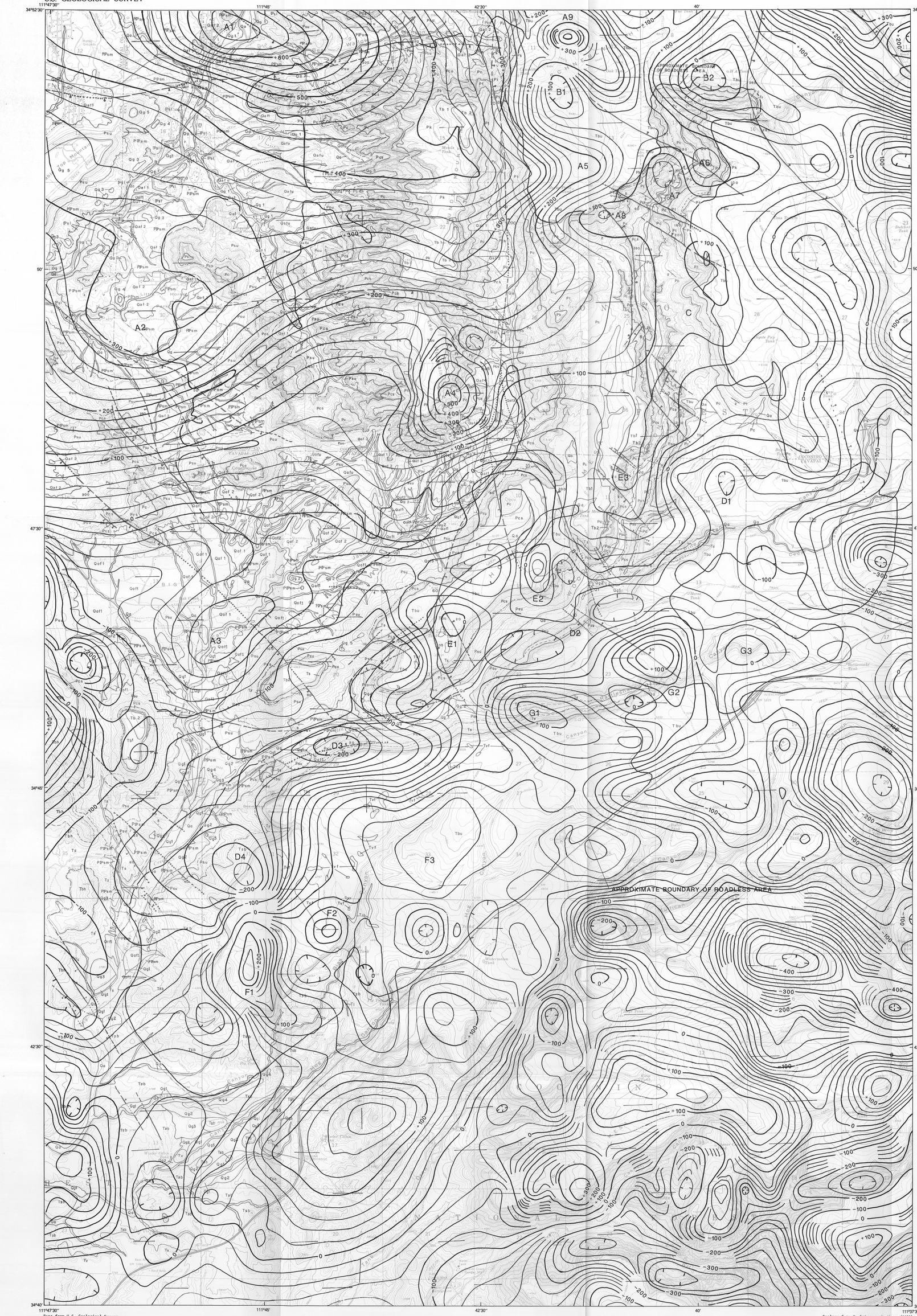
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-1567-C



Base from U.S. Geological Survey,
Casner Butte, 1965; Lake Montezuma, 1969;
Munds Mtn., 1965; Sedona, 1969.

Geology from Karlstrom and others (1983)

EXPLANATION

MAGNETIC CONTOURS--Represent total-intensity magnetic field value of Earth, in gammas. Contour interval 20 gammas. Hachures indicate areas of low magnetic intensity. Survey flown and data compiled by High Life-QEB, Inc., Denver, Colo., in May 1981 under contract to the U.S. Geological Survey. Regional field removed; IGRF 1975 (Barraclough and Fabiano, 1978) updated to month flown; datum base arbitrary

A1 ANOMALIES--Discussed in text

FLIGHT PATH--Flight level 1,000 ft above ground level; Flight-line spacing 0.5 mi

APPROXIMATE BOUNDARY OF ROADLESS AREA

CONTACT--Dashed where approximately located; short-dashed where inferred; dotted where concealed

FAULT--Dashed where approximately located; short-dashed where inferred; dotted where concealed. Bar and ball on downthrown side. Figure indicates estimated amount of displacement in feet

OUTCROP--Fort Apache(?) Member of Supai Formation

STRIKE AND DIP OF BEDS

SLUMP FRACTURE

(Note: The following correlation, description of map units, and list of symbols are for the geologic base map shown in gray.)

CORRELATION OF MAP UNITS

Qa	Qg1	Qaf1	Qt						Holocene and Pleistocene		QUATERNARY
	Qg2	Qaf2		Qafu							
	Qg3	Qaf3									
	Qg4	Qaf4							Pliocene(?)		
	Qg5										
UNCONFORMITY											
	Tb2		T1	Tbh	Tsb	Tv	Tvf	Ts	Pliocene, Miocene, Oligocene, and lower rocks		TERTIARY
Tbu	Tb1										
UNCONFORMITY											
Pk									Lower Permian		PERMIAN
Pt											
Pc											
Pcs											
Psu											
PPsm									Upper Pennsylvanian		PENNSYLVANIAN
UNCONFORMITY											
PPsl											

DESCRIPTION OF MAP UNITS

Qa FLOODPLAIN ALLUVIUM (QUATERNARY)--Modern floodplain deposits and lower terrace deposits that are periodically flooded

Qg1 to Qg5 TERRACE GRAVEL (QUATERNARY)--Unit Qg1 is the youngest terrace; oldest gravels (Qg5) may be late Tertiary in age

Qaf1 to Qaf4 ALLUVIAL-FAN AND COALESCENT-FAN DEPOSITS (QUATERNARY)--Unit Qaf1 is the youngest fan deposit

Qafu ALLUVIAL-FAN COMPLEXES, UNDIVIDED (QUATERNARY)--Deeply dissected and terraced fan deposits. Present in Marges Draw, southeast of Sedona, and in lower Jacks Canyon

Qt TRAVERTINE DEPOSITS (QUATERNARY)

Tbu BASALT FLOWS AND PYROCLASTIC DEPOSITS, UNDIVIDED (TERTIARY)

Tb1 and Tb2 BASALT FLOW(S) AND PYROCLASTIC DEPOSITS (TERTIARY)--Unit Tb1 is the older flow

Ti BASALT INTRUSIVE (TERTIARY)--Dikes and plugs

Tbh BASALT FLOWS AND LACUSTRINE DEPOSITS (TERTIARY)--Basalt flows near House Mountain, west of lower Dry Beaver Creek; includes undivided complex of marginal lacustrine facies and intercalated basalt flows

Tsb SEDIMENTARY ROCKS AND BASALT (TERTIARY)--Undivided complex of interbedded conglomerate, mudstone, and dense limestone, and intercalated basalt flows; unit largely mantled by colluvium and locally slumped. Mapped east of lower Dry Beaver Creek; probably contains both Verde and pre-Verde deposits

Tv VERDE FORMATION (TERTIARY)--Lacustrine facies composed of mudstone, marlstone, and limestone

Tvf VERDE FORMATION FLOAT (TERTIARY)--Marlstone and limestone clasts, and local areas of stromatolitic limestone encrustation on surfaces of basalt flows

Ts MAINLY PREVOLCANIC SEDIMENTS (TERTIARY)--Conglomeratic facies containing interfingering mudstone, marlstone, and limestone beds. Conglomerate composition varies from monolithologic gravels from local Paleozoic rocks to gravels of mixed lithologies reflecting both local and more distant rock sources

Pk KAIBAB FORMATION (LOWER PERMIAN)--Gray to reddish-buff dolomite, limestone, and sandstone

Pt TORONEAP FORMATION (LOWER PERMIAN)--Grayish, medium-bedded sandstone facies. Bottom of formation mapped at conspicuous change in lithology, weathering characteristics, and topographic expression

Pc COCONINO SANDSTONE (LOWER PERMIAN)--Grayish, medium- to thick-bedded sandstone; largely eolian

Pcs TRANSITION ZONE BETWEEN COCONINO SANDSTONE AND SUPAI FORMATION (LOWER PERMIAN)--Interbedded white and red sandstone and siltstone. Top of unit mapped at top of uppermost red siltstone

Psu SUPAI FORMATION, UPPER PART (LOWER PERMIAN)--Reddish, thin- to medium-bedded siltstone and sandstone. Top of formation mapped at top of Fort Apache(?) Member that forms a limestone marker bed 5-25 ft thick; bottom at top of Rancho Rojo Member of Schnebly Hill Formation of Blakely (1979). Equivalent to most of "A" member of McKee (1945)

PPsm SUPAI FORMATION, MIDDLE PART (LOWER PERMIAN AND UPPER PENNSYLVANIAN)--Purplish-red, thin- to medium-bedded sandstone containing intraformational conglomerates. Equivalent to "B" member of McKee (1945)

PPsl SUPAI FORMATION, LOWER PART (UPPER PENNSYLVANIAN)--Gray to brown, limey conglomerate, siltstone, and sandstone. Equivalent to "C" member of McKee (1945)

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 an aeromagnetic survey of the Rattlesnake Roadless Area (03054) in the Coconino National Forest, Coconino and Yavapai Counties, Ariz. The Rattlesnake Roadless area was classified as a further planning area during the Second Roadless Area Review and Evaluation (Rare II) by the U.S. Forest Service, January 1979.

INTRODUCTION

The Rattlesnake Roadless Area covers 32,870 acres between long 111°37'30" and long 111°47'30" W. and between lat 34°40' and lat 34°45'N., Coconino and Yavapai Counties, in central Arizona. Sedona and Oak Creek, the nearest population centers, are located, respectively, at the northwest corner and along the west boundary of the roadless area.

The Rattlesnake Roadless Area includes the deeply embayed Mogollon Rim margin of the Colorado Plateau Province and part of the Verde Valley. The Verde Valley is a deeply dissected lacustrine basin, one of several tectonic basins in the Arizona transition zone that separate the Basin and Range Province from the Colorado Plateau Province. Here the plateau surface falls off abruptly to the Verde Valley, drained by the Verde River, the master stream of the region.

The highest point in the roadless area is 6,834 ft at the basalt cap at the north end of Munds Mountain. The lowest point, about 3,480 ft, is along Dry Beaver Creek, near the southwest corner of the roadless area. The maximum relief, more than 2,000 ft, occurs between the Munds-Lee Mountain divide and the valley floors of bordering Oak Creek and Jacks Canyon. The relief between floor and upper canyon rims along the steep-walled and narrow Woods Canyon ranges from 980 ft to more than 1,400 ft; the east side of the canyon has the highest walls.

Canyon rims in the roadless area are accessible by several four-wheel-drive trails across the plateau surface from points along Schnebly Hill Road and Highway I-17. Access to Jacks Canyon is by road and four-wheel-drive trail to Jacks Canyon Tank, about 4 mi up the canyon from Highway 179. Access to the head of Jacks Canyon is by foot or horse along a well-maintained trail. Access to the bottom of Woods Canyon is by four-wheel-drive vehicle for about 2 mi from Highway 179 and then by pack trail for about 5 mi more.

AEROMAGNETIC INTERPRETATION

The dominant aeromagnetic anomaly of the Rattlesnake Roadless Area is magnetic high A1, centered on Oak Creek east of Sedona, along the northwest boundary of the roadless area. The broad, generally uniform gradient of the magnetic-contour pattern reflects rocks beneath the surface. The Permian and Pennsylvanian rocks exposed in the area of this anomaly show very little magnetic contrast, and Tertiary surface basalt flows are missing. Pennsylvanian sedimentary rocks (PPsl), the oldest rocks in the roadless area, crop out coincident with the apex of magnetic-high anomaly A1. Faults that tend to enclose the anomaly on the south and east are downdropped away from the anomaly apex.

The faults near the apex of anomaly A1 and faults between anomalies A2 and A3 generally trend across magnetic-contour lines, but the fault east of Munds Mountain, along the upper part of Jacks Canyon, is expressed by an intense magnetic gradient. The Jacks Canyon fault is evident in the magnetic pattern as far south as anomaly E1, and the prominent north-south-trending fault along Woods Canyon causes an elongate magnetic pattern. The Woods and Jacks Canyon faults are part of a north-south-trending regional fault system that extends northward to the Grand Canyon (T. N. V. Karlstrom, oral commun., 1982). The high-amplitude, relatively uniform magnetic gradient around the apex of anomaly A1 suggests that Precambrian basement rocks have been uplifted and that faulting in Jacks and Woods Canyons may mark the eastern margin of the uplift. Possibly the Precambrian basement rocks were uplifted along the faults by an intrusive body having high magnetic susceptibility that juxtaposed the basement rocks and possibly mafic intrusive rocks against sedimentary rocks capped with basalt flows (Tbu, Tb1, Tb2); rock samples taken from drill holes near Sedona show mafic intrusions into the Precambrian basement (T. N. V. Karlstrom, oral commun., 1982).

Magnetic anomalies over Little Horse Park (A2), Big Park (A3), Lee Mountain (A4), Munds Mountain (A5), and Schnebly Hill (A9) mark the perimeter of anomaly A1. Mafic rock in the subsurface possibly accounts for the magnetic high over Little Horse Park (A2); a basaltic dike (Ti) intrudes Paleozoic rocks in the Devils Dining Room area on the northeast flank of anomaly A2. The magnetic high over Big Park (A3) possibly relates to mafic rocks in the subsurface. The apex of Lee Mountain magnetic high (A4) is centered over the intrusive basalt (T1) cap, but the shape and gradient of the anomaly suggest a large feeder body of mafic rock beneath the surface. The eastward-trending magnetic-high ridge (A5) radiating from anomaly A1 across Munds Mountain also possibly relates to mafic rocks in the subsurface. The crest of the magnetic ridge (A5) lies along a single flight line, but magnetic gradients between flight lines across Munds Mountain suggest that the data are not spurious; the magnetic ridge extends through the low-amplitude magnetic high (A6) in Woods Canyon that probably also relates to intrusive rocks in the subsurface. The magnetic lows (A7, A8) that mark the southern edge of the basalt flows between Jacks and Woods Canyons on the south flank of anomaly A5 are possibly caused by magnetic edge effects resulting from topographic truncations of the basalt flows and pyroclastic deposit (Tbu) and by the elevation of the magnetometer probably more than 1,000 ft above the Woods Canyon floor. The magnetic high over Schnebly Hill (A9) probably relates to intrusive rocks beneath the basalt flows and pyroclastic deposits (Tbu). Mafic intrusive rocks at Schnebly Hill have been reported (Mears, 1949). The elongate shape of anomaly A9 and the steep gradient between A9 and B1 suggest that the northwest-trending fault mapped southeast of Schnebly Hill extends across Schnebly Hill between the two magnetic closures and that Paleozoic rocks covered with basalt flows (Tbu) are juxtaposed against mafic intrusive rocks capped with basalt flows (Tbu). Anomalies A2, A3, A4, A5, A6, and A9 probably represent the magnetic expressions of near-surface intrusive rocks that are related to the mafic rocks that have intruded the Precambrian basement and whose placement was controlled by the faults associated with the postulated uplift at A1.

The magnetic low over Schnebly Hill (B1) and the magnetic low at the north end of Woods Canyon (B2) occur over a structural horst and a tilted fault block, respectively, where basalt flows (Tbu) have been thinned by erosion. The lows probably reflect the low magnetic susceptibility of the underlying Paleozoic rocks that have been uplifted.

The magnetic-high ridge (C) extending southeastward along the east boundary of the roadless area is bounded on the east and south by broad magnetic lows interpreted to relate to Paleozoic sediments beneath basalt flow (Tbu) cover. Anomaly C possibly marks the east edge of subsurface rocks responsible for magnetic high A1, but probably reflects primarily the magnetic-susceptibility contrast of the contact between the Toroweap Formation (Pt) and the basalt flows (Tbu).

A northeast-trending line of magnetic lows (D1, D2, D3, D4) parallels Dry Beaver Creek and Pine Tank Canyon. This line of low-amplitude magnetic closures is probably caused primarily by topographic edge effects of basalt flows (Tbu) that are exposed in the canyon walls and contrast magnetically with the relatively nonmagnetic sedimentary rocks in the canyon floors. The direction of flight relative to the topography caused the magnetometer to be more than 1,000 ft above the canyon floor and the increased distance between the magnetometer and the magnetic source probably enhanced magnetic lows D1, D2, D3, and D4. The northeast-trending line of magnetic-low closures shown on the low-altitude magnetic map is represented on the regional aeromagnetic map (Sauck and Sumner, 1970) as a northeast-trending steepened magnetic gradient; the basalt flows were not sensed by the high-level survey. The regional survey shows the magnetic character of the rocks to change from broad closed magnetic lows south of the steepened magnetic gradient to a relatively uniform gradient that increases by about 500 gammas to the apex of magnetic high A1. The northeast-trending regional magnetic feature possibly represents a deep structural break along Dry Beaver Creek and Pine Tank Canyon that marks the boundary between predominantly sedimentary rocks to the south and southeast and magnetic high A1, where a mafic intrusive has possibly uplifted Precambrian basement rocks. The postulated deep structural break possibly controlled placement of small mafic intrusives such as those suggested by the low-amplitude magnetic highs along Woods Canyon southeast of Horse Mesa (E1, E2, E3).

CONCLUSIONS

Aeromagnetic data across the Rattlesnake Roadless Area show the geophysical expressions of the major geological features. The dominant magnetic high centered near Sedona is postulated to be caused by uplifted Precambrian rocks that overlie an intrusive body having high magnetic susceptibility. The steep magnetic gradient east of Munds Mountain, along Jacks Canyon, reflects the Jacks Canyon fault and marks the east edge of the postulated uplift. Magnetic highs around the perimeter of the area of postulated uplift suggest that faulting may have controlled placement of small intrusives and that the small intrusives probably are related to the mafic intrusive beneath the dominant magnetic high.

The northeast-trending line of closed magnetic lows along Dry Beaver Creek is probably caused by topographic edge effects of basalt flows and pyroclastic deposits (Tbu) exposed in the canyon walls. This line of magnetic lows is represented on the high-level regional survey (Sauck and Sumner, 1970) as a steepened magnetic gradient; surface and near-surface basalt flows are not evident on the high-level aeromagnetic map. The northeast-trending regional magnetic feature possibly represents a deep structural break that marks the south and southeast margins of the area postulated to be uplifted by a mafic intrusive.

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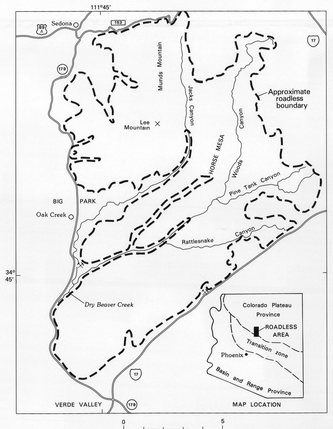

Figure 1.--Index map showing location of the Rattlesnake Roadless Area (03054).

SCALE 1:24 000

1 MILE

1 KILOMETER

CONTOUR INTERVAL 20 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

AEROMAGNETIC MAP OF THE RATTLESNAKE ROADLESS AREA, COCONINO AND YAVAPAI COUNTIES, ARIZONA

By

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