastern flank. Magnetic modeling (Cady and Hummel, 1976, p. 18-20) showed that a possible configuration of the source of high A2 which has a steep west flank and a very broad east flank, is a subhorizontal magnetic zone 1 to 3 km thick, exposed at the surface along the west plank of the magnetic high, but downfaulted to a depth of three or more kilometers west of the high. Other, more symmetrical highs of the A-set could be caused by anticlines in which the magnetic zone is thickened and brought close to the surface.

High A3, discussed below in connection with the pKmu unit, lies in a zone of intermediate grade between the low metamorphic grade rocks of the p6s unit and the high grade rocks of the pKmu unit. It is similar in amplitude and wavelength to the other A-anomalies.

Some of the A1 to A14 magnetic highs occur over metavolcanic and related rocks (p6v). These include most of A6 and the southwestern part of A9. The following explanations appear to be possible: (1) There are separate magnetic sources in the p6s and p6v units, and these sources occasionally line up to cause continuous trends of magnetic highs. (2) The two map units are different facies of the same time-stratigraphic unit, and the magnetic zone cuts across the facies boundary. (3) The magnetic zone is a function of metamorphic grade, and cuts across the metamorphic grade boundaries. Additional ground magnetometer profiling, sampling, and geologic mapping would be required to resolve the question, but the following relations seem pertinent: (1) The southern part of high A1 occurs over the siliceous metasedimentary rocks (p6s) and is separated, by a gap between two aeromagnetic surveys, from the northern part of the high, which occurs over metavolcanic rocks (p6v). (2) The southern part of high A5, over metavolcanic rocks, has much lower amplitude than the northern part of the high, over siliceous metasedimentary rocks, and the southern part could be considered a separate ancmaly. (3) High A9 has a northwest-trending southern part which occurs mainly over metasedimentary rocks. and north-trending northern part which occurs over siliceous metasedimentaryu rocks. These relations suggest that separate magnetic sources are present in the p€s and p€v map units and alinement of the sources leads to apparent continuity of magnetic trends.

Marble and limestone (Ml and Pzm)

In several places magnetic highs occur over exposures of marble. Because marble is normally nonmagnetic, these magnetic highs suggest that the marble rock units occur as thin sheets over underlying magnetic rock units. One example is present in the area where high A7 occurs over a mapped thrust sheet of carbonate rocks (Johnson and Sainsbury, 1974). Rough calculations of the depth to source beneath the sharpest part of the magnetic high shows that at this locality the source is at or near the surface. This indicates that the marble unit must be very thin and lends support to the mapped geologic relations.

In other areas, mapped marble units are accompanied by 20 to 30 gamma aeromagnetic lows. Calculations suggest that the marble units in these areas have probable depth extents of 1 to 3 km (Cady and Hummel, 1976, p. 20-22). The low labeled L1 north of Solomon, with an amplitude of 70 gammas, indicates a body of marble with a minimum thickness of 1 to 2 km. The study of large scale aeromagnetic maps should prove useful in future geologic investigations concerned with the extent and contact relations of marble units.

Cretaceous plutonic rocks (Kgg or Kai)

A north-south trending aeromagnetic high labelled C1 occurs over

Cretaceous granite of the Darby Mountains. Two saddles in the high, labelled 8, are caused by increased distance of the aircraft from magnetic rock units as it flew over valleys. South of lat. 64°45′ north, the high is attenuated, partly because of lower topography, but also because the exposed granite body narrows. Near lat. 65° the high splays out to the west, suggesting a subsurface extension of the granite beneath the pKmu unit. A pair of aeromagnetic highs occur at the north end of C1. The western member of the pair coincides with mapped alkalic intrusive rocks (Kai). The eastern member of the pair (labelled 3) occur over Quaternary sediments, but surely indicates either alkalic intrusive rocks (Kai) or granite (Kgg) at depth. A north-south magnetic low, not attributable to topography, separates the two members of the pair. Further south, a magnetic high (labelled 4) lies about 7 km west of C1, over Pre-Cretaceous metamorphic rocks (pKmu). It alines with a high over alkalic and related intrusive rocks (Kai) and may indicate similar rocks at depth.

If the high labelled 3 is caused by buried granite (Kgg), then there is a simple arrangement of magnetic features in the Darby Mountains. Consistently magnetic granite (Kgg) in the east is separated, by a medial zone of non-magnetic, Pre-Cretaceous metamorphic rocks (pKmu), from a western zone of spotilly magnetic alkalic and related intrusive rocks (Kai).

The trend of highs labelled C2 occurs mainly in a terrane of young basalts (QTb) discussed below. The higher amplitude, longer wavelength, and approximate north-south alinement of the C2 trend permits it to "print through" the complex anomaly pattern caused by the basalt. It appears to be a continuation, north of the Bendeleben Mountains, of trend C1. Several exposures of granite (Kgg) occurring along the C2 trend suggest that granite, buried by basalt in most places, is the source of the C2 magnetic highs. A 600 gamma high (labelled 14) over the northeastern side of Imuruk Lake marks the largest of the hidden bodies of inferred granite. In amplitude and areal extent this high is similar to the high at Kugruk Mountain (15) in trend C3, which is discussed below in connection with massive magnetite bodies. Elongate north-trending anomalies, which probably mark buried bodies of granite within the C2 trend, occur north of lat. 65°45′; but they occur partly over siliceous metasedimentary rocks (p€s) and possibly should be assigned to the A trends. The A and C trends are both oriented north-south, have similar degrees of sinuosity, and occur in terranes containing siliceous metasedimentary rocks. Both are truncated by the Kiglauik and Bendeleben uplifts, as described below. Hence it is tempting to infer that the same kinds of folds or faults which uplifted the p€s unit to form the A trends were responsible for localizing the granitic intrusions which formed the C trends.

An alinement of highs which trends north-northeast, oblique to local structures, has been labelled C3. A high at the southern end of C3 occurs over sedimentary rocks (TKs), which are probably non-magnetic and obscure the true source of the high. A central high (15) occurs over a large body of granite (Kgg), and in the north the high occurs over siliceous metasedimentary rocks (p€s). Hence trend C3 may represent a chance alinement of highs.

About 4 km northeast of the central high in anomaly trend C3 (labelled 15) is a 1000 gamma high (labelled 16) less than 2 km wide and about 3 km long, which coincides with a recently discovered deposit of magnetite at Kugruk Mountain (Hudson, Miller, and Pickthorn, 1977). The aeromagnetic data permit the presence of a magnetite deposit under the central high (which has equal magnitude and much greater area than that over the deposit) although no deposits are known here.

A pair of narrow highs labelled 17 a few kilometers south of the central high are similar in character to the high over the known magnetite deposit. Additional magnetite deposits could be present further north along trend G3, where magnetic highs have amplitudes of 800 gammas.

Quaternary basalt (QTb)

Complex patterns of highs and lows accompany most areas of Quaternary basalt, and two regions of complex anomaly pattern caused by basalts have been outlined on the map and labelled T4. Printing through the anomaly pattern caused by the basalts are trends of higher-amplitude anomalies caused by underlying magnetic units which are discussed below. East of the Kiwalik River, the anomaly pattern of the basalts is difficult to recognize against the highs caused by deeper sources.

Within a basalt field near long. 163°30′, lat.65°35′, is a ring like grouping of magnetic highs (anomaly B1) approximately 6 km in diameter. Some of the highs correlate with volcanic cones mapped by Sainsbury (1974); others do not. It is tempting to conclude that anomaly B1 marks a ring-dike, the surface expression of which is an imperfect ring of volcanic vents. Two strings of highs labelled B2 and B3 run south to southwest from anomaly B1. They may indicate thick basalt flows fed by the vents--possibly flows that filled Tertiary stream channels. Other highs (labelled B4, B5, and B6) to the south of anomaly B1 are partially caused by basalt flows, but the main highs belong to the trend labelled C2 and are apparently associated with granitic plutons.

A very coherent magnetic low labelled L2 wraps around the south and east sides of B1 and B2. The amplitude of the low is less than that of the bounding highs, so it could be explained as the normal polarization low that is expected to occur over magnetic rocks adjacent to magnetic highs. It is difficult to explain, however, why there is a continuous band of apparently nonmagnetic rocks within this area because all rocks known to be present are basaltic volcanic rocks. The low may mark a post-Cretaceous fault, downthrown to the west, for Cretaceous granitic rocks are exposed to the east but not to the west of this anomaly.

Mafic metavolcanic rocks (JPv)

A trend of weak (70 to 150 gamma) magnetic highs labelled D is roughly associated with Jurassic (?) to Permian (?) metavolcanic rocks which form an arcuate belt around the eastern and northern sides of the Darby Mountains. The anomaly trend may continue to the north or northwest (D?), but if so, it is disguised by higher-amplitude anomalies. The anomalies are interesting because they are similar in character to a trend of weak magnetic highs which mark a belt of Jurassic (?) to Permian (?) volcanic rocks which runs east-west along the south side of the Brooks Range (Cady, 1977).

Higher grade metamorphic rocks (pKmu)

A zone of low magnetic relief labelled T3 runs approximately east-west over the high grade metamorphic rocks of the Kigluaik and Bendeleben Mountains. Isolated weak magnetic highs within T3 almost always correlate with high topography, but some areas of high topography are not accompanied by magnetic highs. Hence the pKmu rocks have variable magnetic properties, varying from nonmagnetic to weakly-magnetic. The boundary of T3 is drawn to exclude magnetic highs which are not topographic in origin. For example, highs A2, A5, A6, A7, A9, C1, C2, and C3 all terminate against the boundaries of T3. Some of these highs may have formed continuous trends which were truncated when the uplift and denudation of the Kigluaik and Bendeleben Mountains exposed high grade, weakly-magnetic metamorphic rocks. Other highs which define the boundary of T3 occur in the Imruk Basin (labelled 20), in the valley of the Kuzitrin River (21), and in McCarthy's Marsh (22). The source of these weak magnetic highs, all of which occur over sedimentary basins (Barnes and Hudson, 1977), is not known. Both the high in the Imuruk Basin and the highs on the south side of McCarthy's Marsh coincide with steep gravity gradients which mark the edges of the basins. Hence the sources of the highs lie in the shallow basement rocks at the edge of the basins.

High A3, which runs approximately east-west along the south flank of the Kigluaik Mountains, occurs partly over the pЄs unit, but mainly over the higher grade, pKmu unit. The rocks of the pKmu unit in the vicinity of high A3 are intermediate in metamorphic grade between the pЄs unit and other parts of the pKmu unit to the north (Travis Hudson, oral commun., 1977). Based on the assumptions that (1) the pKmu unit is a high grade equivalent of the pЄs unit; (2) that transitional rocks, intermediate in grade between typical pЄs rocks and pKmu rocks, are more magnetic than rocks of either higher or lower grade; and (3) that metamorphic grade increases with depth--two faults are drawn on the interpretation map to either side of high A3. The inferred faults bound the intermediate grade pKmu terrane, which gives rise to high A3, from the higher grade pKmu terrane in the north and the lower grade pЄs terrane to the south.

A large body of granite in the east end of the Bendeleben Mountains (under the easternmost T3 label) has no aeromagnetic expression, and it lies between the magnetic plutons of trends C1 and C2. It would be interesting to determine what petrologic differences make the granite of the higher grade metamorphic terrane nonmagnetic.

The high grade metamorphic terrane is present to the south along the west side of the Darby Mountains, but here there is more magnetic expression than in the area of T3 because of highs associated with alkalic related intrusive rocks (Kai).

Cretaceous andesitic volcanic rocks (Kv) and alkalic and related intrusive rocks (Kai)

East of the Kiwalik River, the geology is a complex association of lower Cretaceous volcanic rocks (Kv) intruded by late Cretaceous granitic rocks (Kai), which are half-covered by Quaternary basalt and sedimentary deposits. The Quaternary rocks have little or no aeromagnetic expression, so anomalies due to older basement rocks are readily identified, but neither of the basement Cretaceous units has a consistent aeromagnetic signature.

Most of the magnetic highs of the region either occur over the volcanic Kv unit or occur over Quaternary deposits and can be traced into the Kv unit. The easiest of these anomalies to explain are labelled E1, E2, and E3, and occur over the Kv unit at the boundaries of the granitic plutons (Kai). They probably mark contact metamorphic aureoles. The second kind, labelled F1 through F14, are more elongate and trend generally north-south. Three of them, (F1, F2, and F3), have amplitudes of about 1400 gammas. The symmetry of high F1 shows that its source is approximately vertical. High F2, broader and more irregular in shape than F1 and F3, overlies the northwest trending valley of the Buckland River and its source is covered by basalt. F3 occurs over mapped volcanic and intrusive rocks. Due to its high amplitude, it appears to be caused by the same rock type as F1 and F2. The source for F3 has an irregular boundary, but its contacts are approximately vertical. Magnetic highs with amplitudes as high as F1, F2, and F3 are often caused by ultramafic rocks. A pyroxenite dike has been found in the vicinity of F1 (Miller and Elliott, 1969, p. 5). The other highs labelled F have only half the amplitude of F1, F2, and

F3.

High F4 is complex, but steeper gradients on the northwest flank probably indicate a southeast dip. A complex zone of highs north of F4 and east of F2 is probably caused by irregular pods or highly deformed sheets of magnetic rock. Other highs, labelled G1 through G4, are so similar to the F-highs that, if they did not occur over mapped granitic rocks, they would be interpreted to overlie rocks of the Kv unit. If they are indeed caused by sources within the granite, the source may be pyroxenite. Approximately 150 km northeast, in the Shungnak quadrangle, pyroxenite dikes intruding nepheline syenite have been identified as the sources of north-south trending aeromagnetic highs (Wallace and Cady, 1977).

Very limited data show a 10 to 15 mgal gravity high running north-south near long. 161°30′ (Barnes and Hudson, 1977), coincident with the belt of magnetic highs labelled F and G. The gravity and magnetic highs could both be caused by a belt of mafic and ultramafic rocks bounded on the west by line S. The magnetic anomalies suggest that the source rocks have steep dips. The azimuths of magnetic anomaly trends range from north-northwest to north-northeast, and individual anomaly trends intersect each other at oblique angles. It is possible that the sources of the magnetic anomalies were emplaced along a number of north-northwest to north-northeast trending faults, and the complex magnetic anomaly pattern could result from the intersection of the subparallel faults.

It is obvious that much more detailed geologic mapping is required to unravel the geology east of the Kiwalik River. Aeromagnetic maps of the eastern Seward Peninsula have been published by the State of Alaska at a scale of 1,63,360 and 1:250,000. Aeromagnetic interpretations at these scales would help to guide additional field work in this area.

Magnetic Lineaments

East of the Kiwalik River the magnetic anomaly pattern is very complex, but four possible discontinuities in anomaly pattern were identified and are labelled R1 through R4. These discontinuities, or lineaments, are straight lines which connect the termini of several anomalies, usually lie in magnetic lows, and do not cut across any major magnetic highs. R1 terminates highs A11, A12, and A13. It extends to the northwest to an area of weak magnetic highs over siliceous and carbonaceous metasedimentary rocks (pЄs) and to the southeast to the vicinity of a high of unknown origin (labelled 19). Lineament R1 separates mapped Pre-Cambrian rocks to the southwest from Cretaceous rocks to the northeast, so it may mark a major fault. Curved line S, however, which coincides with R1 in the southeast, achieves the same separation of Pre-Cambrian rocks from Cretaceous rocks and also separates the complex aeromagnetic pattern in the east from the simpler pattern in the west.

Lineament R2 connects the termini of several north-northwest to north-northeast trending sets of magnetic highs. Several of these anomaly trends would line up across the lineament with restoration of approximately 15 km of right-lateral displacement along the lineament. Two other lineaments, R3 and R4, are drawn through the termini of several highs, but they are not as well defined as lineaments R1 and R2.

The significance of the lineaments R1 to R4 is unknown.

Miscellaneous magnetic features

Certain magnetic features, principally highs, are identified on the map by number. Although some of the numbered features are discussed above in the text, many do not fit into the discussion. Some are caused by unknown sources which are completely buried by overlying rocks. The numbered features are listed and briefly described below. Some numbered descriptions refer to more than one occurrence of a given kind of feature on the map.

1. Highs of the A-trends occurring over Quaternary sediments or basalt indicate siliceous metasedimentary rocks (p6s) beneath the cover.

2. The north end of trend A10 crosses the boundary form siliceous metasedimentary rocks (p6s) into micaceous calc-schist (p6l), suggesting that in this area siliceous metasedimentary rocks are present beneath a thin cover of micaceous calc-schist.

3. A strong magnetic high over Quaternary sediments of Death Valley probably indicates a buried pluton (Kai or Kgg).

4. A trend of weak magnetic highs over high grade metamorphic rocks (pKmu) on the west flank of the Darby Mountains may indicate a small buried pluton (Kai?). Alternatively, the rocks may be magnetic varients of the pKmu unit like those exposed beneath trend A3.

5. An isolated high west of the Darby Mountains may indicate a buried pluton (Kai?).

6. An isolated high west of the Darby Mountains crosses the mapped boundary between siliceous metasedimentary rocks (p6s) and a pluton (Kai). The origin is uncertain.

7. Elongate, north-south trending highs near Norton Bay, similar to those of the A-trends, are probably caused by siliceous metasedimentary rocks (p6s) covered by Quaternary sediments.

8. Saddles in trend C1 are topographic effects caused by the increased height of the aircraft above magnetic terrane in valleys.

9. Lying at the edge of detailed aeromagnetic coverage, this high seems to be part of the A6 trend and is probably caused by rocks of the p6v or p6s unit covered by Quaternary sediments.

10. Lying outside the area of detailed aeromagnetic coverage in the northern part of the peninsula, this high is caused by an unknown rock type covered by Quaternary basalt.

11. Lying west of trend C2, this broad high occurs in an area of Mississippian limestone. The source of the high is unknown, but its equant shape suggests a buried pluton.

12. These weak highs lie east of trend C2, in an area covered by Paleozoic marble and Quaternary sediments. The source is unknown.

13. This high lies east of trend A14 in an area of Paleozoic marble and Quaternary sediments. It may be associated with trend A14 and may be caused by siliceous metasedimentary rocks (p€s).

14. This 1000 gamma high is the largest of several strong highs in trend C2. It is probably caused by a pluton (Kgg) buried beneath Quaternary basalt.

15, 16, 17. These highs in the C3 trend are associated with granite rocks (Kgg) and magnetite deposits. They are discussed more fully in the section on the C-trends.

18. This elongate, north-south trending high occurs east of trend A14 in an area of Quaternary sediments and Paleozoic marble. It may be caused by siliceous metasedimentary rocks (p€s).

19. This very broad high occurs in an area of Cretaceous sedimentary rocks. It may be caused by deeply buried Cretaceous volcanic rocks. A little to the northwest lies a fault, inferred from magnetic gradients, that separates exposed volcanic from sedimentary rocks.

20, 21, 22. These weak highs occur in sedimentary basins at the edge of the Kigluaik and Bendeleben uplifts. They are caused by basement rocks of unknown composition covered by Quaternary alluvium.

Summary and conclusions

The 1:1,000,000 scale aeromagnetic map and its interpretation are primarily useful for identifying regional magnetic and geologic trends and regions of different magnetic and geologic character. For mineral exploration the aeromagnetic data would be more useful at the larger scale of 1:250,000 or 1:63,360 as originally released.

Several features recognizable on the aeromagnetic map which may be useful for mineral resource exploration are listed below:

1. A number of plutons in the C1, C2, and C3 trends cause striking highs. One of these plutons has magnetite deposits associated with it, and the other plutons may be associated with magnetite deposits also.

2. Anomalies labelled E1, E2, and E3 may indicate contact metamorphic aureoles. These could have a potential for mineralization. The anomalies are very discontinuous, indicating that the aureoles are complex.

3. Several highs (20, 21, and 22) occur in sedimentary basins. These highs show that basement rock is magnetic. Detailed magnetic profiles over the basins could provide an estimate of basement depth.

4. Numerous highs occur over sedimentary rock, which is probably nonmagnetic. Study of large scale aeromagnetic maps could provide estimates of depth to magnetic, sometimes mineralized rock beneath the sedimentary units. An example occurs near the Fish River, where magnetic highs near the north end of trend A10 suggest that the magnetic, silicious, metasedimentary unit (p€s), locally associated with gold deposition on Seward Peninsula, in thinly covered by micaceous calc-schist.

5. The aeromagnetic data show that the geology is more complicated than existing geologic maps show. Regions of unexplained anomalies include the

eastern region labelled T2, where complex, high amplitude anomaly patterns suggest the presence of ultramafic rocks and possible complex faulting; and sedimentary terranes which cover magnetic rock units, such as the marble terrane under trend A12, near Norton Bay; the marble terrane under high 18, near Spafarief Bay; and the limestone terrane under the northern part of trend A7, southwest of Goodhope Bay.

6. Of particular interest is the widespread but poorly known magnetic zone within siliceous metasedimentary rocks (p€s) and possibly metavolcanic rock (p€v), which causes highs of the A-trends. Evidence cited in the discussion of the A-trends suggests that this magnetic zone is preferentially weathered and eroded, resulting in a lack of outcrops and concomitant inadequate sampling of it by geologists and prospectors.

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