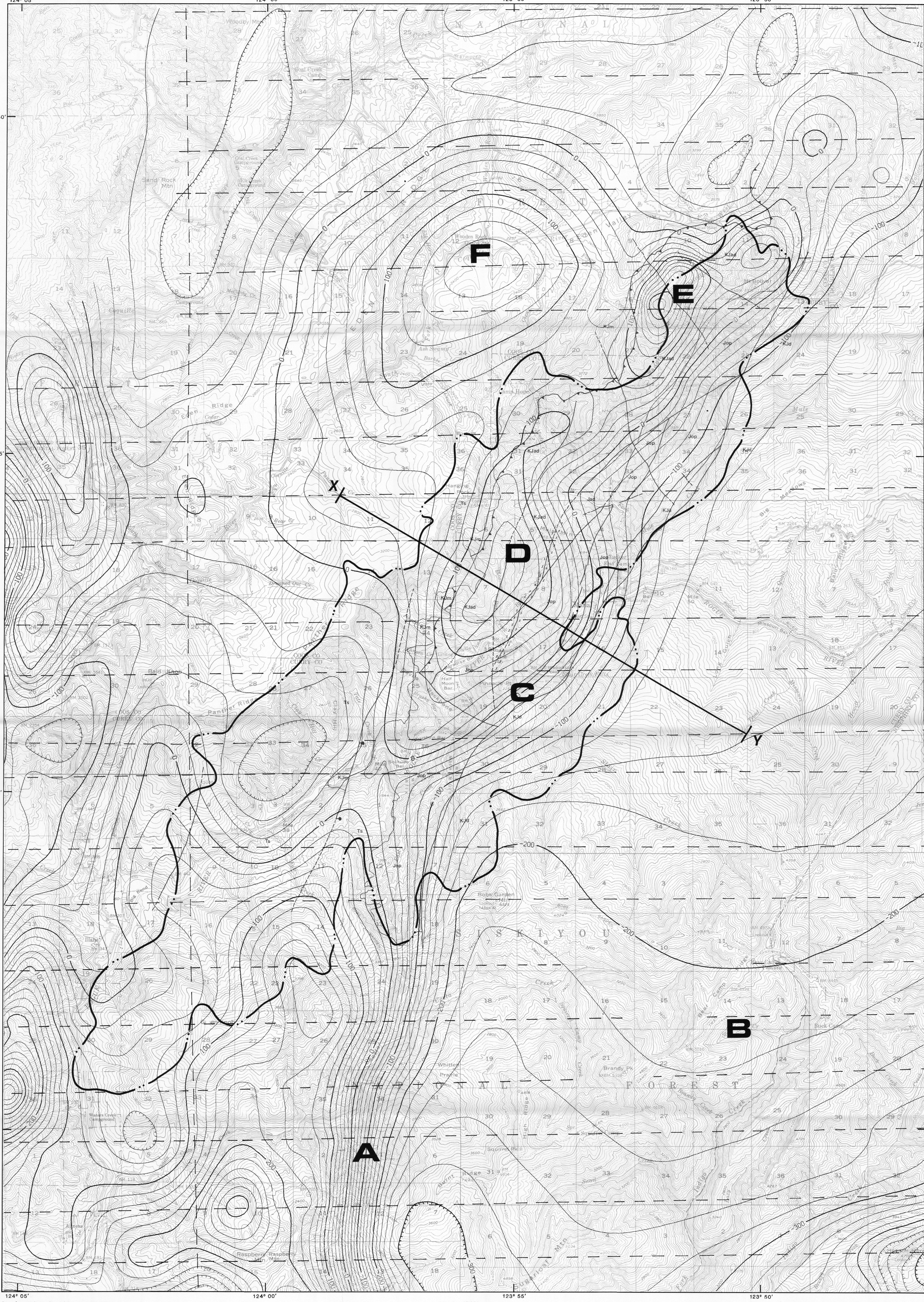
UNITED STATES GEOLOGICAL SURVEY
DEPARTMENT OF THE INTERIOR

MISCELLANEOUS FIELD STUDIES
MAP MF-1381-C



Base from U.S. Geological Survey, 1:62 500, Agness, Bone Mountain, Marial, Powers, 1954.

APPROXIMATE MEAN DECLINATION, 1982

SCALE 1:48 000

CONTOUR INTERVAL 80 FEET
DATUM IS MEAN SEA LEVEL

Geology generalized from Gray and others (1982).
Aeromagnetic survey flown and compiled by Aero Services, 1978.

CORRELATION OF MAP UNITS

Ts — TERTIARY

KJm, KJd, KJad — CRETACEOUS AND JURASSIC

Jop — JURASSIC

DESCRIPTION OF MAP UNITS

Ts — SEDIMENTARY ROCKS (TERTIARY)--As mapped, includes Tyee Formation, Flournoy Formation of Baldwin (1974), and Lookingglass Formation of Baldwin (1974). Formations are composed of sandstone, conglomerate, siltstone, and mudstone

KJm — MYRTLE GROUP (CRETACEOUS AND JURASSIC)--Includes Days Creek Formation and Riddle Formation composed of siltstone, sandstone, and conglomerate

KJd — DOTHAN FORMATION (CRETACEOUS AND JURASSIC)--Includes a sedimentary unit of graywacke and mudstone with local exposures of chert and a volcanic unit of aphanitic to porphyritic basalt

KJad — ANDESITIC TO DACITIC ROCKS (CRETACEOUS AND JURASSIC)--Andesitic flows, agglomerate, tuff, hornblende dacite, quartz diorite, and minor hypabyssal rocks comprising an island-arc sequence

Jop — OPHIOLITIC ROCKS (JURASSIC)--Basaltic greenstone, sheeted diabase dike, gabbro, serpentine

CONTACT

FAULT--Dashed where approximately located; ball and bar on downthrown side

THRUST FAULT--Sawteeth on upper plate

SHEAR ZONE

BOUNDARY OF WILDERNESS AREA

MAGNETIC CONTOURS--Showing total field anomaly in gammas. Hachures indicate closed areas of lower magnetic intensity. Contour interval 20 gammas. Letters indicate features referred to in text

FLIGHT PATH--Showing location of data

MAGNETIC AND TOPOGRAPHIC PROFILE

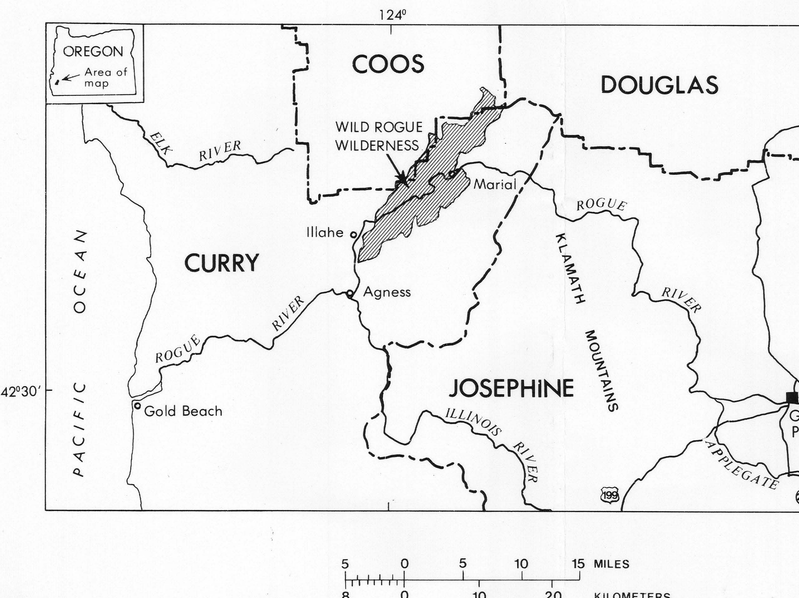


Figure 1. Index map showing location of the Wild Rogue Wilderness (NF105) and adjacent geographic features.

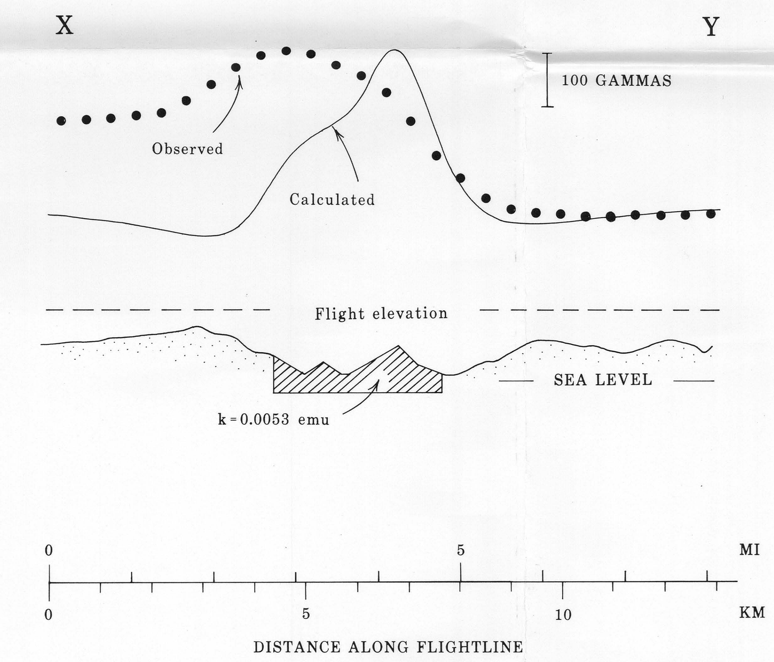


Figure 2. Magnetic model of Mule Mountain and vicinity assuming source is exposed volcanic and intrusive rocks. Location of profile shown on map as profile X-Y. The body, shown by the hachured area, is assumed to be infinitely extended in the direction perpendicular to the profile. Magnetic susceptibility, k, is in electromagnetic units (emu) and was calculated using an intensity of 0.536 oersted for the earth's field. Remanent magnetization was assumed negligible. The continuous-line profile is the calculated anomaly; the dotted profile is the observed. See text for a more complete explanation.

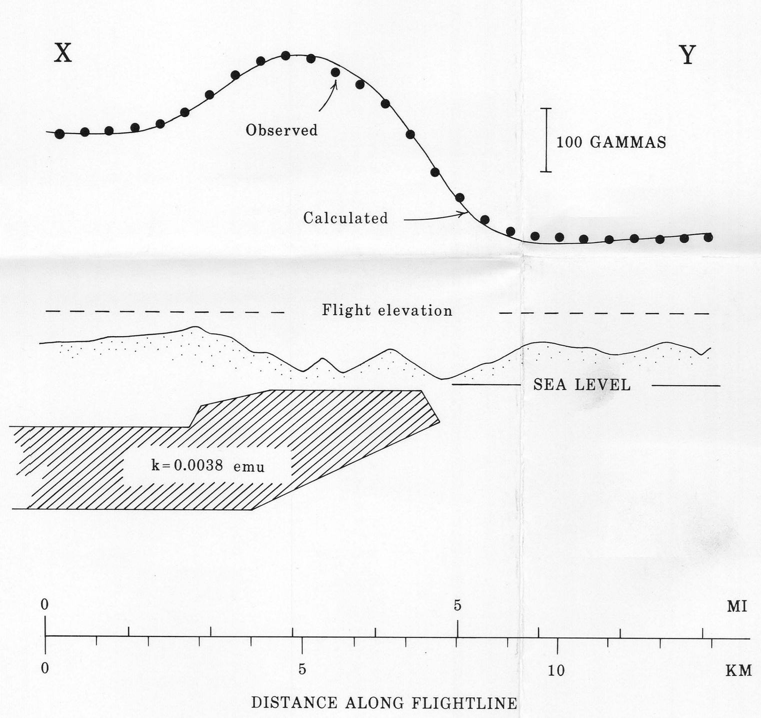


Figure 3. Magnetic model of Mule Mountain and vicinity assuming a buried source. See fig. 2 for further description.

STUDIES RELATED TO WILDERNESS

The Wilderness Act (Public Law 88-577, September 3, 1964) and related acts require the U.S. Geological Survey and the U.S. Bureau of Mines to survey certain areas on Federal lands to determine their mineral resource potential. Results must be made available to the public and be submitted to the President and the Congress. This report presents the results of a geophysical survey of the Wild Rogue Wilderness in the Siskiyou National Forest in Coos and Curry Counties, Oregon. The Wild Rogue Wilderness (NF105) was established by Public Law 95-237, February 28, 1978.

INTRODUCTION

The Wild Rogue Wilderness is located in Coos and Curry Counties, southwestern Oregon and covers part of Bone Mountain, Marial, and Agness 15-minute quadrangles (fig. 1). It is an elongate area 19 mi by 1 to 3 mi (31 km by 1.3 to 5 km) and covers approximately 35,818 acres extending from the town of Agness to Mount Bolivar.

The mapped geology of the Wild Rogue Wilderness (Gray and others, 1982) consists of a tectonic wedge of volcanic and intrusive rocks of Jurassic age surrounded on all sides by thick sequences of Jurassic, Cretaceous, and Tertiary sedimentary rocks. Normally, volcanic and intrusive rocks are more magnetic than sedimentary rocks, a property which should be reflected by the aeromagnetic data. We conclude, however, that most of the magnetic anomalies of the Wild Rogue Wilderness are caused by magnetic rocks that are not exposed but which occur at relatively shallow depth below the topographic surface.

DATA COLLECTION

An aeromagnetic survey of the earth's total field in the vicinity of the Wild Rogue Wilderness was flown and compiled in 1978 by a private contractor as part of a larger survey of the Medford 1°x 2° quadrangle (USGS, 1979). East-west flightlines, spaced 5250 ft (1600 m) apart, were flown at a constant barometric elevation of 4400 ft (1372 m) above sea level. One north-south line was flown through the map area to aid in compilation. To produce the map, the International Geomagnetic Reference Field (IGRF) updated to 1978.5 was subtracted from the original flightline data, the flightline data were interpolated to a rectangular grid with a 1640 ft (500 m) spacing, and the gridded data were machine-contoured at a contour interval of 20 gammas.

INTERPRETATION

The most striking feature of the aeromagnetic map is a linear north-south gradient (A) that separates the subdued anomalies (B) associated with the Dothan Formation to the east from high-amplitude, short-wavelength anomalies to the west. The gradient continues 8 mi (13 km) south of the map, closely following this contact, where it is coincident with the edge of a thin sheet of ultramafic rock thrust from the west over the Dothan Formation. Modeling experiments suggest that the ultramafic sheet is the source of the short-wavelength, high-amplitude anomalies at this southern extremity (Blakely and others, 1982). Near the southern edge of the Wild Rogue Wilderness aeromagnetic map, short-wavelength, high-amplitude anomalies overlie a widespread gabbroic unit that is unconformably overlain by Tertiary sedimentary rocks (Page and others, 1981). It seems likely, therefore, that many of the anomalies west of gradient A are caused by widespread mafic or ultramafic rocks buried at shallow depth below the sedimentary rocks. We cannot say from the magnetic data whether these rocks occur as a continuous sheet with variable magnetic properties or as a discontinuous sequence of tectonic wedges.

At about lat 42°40' N., the north-south gradient broadens and abruptly shifts to a northeasterly trend (C). Most of the Wild Rogue Wilderness is covered by this broad gradient and an associated positive anomaly (anomaly D). Geologic mapping (Gray and others, 1982) shows that this gradient and anomaly overlie a tectonic wedge of volcanic and intrusive rocks surrounded by Jurassic and Tertiary sedimentary rocks on the west and by the Dothan Formation on the east. As volcanic and intrusive rocks are usually more magnetic than sedimentary rocks, it is reasonable to assume that they are the source of anomaly D. However, the gradients that form anomaly D are too broad to be caused by rocks exposed at the surface. Moreover, the topographic features within the wedge should produce numerous short-wavelength magnetic anomalies if the surface rocks are the main magnetic sources.

Figure 2 shows a simple modeling experiment to demonstrate that gradient C and anomaly D must be caused by subsurface rocks. Profile X-Y, directly across the wilderness, was extracted from the aeromagnetic data and a magnetic model was constructed assuming the volcanic rocks are uniformly magnetized and that the surrounding sedimentary rocks are nonmagnetic. Consequently, the upper surface of the model conforms to the topography directly below the profile and the east and west ends correspond to the contacts of the volcanic wedge. The model incorporates two simplifying assumptions: the topography and anomaly are linear over large distances perpendicular to the profile and the remanent magnetization of the volcanic rocks is negligible compared to the induced magnetization. Errors induced by either of these assumptions will not greatly affect our conclusions. The magnetic profile produced by this model is shown superimposed on the observed profile. The peak of the observed anomaly is displaced more than 1 mi (2 km) west and has a much broader shape than the calculated anomaly. Reasonable adjustments of the dips of the two ends of the body, of the depth of the bottom of the body, or of the direction of magnetization will not appreciably improve the agreement of the calculated and observed profiles. Moreover, the discrepancy between the observed and calculated profiles would be even greater if the profile had been taken over one of the large topographic features in the vicinity, such as Mule Mountain about 1 mi (2 km) north of profile X-Y. Hence, the mapped wedge of exposed volcanic and intrusive rocks of the Wild Rogue Wilderness is probably not the source of anomaly D and gradient C.

To investigate the general depth and size of the source of gradient C and anomaly D, a model was constructed by trial and error that produces a profile in close agreement with the observed profile. The result is shown in figure 3. The calculated body is a relatively thin sheet that ends abruptly near the eastern edge of the volcanic wedge. Because of our simplifying assumptions and the non-uniqueness of magnetic modeling, the exact shape of the model is not of particular significance. We conclude only that the upper surface of the body is at shallow depth (< 1640 ft (500 m)) below the surface, that the body may be relatively thin (< 1 mi (2 km)), and that it is probably a buried sheet of mafic or ultramafic material. Moreover, its extension to the west suggests that the mapped thrust fault along the western boundary of the volcanic wedge and the numerous normal faults within the wedge may not extend much below sea level. All of these conclusions are consistent with the geologic interpretations of Gray and others (1982).

Anomaly E is over the dacite of Saddle Peaks and is the only substantial anomaly within the wilderness that is caused by rocks cropping out at the surface. Although this region of the dacite is sufficiently magnetic to produce a substantial anomaly, elsewhere the dacite appears only weakly magnetic. Mount Bolivar, for example, is a larger topographic feature than Saddle Peaks, and is composed of the same dacitic lithology, but produces only a subdued magnetic anomaly. Dacite and andesite samples from the Wild Rogue Wilderness have high magnetite contents (Gray and others, 1982) that may explain anomaly E. Gray and others also note the presence of massive sulfide deposits in the Mount Bolivar region, and any associated hydrothermal alteration may have destroyed magnetite over a wide area. Apparently, anomaly E reflects a relatively unaltered part of the dacite at or near the topographic surface.

Anomaly F is located outside the wilderness but may have an impact on the mineral potential of the area. Its circular shape and broad gradients are typical of anomalies caused by magnetic plutons, in this case located several miles below the elevation of the aeromagnetic survey. The emplacement of a buried pluton often has profound effects on the mineralization of surrounding rocks, but there is no evidence of metamorphism of the Jurassic sedimentary rocks in this region. We prefer to interpret anomaly F as being caused by an especially magnetic wedge of the same mafic or ultramafic unit that is postulated to cause gradients A and C and anomaly D. The latter conclusion is supported by the fact that anomaly F and D and gradient C appear connected.

CONCLUSIONS

Only a small region of the Wild Rogue Wilderness has rocks at the surface sufficiently magnetic to produce an aeromagnetic anomaly (anomaly E). The area of this anomaly is underlain by the dacite of Saddle Peaks. Elsewhere the same dacite is much less magnetic so it is possible that anomaly E reflects a relatively unaltered part of the dacite.

Except for this one region, the volcanic and intrusive rocks exposed at the surface are not the source of the major anomalies of the wilderness, but modeling experiments indicate that the source may be less than 1640 ft (500 m) below the topographic surface. Considering the exceptionally linear extension of gradients C and A to gabbro outcrops at the southern edge of the map and to ultramafic outcrops 8 mi (13 km) south of the map, we conclude that gradients A and C, anomaly D, and many of the anomalies west of gradients A and C are caused by variations in the magnetization of a thin but widespread tectonic slice of mafic or ultramafic rocks. If this sheet has mineral potential, such as chromite, where it crops out to the south, then it is possible that similar potentials exist at relatively shallow depth in the Wild Rogue Wilderness.

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MAP AND INTERPRETATION OF AEROMAGNETIC DATA FOR THE WILD ROGUE WILDERNESS, COOS AND CURRY COUNTIES, OREGON

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1983

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