UNITED STATES GEOLOGICAL SURVEY
DEPARTMENT OF THE INTERIOR

MISCELLANEOUS FIELD STUDIES
MAP MF-1555-B

AEROMAGNETIC MAP OF THE WEST CLEAR CREEK ROADLESS AREA, COCONINO AND YAVAPAI COUNTIES, ARIZONA

By
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1983

Base from U.S. Geological Survey
Long Valley, Calloway Butte, Buckhorn Mountain, 1965; Walker Mountain, Camp Verde, 1969; Hackberry Mountain, 1967

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET

Geology by George E. Ulrich, 1980

Aeromagnetic survey flown and compiled by Airmag Surveys, Inc., 1980

CORRELATION OF MAP UNITS

QTs	Pliocene(?) and Miocene	QUATERNARY AND TERTIARY
Unconformity		
Tvm Tvs	Middle(?) and Lower Triassic	TRIASSIC
Unconformity		
Pz		PERMIAN AND PENNSYLVANIAN

DESCRIPTION OF MAP UNITS

QTs SEDIMENTARY ROCKS AND SURFICIAL DEPOSITS (QUATERNARY AND TERTIARY)--Silt, sand, gravel, conglomerate, limestone, claystone, and marl. Includes the Verde Formation of Pleistocene and Tertiary age

Tvm MAFIC VOLCANIC ROCKS (PLIOCENE(?) AND MIOCENE)--Basalt and andesite; lava flows, dikes, plugs, and pyroclastic vent deposits

Tvs SILICIC VOLCANIC ROCKS (PLIOCENE(?) AND MIOCENE)--Dacite and rhyolite tuff; nonwelded ash flows and airfall deposits

Rm MOENKOPI FORMATION (MIDDLE(?) AND LOWER TRIASSIC)--Conglomerate, sandstone, and siltstone. Occurs only in northeast corner of map area

Pz PALEOZOIC SEDIMENTARY ROCKS (PERMIAN AND PENNSYLVANIAN)--Kaibab Formation (dolomite, limestone, and sandstone) and Coconino Sandstone of Permian age, and Supai Formation (siltstone, sandstone, limestone, and dolomite) of Permian and Pennsylvanian age, undivided

CONTACT

FAULT--Dashed where inferred; bar and ball on downthrown side; dotted where concealed

LIMIT OF GEOLOGIC MAPPING WHERE NOT BOUNDED BY MARGIN OF ROADLESS AREA

APPROXIMATE BOUNDARY OF ROADLESS AREA--Dotted to aid legibility

MAGNETIC CONTOURS--Showing residual total intensity of earth's magnetic field in gammas. Regional field (IGRF, 1975) updated to months flown has been removed. Hachured to indicate closed areas of lower magnetic intensity. Contour intervals 20 and 100 gammas

FLIGHT LINE--Showing location and spacing of data

MAGNETIC ANOMALY--Referred to in text and shown on map

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 of 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 West Clear Creek Roadless Area in the Coconino National Forest, Yavapai and Coconino Counties, Ariz. West Clear Creek Roadless Area (03A07) 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 West Clear Creek Roadless Area lies within the Coconino National Forest in central Arizona (fig. 1) and includes parts of Yavapai and Coconino Counties. Camp Verde, the nearest population center, is approximately 7 miles (11 km) west of the area. West Clear Creek canyon begins on the east at the confluence of the incised gorges of Willow Valley and of Clover Creek and is joined toward the west by Black Mountain Canyon. The canyon of West Clear Creek is very rugged; in several places it is more than 1,900 ft (580 m) deep. Creek elevation ranges from 6,100 ft (1,860 m) near the junction with Clover Creek to 3,200 ft (975 m) at the mouth of the canyon. The elevation of peaks and ridges near the canyon range from 4,000 ft (1,220 m) to 7,000 ft (2,135 m). Uplands at the head of Willow Valley and Clover Creek reach elevations up to 7,100 ft (2,165 m) above sea level.

The greater part of the surface is underlain by late Tertiary volcanic rocks, mainly alkali olivine basalts. These overlie Lower Permian sedimentary rocks consisting mostly of dolomite, limestone, and sandstone strata that dip gently westward. Late Tertiary and Quaternary sedimentary rocks and deposits mantle several ridges (terrace gravels) and cover basalt flows in Verde Valley at the west end of the area (Verde Formation). Quaternary alluvial deposits occur in the main West Clear Creek drainage and its larger tributaries at the west end of the area.

AEROMAGNETIC DATA

Data for the aeromagnetic map of the West Clear Creek Roadless Area (see map) were collected in 1980 by Airmag Surveys, Inc., for the U.S. Geological Survey. Total magnetic intensity measurements were made along east-west flight lines about 0.8 km apart and flown at an average altitude of 985 ft (300 m) above the ground surface. A regional magnetic field (International Geomagnetic Reference Field of 1975) updated to months flown was removed from the data and a constant of 50,800 was added to the adjusted total field intensity values.

The aeromagnetic map shows an irregular pattern of small high-gradient anomalies in the central and western parts of the area, and general low magnetic relief in the eastern part. The anomalies are caused by contrasts in magnetic properties of the various rock units. Basaltic rocks generally contain comparatively large amounts of magnetic minerals, mainly magnetite, and therefore possess stronger intensities of magnetization than the more silicic volcanic rocks of lower magnetite content. Sedimentary rocks usually contain little or no magnetite, and are considered here to be essentially nonmagnetic. The high magnetic gradients that bound most of the anomalies indicate that their sources are exposed or lie in the shallow subsurface.

INTERPRETATION OF MAGNETIC FEATURES

Low magnetic gradients occur over the pre-Tertiary sedimentary rocks bordering Clover Creek and Toms Creek and along the east side of Willow Valley in the western part of the area. Between Toms Creek and West Clear Creek, a broad magnetic high (A) of small amplitude suggests relief on the Precambrian basement surface or an intrusive body located at considerable depth. A linear magnetic gradient on the southeast side of the high coincides with the northeasterly-trending Toms Creek fault. The gradient continues northeastward and suggests that the fault extends in that direction, perhaps, as far as Long Valley on the east side of the area. Near the head of Willow Valley, thin basalt flows, cause a weak magnetic high (B) that is superimposed on the low gradients associated with the sedimentary rocks.

West of Willow Valley, low magnetic relief characterizes thin volcanic rocks along the north rim of West Clear Creek canyon and a minor magnetic low (C) occurs over pyroclastic materials and small flows underlying low hills near Maxwell Park. Reversed or abnormally directed magnetization in flows near the hills may be the main source of the magnetic low. A prominent magnetic high (D) indicates a thicker accumulation of basalt flows on Snake Ridge to the northwest on the margin of the roadless area.

West of Bear Canyon, magnetic lows (E) mark the sedimentary rocks exposed along canyons on the south side of West Clear Creek and weak magnetic intensity is expressed by thin volcanic rocks on the upland. Magnetic maxima (F) are coincident with thicker parts of the volcanic sequence occurring under Calloway Butte and near Tule Butte. To the south, a small minimum (G) indicates a thin basalt cover similar to anomaly "E" near the head of Meadow Canyon and north of the Zane Grey Highway (now called Forest Highway 9 and the General Crook Highway).

Near the mouth of Meadow Canyon, high magnetic gradients trend northeastward across the area. The gradients coincide with the Cash Tank fault and mark the edge of a rapidly thickening volcanic sequence to the west. From linear trends of the gradients we infer that a branch of the fault may continue northeastward along drainage on the east side of Snake Ridge (anomaly "D"); another branch probably extends southwestward into Salmon Lake Basin.

In the central part of the area, a broad magnetic high (H) lies over volcanic rocks on Oak Hill south of West Clear Creek. The anomaly has an amplitude of about 400 gammas and is attributed mainly to basalt flows. Magnetic gradients indicate that the thickest accumulation of the flows lies beneath the crest and upper slopes of the hill. The shape of the anomaly suggests that thinner parts of the lava flow extend east to near Meadow Canyon and south to Toms Creek Road (now called the General Crook Highway and Forest Highway 9).

The strongest magnetic high (I) in the map area is found over Indian Flat on the north rim of West Clear Creek canyon. The anomaly extends eastward to include a second peak southwest of Buckhorn Mountain. Magnetic maxima of about 700 and 400 gammas occur near the canyon rim bordering Indian Flat and south of the second peak, respectively. The combined anomaly is associated with volcanic rocks and may be the expression of a major source of extensive basalt flows in this part of the area. The maxima may be reinforced by volcanic plugs near the rim of the canyon.

A narrow meandering zone of low magnetic intensity (J) occurs parallel to the canyon of West Clear Creek west of the Cash Tank fault. Along east-west segments of the canyon, the zone is shifted slightly southward of the canyon floor and has steeper gradients. On more northerly trending segments like the segment in the Big Spring area, it coincides with the canyon floor and has gentle gradients. Anomaly "J" is a combination of several effects including negative end effects of flows in the canyon walls, variation in flight altitude, position of magnetic detector with respect to canyon rim and walls, and magnetic effects of rocks in the canyon floor. The major geologic factors causing the anomaly are the large topographic feature of West Clear Creek canyon and the exposure of nonmagnetic sedimentary rocks overlain by a thick sequence of as much as 490 m (1,600 ft) of basalt having high magnetic intensity. The low intensity zone (J) extends westward to the mouth of the canyon where it decreases in intensity and broadens over sedimentary rocks of the Verde Formation overlying the more deeply buried volcanic rocks.

Southwest of Black Mountain, a magnetic high (K) with two maxima lies over volcanic rocks bordering Black Mountain Canyon. The main maximum has an amplitude of about 200 gammas and is centered on the south rim of the canyon. The maximum is probably caused by mafic rocks of a volcanic vent in slopes beneath the south flank of the maximum. The other maximum has a much lower amplitude, about 100 gammas, and is attributed to basaltic rocks on the south slopes of Black Mountain. Similar rocks along the canyon rim lie beneath the northern and western flanks of the high and also contribute to the amplitude of the anomaly. On the edge of the high, a small satellite maximum (L) marks the local flows of an andesite vent west of Thirteenmile Rock Butte.

A minor magnetic low (M) is nearly coincident with Thirteenmile Rock Butte and an adjoining northeast-trending ridge. From its trend, this low appears to be a southwestward extension of the "J" anomaly; however, the topography is physiographically different and the ridge it overlies is almost entirely basalt. The lens of silicic tuff exposed in the ridge may be from a local vent, but too little of it is exposed to indicate a sufficient volume that would explain the negative anomaly. Volcanic and interbedded sedimentary strata enclosing the area of Thirteenmile Rock Butte have been found to be reversely polarized, whereas overlying strata sampled along the highway east of the butte are, with one exception, normally polarized (D. P. Elston, written commun., 1981). Anomaly "M" may reflect a band of reversely polarized strata whose magnetization has reduced the total field intensity in this area.

East of the butte, a magnetic high (N) of about 200 gammas lies over the Devils Windpipe and the old Toms Creek Road. The anomaly seems to be associated with flows along high ridges extending southward beyond the area of the map. Small maxima of the feature may be the magnetic expression of dikes or small feeders exposed in the head of a gulch near the road.

A narrow zone of high magnetic intensity (O) with several maxima lies along the north rim of West Clear Creek canyon between Cactus Mountain in the western part of the roadless area and Blodgett Basin to the east. Near the basin, the zone turns northward and continues to Bald Hill. The north-trending part of the zone contains prominent maxima that are caused partly by coherent vent material underlying Bald Hill and by lava flows along the high ridge to the south. Maxima in the south and west parts of the zone are associated with a thick basalt sequence underlying hills near the rim and spurs in the canyon wall.

West of Bull Pen Ranch on the floor of the canyon, steep magnetic gradients coincide with an inferred fault along which the volcanic rocks were displaced down toward Verde Valley. To the south, magnetic lows and strong gradients suggest the presence of other northwest-trending faults (not mapped and possibly buried) that cut across West Clear Creek near the mouth of Black Mountain Canyon.

In the west end of the area, magnetic highs and lows of small amplitude occur over gravel deposits and the Verde Formation overlying the basaltic rocks along the edge of the Verde Valley. These features probably reflect the topographic relief on the eroded volcanic surface.

No mineral occurrences are known within the roadless area and the magnetic anomalies described above do not require that mineralization be present in their interpretation. Where mineralization is found beyond the eastern and western boundaries of the area (Ulrich and Bielski, in press), the magnetic data do not produce unusual patterns or obviously related anomalies.

REFERENCE

Ulrich, G. E., and Bielski A. M., in press, Mineral resource potential map of West Clear Creek Roadless Area, Yavapai and Coconino Counties, Arizona: U.S. Geological Survey Miscellaneous Field Studies Map MF-1555-A, scale 1:24,000.

West Map Area | East Map Area

YAVAPAI CO. | COCONINO CO.

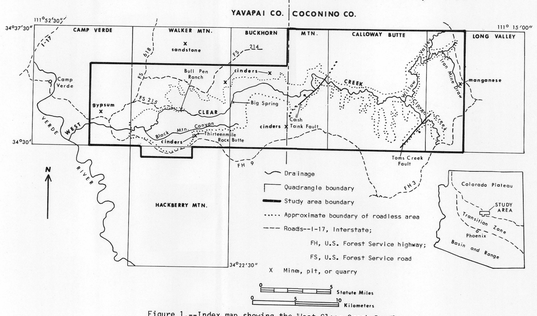

Figure 1.--Index map showing the West Clear Creek Roadless Area.

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