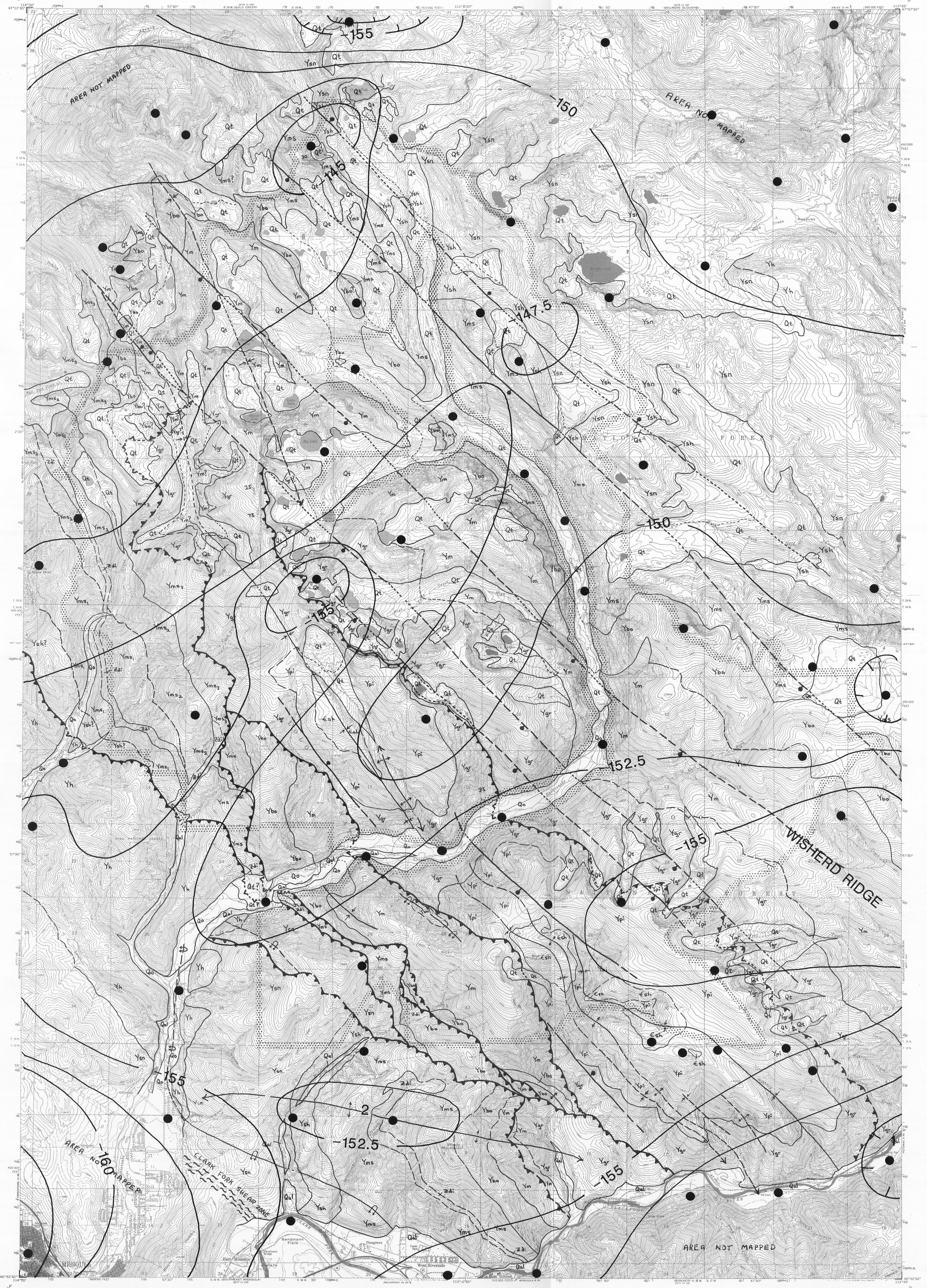
MISCELLANEOUS FIELD STUDIES
MAP MF-1235-B



Base from U.S. Geological Survey, 1:24,000
Blue Point, Stuart Peak, Wapiti Lake,
1965-76; NE Missoula, 1978

SCALE 1:50 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Gravity data mapped in 1979;
geology from Wallace and Lidke (1980)

MAP A. COMPLETE BOUGUER GRAVITY MAP

EXPLANATION FOR MAP A

APPROXIMATE BOUNDARY OF ROADLESS AREA

-145 GRAVITY CONTOUR—Contour interval, 2 mgal; hachures indicate closed areas of lower gravity

GRAVITY STATION

1 GRAVITY ANOMALY

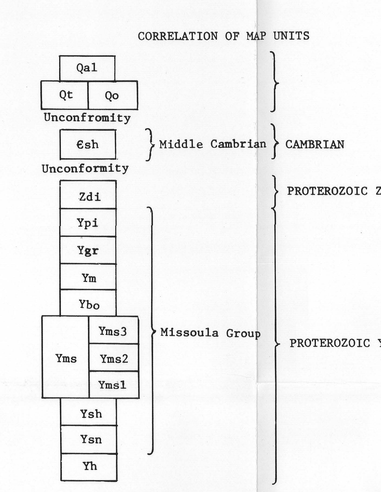
EXPLANATION FOR MAP B

APPROXIMATE BOUNDARY OF ROADLESS AREA

-160 MAGNETIC CONTOUR—Contour interval, 10 gammas; hachures indicate closed magnetic lows

A MAGNETIC ANOMALY

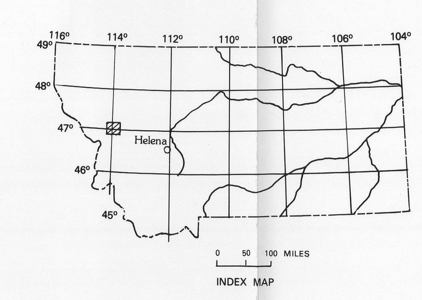
CORRELATION OF MAP UNITS



LIST OF MAP UNITS

Qal ALLUVIAL DEPOSITS (QUATERNARY)—Poorly sorted, bouldery, sandy gravel
Qo GLACIAL OUTWASH DEPOSITS (QUATERNARY)—Poorly sorted, bouldery gravel and sand
Qt TILL (QUATERNARY)—Unsorted bouldery, sandy, muddy gravel
Єsh SILVER HILL FORMATION (MIDDLE CAMBRIAN)—Upper part is dark-gray limestone that contains irregular siliceous, dolomitic bands. Lower part is interbedded shale, siltstone, and sandstone
Zdi DIABASE DIKES AND SILLS (PROTEROZOIC Z)—Fine- to medium-grained diabase of diorite and gabbro composition
Ypi PILCHER QUARTZITE (PROTEROZOIC Y)—Medium- and coarse-grained orthoquartzite
Ygr GARNET RANGE FORMATION (PROTEROZOIC Y)—Greenish-gray, argillaceous and silty, fine-grained quartzite interbedded with sandy argillite
Ym McNAMARA FORMATION (PROTEROZOIC Y)—Interbedded red and green argillite, siltite, and fine-grained quartzite
Ybo BONNER QUARTZITE (PROTEROZOIC Y)—Pink and buff, coarse- and medium-grained feldspathic quartzite
Yms MOUNT SHIELDS FORMATION (PROTEROZOIC Y)
Yms3 Member 3—Interbedded red argillite and buff fine-grained quartzite
Yms2 Member 2—Buff, fine-grained feldspathic quartzite
Yms1 Member 1—Zones of interbedded red argillite and buff, fine grained quartzite and zones of fine-grained quartzite
Ysh SHEPARD FORMATION (PROTEROZOIC Y)—Greenish thinly laminated argillite interbedded with carbonate-bearing siltite
Ysn SNOWSLIP FORMATION (PROTEROZOIC Y)—Interbedded red and green argillite, siltite, and quartzite
Yh HELENA FORMATION (PROTEROZOIC Y)—Interbedded limey argillite, limey siltite, and quartzite

CONTACT—Dashed where approximately located, short dashed where covered by younger deposits
FAULT—Dashed where approximately located, short dashed where covered by younger deposits. Ball and bar on downthrown side
THRUST FAULT—Dashed where approximately located, short dashed with open sawteeth where covered by younger deposits. Sawteeth on upper plate
SHEAR ZONE—Sheared rocks of Proterozoic age. Rock units not identifiable in the zone. Pulverized rock is susceptible to landslides
ANTICLINE—Showing trace of axial plane; dashed where approximately located, short dashed where covered by younger deposits
SYNCLINE—Showing trace of axial plane; dashed where approximately located, short dashed where covered by younger deposits
OVERTURNED ANTICLINE—Showing trace of axial plane; dashed where approximately located. Limbs of anticline dip in direction of arrows



INDEX MAP

Base from U.S. Geological Survey, 1:24,000
Blue Point, Stuart Peak, Wapiti Lake,
1965-76; NE Missoula, 1978

SCALE 1:50 000

CONTOUR INTERVAL 40 FEET
NATIONAL GEODETIC VERTICAL DATUM OF 1929

Aeromagnetic data mapped in 1979;
geology from Wallace and Lidke (1980)

Regional field removed—IGRF 1975 (updated to 8/75) (Barraclough and Fabiano, 1977)
Flight line spacing, 0.5 and 1 mile
Flight line direction, E-W
Flight altitude, 8,000 ft barometric
Instrumentation, Geometrics G803 magnetometer[1]
Sampling rate, 1 second
Sensitivity, 1 gamma
Survey completed in August, 1979
Flown and compiled by U.S. Geological Survey

MAP B. AEROMAGNETIC MAP

Survey flown July 22 - Aug. 1, 1971
at 7,500 ft barometric elevation
Values based on arbitrary datum
Regional magnetic gradient removed
Contour interval, 20 nanoteslas

5 MILES
5 KM

Approximate mean declination 1971

Figure 1.—Total intensity aeromagnetic map of the Rattlesnake Roadless Area, Mont.

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 values, if any, that may be present. 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 Rattlesnake Roadless Area in the Lolo National Forest, Missoula County, Montana. Rattlesnake Roadless Area (01801) 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 was identified by the U.S. Forest Service as a possible addition to the Wilderness System. This 120 square mile area is north of Missoula, Mont. (see index map); Rattlesnake Creek forms the major drainage to the south.

The rocks in the study area consist mainly of the Helena Formation and the Missoula Group of the Belt Supergroup (Proterozoic Y). Rock units of less importance are diabase sills and dikes of probable Proterozoic Z age, Middle Cambrian rocks, and glacial deposits. Structurally, the study area consists of the Rattlesnake thrust system in the south part and a parautochthonous area broken by vertical faults in the north part.

GRAVITY SURVEY

The gravity survey was made during the summer of 1979. A total of 175 stations was established in and adjacent to the study area using Worden[1] gravimeter W-177 and LaCoste and Romberg[1] gravimeter G-192. Approximately 90 stations were measured in the area shown on map A. Additional stations were measured outside the study area boundaries for regional control of the gravity data and are not shown. The data were tied to the International Gravity Standardization Net 1971 (U.S. Defense Mapping Agency, Aerospace Center, 1974) at base stations established at Seeley Lake Post Office in Montana, at Plains, Mont., and Family Inn in Missoula, Mont. Data from the 1979 survey were supplemented by data from nearby areas (Wilson, 1978; Wilson, 1979; Kulik, 1981).

Because of rugged terrain, some stations within the study area and parts of the surrounding area were reached by helicopter; those stations in less rugged areas were reached on foot and by four-wheel drive vehicle. Station elevations were obtained from benchmarks, spot elevations, and estimates from topographic maps at 1:24,000 and 1:62,500 scales. The elevations are accurate to 5-10 ft in areas of low relief, but may be in error by 20-30 ft in rugged terrain. The resultant error in the Bouguer anomaly is less than ±2 milligals (mgal) for errors in elevation control.

Gravity data preparation

Gravity data were reduced using an unpublished digital computer program of the U.S. Geological Survey. Gravity meter readings were converted to observed gravity using the 1971 base values of the International Gravity Standardization Net. Corrections were made for earth tides and linear instrument drift. The Geodetic Reference System 1967 formula (International Association of Geodesy, 1967) was used to compute theoretical gravity. The data were reduced to Bouguer anomaly values using an assumed average rock density of 2.67 g/cm^3 (grams per cubic centimeter). Terrain corrections were based on digitized terrain elevations spaced at 15 second intervals. The corrections ranged from 1.37 mgal at the mouth of Finley Creek northeast of the mapped area to 35.95 mgal on Wisherd Ridge. The corrections were made from the station to a distance of 100 mi.

The data are presented as a complete Bouguer gravity map (map A).

[1]Use of brand names in this report is for descriptive purposes only and does not constitute endorsement by the U.S. Geological Survey.

Gravity interpretations

Gravity data provide information on structural relations and on the subsurface distribution of rock types. Rocks of the Belt Supergroup within the study area have minimal density contrasts, and the area is characterized by a gravity plateau of little relief.

The negative gravity anomaly (1) southeast of the study area is probably caused by low-density valley fill. The positive gravity anomaly (2), controlled by only two data points, is associated with the axis of a fold in the thrust plate. The gravity gradient shown in the southwestern corner of the map is attributed to the contrast of low-density Tertiary sedimentary rocks that overlap the higher density Precambrian Belt rocks.

A series of northeast-trending linear high and low anomalies reflects density contrasts or possibly structural relief in the crystalline basement rocks (Kulik, 1981).

AEROMAGNETIC SURVEYS

Aeromagnetic data provide information on the distribution of magnetic rocks and on possible relations between magnetic rocks and mineralization. Two aeromagnetic maps provide data on the study area. The aeromagnetic map (map B) shown superimposed on the geologic map is from a survey flown by the U.S. Geological Survey (USGS) (1980) on east-west flight lines having spacing of 1/2 to 1 mi at a barometric elevation of 8,000 ft. The values from the 1975 International Geomagnetic Reference Field (IGRF) were removed and the data contoured at 10-gamma intervals. A second aeromagnetic map is shown in figure 1. It is a segment of a regional survey in northwestern Montana (Douglas, 1972) and was flown on north-south flight lines at approximately 1-mi spacing at a barometric elevation of 7,500 ft. An ambient field of 0.635 gammas per mi E and 1.08 gammas per mi N was removed and the data contoured at 20-gamma intervals. Inasmuch as the complete IGRF was not removed by Douglas from his map, caution must be exercised in attempting any qualitative or quantitative interpretation. It is presented here to document the available literature in this area.

Aeromagnetic interpretations

Rocks of the upper Belt Supergroup are essentially nonmagnetic, and the study area is in the magnetic quiet-basement zone of Mabey and others (1978).

A linear, northwest-trending magnetic high is defined by closures of as much as 100 gammas in amplitude (areas A and B on map B) and is associated with outcropping diabase sills containing visible pyrite and of probable Precambrian age. The magnetite content of a similar sill east of the study area has been estimated to be as much as 15 percent (Knapp, 1963). Other local, elongate, high magnetic anomalies to the northeast (C, D, and E), suggest that similar sills are present below the surface in the Mount Shields and Snowslip Formations. These anomalies are also apparent on the regional aeromagnetic map in figure 1.

A broad high magnetic anomaly approximately 20 gammas in amplitude occurs in the northeast corner of the area. Inasmuch as there is no geologic evidence for the presence of a buried pluton, nor does the gravity data suggest a subsurface body with a density different than the Belt rocks, the magnetic high is probably caused by a change in the magnetic mineral content within the Belt strata.

A magnetic gradient of about 50 gammas and an east-west trend crosses the central part of the map area. Geologic evidence does not indicate a source for the gradient, and a similar pattern is not apparent in the gravity data.

CONCLUSIONS

Gravity data in the Rattlesnake Roadless Area suggest possible structural relief in the underlying crystalline basement.

Positive magnetic anomalies are associated with outcropping diabase sills that have intruded the metasedimentary Belt rocks and indicate that other similar sills may be present in the subsurface. In the northeast part of the area, a difference in magnetic mineral content within Belt strata is interpreted from the USGS aeromagnetic map.

ACKNOWLEDGMENTS

I gratefully acknowledge the Confederated Tribes of the Kootenai and Salish for permission to work in restricted areas of their lands that adjoin the Rattlesnake Roadless Area.

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COMPLETE BOUGUER GRAVITY AND AEROMAGNETIC MAPS OF THE RATTLESNAKE ROADLESS AREA, MISSOULA COUNTY, MONTANA

By
Dolores M. Kulik
1986

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