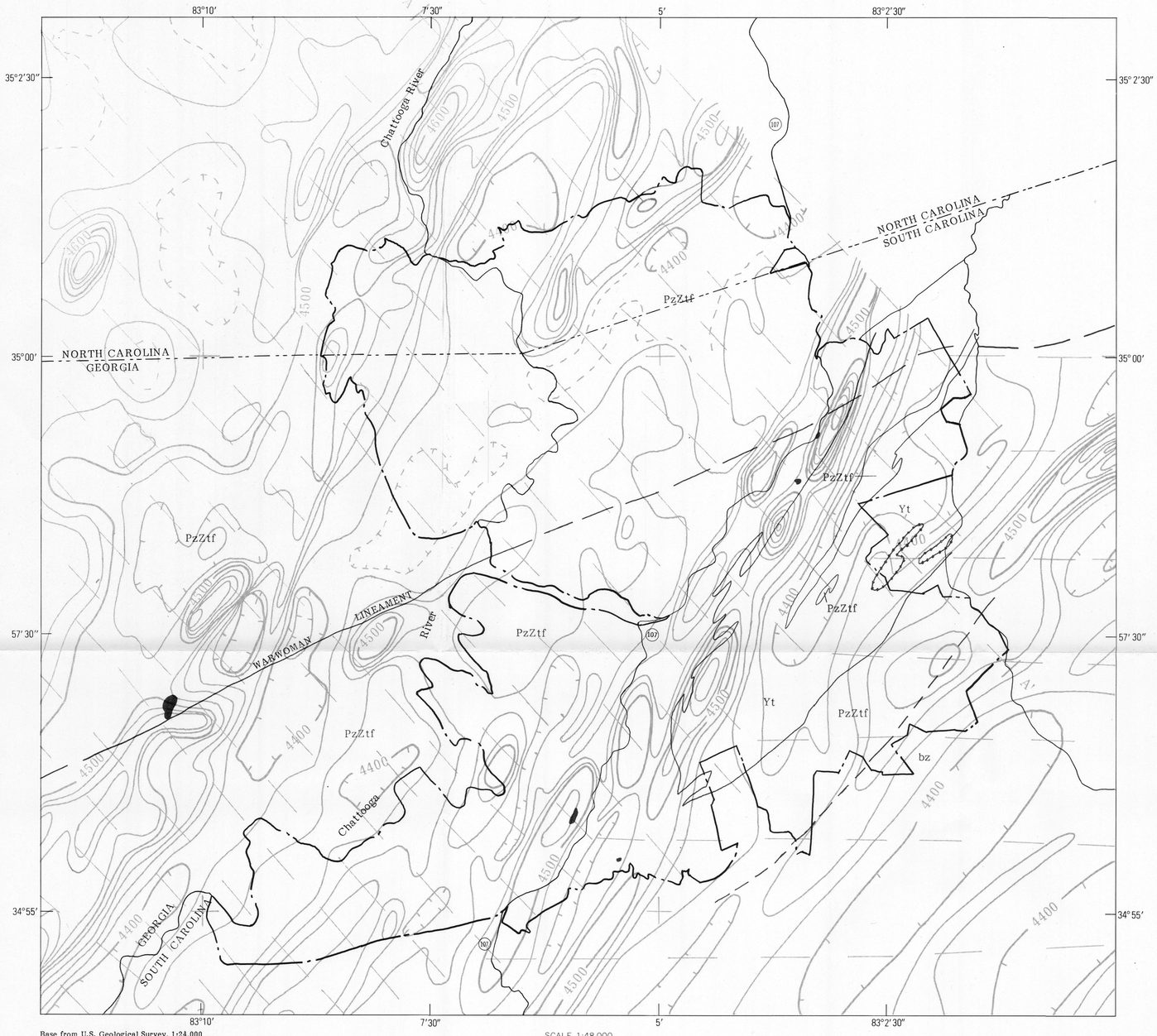
DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF–1287–C



EXPLANATION

- 4400 — Magnetic contours—Showing total-intensity magnetic field of the earth, in gammas relative to an arbitrary datum. Hachured to indicate areas of lower magnetic intensity. Contour interval 20 gammas, with dashed, supplemental 10-gamma contours
- Flight path—Showing location and spacing of magnetic data
- Line enclosing areas of high radiometric intensity on the ground (Luce and others, 1985)
- Contact between geologic units—Approximately located in most areas. In cross section is dashed where inferred
- Fault—Short dashed where inferred
- PzZtf — Tallulah Falls Formation (Proterozoic Z and (or) lower Paleozoic)
- Yt — Toxaway Gneiss (Proterozoic Y)—In cross section is shown by diagonal-rule pattern
- bz — Brevard fault zone rocks (Proterozoic Y to lower Paleozoic)
- Ultramafic rocks (Proterozoic Z and (or) lower Paleozoic)
- 653 — Pegmatite (shown on cross section only)—Taken from Bell and Luce (1983)
- Structural form lines (shown on cross section only)—Upper 500 ft based on measured attitudes. Increasingly schematic with depth
- Boundary of Ellicott Rock Wilderness and additions

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 the 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 Ellicott Rock Wilderness and additions in the Sumter National Forest, Oconee County, South Carolina; the Nantahala National Forest, Macon and Jackson Counties, North Carolina; and the Chattahoochee National Forest, Rabun County, Georgia. The Ellicott Rock Wilderness was established by Public Law 92-622, January 3, 1975. The Ellicott Rock Extension (A8031), in Sumter, Nantahala, and Chattahoochee National Forests, is a roadless area that was recommended for wilderness, and the Ellicott Rock Expansion (08112) and Persimmon Mountain Area (L8116) are roadless areas that were classified as further planning areas, during the Second Roadless Area Review and Evaluation (RARE II) by the U.S. Forest Service, January 1979.

SETTING

The Ellicott Rock Wilderness comprises 3,332 acres in parts of Sumter, Nantahala, and Chattahoochee National Forests. The Ellicott Rock Extension roadless area would expand wilderness boundaries in these national forests by 5,600 acres. The other roadless areas, Ellicott Rock Expansion, 5,512 acres, and the Persimmon Mountain Area, 6,678 acres, are both in Sumter National Forest (index map). Nearly all the land in these parcels is owned by the U.S. Government, and with the exception of the Walhalla National Fish Hatchery, is administered by the U.S. Forest Service. The Ellicott Rock Wilderness and additions surround the rock on which Andrew Ellicott in 1813 located the common corner of the three states. Access to this rugged, scenic, and forested area is from Cashiers, N.C., Walhalla, S.C., and Clayton, Ga., by means of paved state-maintained highways and by improved roads maintained by the U.S. Forest Service.

INTRODUCTION

The aeromagnetic and aeroradiometric data presented herein for the Ellicott Rock Wilderness and additions are taken from an airborne survey that covered a larger area in Georgia, North Carolina, and South Carolina, and that was flown in December 1980 and January 1981 under contract to the U.S. Geological Survey. The flight lines were oriented northwest-southeast, approximately perpendicular to the general strike of the geology, at 0.5-mi (0.8-km) separation and at a nominal altitude of 500 ft (150 m) above mean terrain. A small amount of aeromagnetic data from a previous survey (Riggle and others, 1980) along the southeast edge of the study area is based on east-west flight lines spaced 1 mi (1.6 km) apart. Because of the rugged topography in the region, holding the airplane at a constant elevation above the terrain was not possible. Actual ground clearance over short distances ranged between about 200 and 1200 ft. The International Geomagnetic Reference Field (IGRF) has been removed from the magnetic data (Barraclough and Fabiano, 1975) and 5000 gammas were added to make all values positive.

GEOLOGIC SUMMARY

The geology of the study area is summarized from Bell and Luce (1983) and Hatcher (1977). The study area lies within the Blue Ridge physiographic province. Most of the rocks are of Proterozoic Y and Z and (or) early Paleozoic age. The Tallulah Falls Formation of Proterozoic Z and (or) early Paleozoic age is exposed over the largest portion of the study area, and comprises gneiss and biotite schist, amphibolite, metagraywacke, and a muscovite-garnet-biotite schist (the "garnet aluminous schist" of Hatcher, 1977). The Toxaway Gneiss, of granitic to granodioritic composition and of Proterozoic Y age, is overlain in a probable unconformity by the Tallulah Falls Formation. Both of these formations are probably metasedimentary rather than igneous in origin; they have been complexly deformed by five and possibly six periods of folding. Foliation within these two units, lithologic contacts, and fold axial surfaces generally strike northeast and dip moderately to the southeast. The major structural feature in the study area is proposed to be a northeast-trending, northwest-verging nappe consisting of Toxaway Gneiss (see interpretative cross section A-A'). An alternative interpretation, that of a dome and favored by Bell, is featured in Bell and Luce (1983).

Rocks of the Brevard fault zone of Proterozoic Y and Z and (or) early Paleozoic age crop out in the southeast corner of the study area. Small slices of ultramafic rocks of Proterozoic Z and (or) early Paleozoic age crop out along a northeastward trend near the western contact of the Toxaway Gneiss with the Tallulah Falls Formation.

A prominent northeast-trending linear topographic feature, the Warwoman lineament, crosses the center of the study area and extends for about 25 mi southwest and 30 mi northeast. The lineament was mapped from Landsat images and is interpreted to be a fault although no offset rock units or other evidence of faulting has been demonstrated. Flinty mylonite, however, has been found along the lineament in Georgia (lat 34°52′18″, long 83°27′30″), which supports the fault interpretation of Frank Lesure (U.S. Geological Survey, oral commun., 1980).

AEROMAGNETIC AND AERORADIOACTIVITY SURVEY RESULTS

The aeromagnetic contour map shows a small range in intensity (maximum magnetic relief of 200 gammas) which indicates a weak to moderate average magnetization in the rocks of the study area. The northeast-trending anomaly grain reflects an overall structural grain having a similar orientation in the rocks.

Profiles of total magnetic intensity and total-count gamma-ray intensity (altitude-compensated) were produced for each flight path. One such set of profiles, along flight line A-A', is shown in this report.

A computer-generated contour map of the aeroradiometric data has been prepared but is not illustrated here because the automatic contouring process used produces smoothed anomalies that can be interpreted well only in a more regional context.

INTERPRETATION

A series of linear magnetic anomalies (highs) having a northeastward trend overlies parts of both the Toxaway Gneiss and the Tallulah Falls Formation along the contact between these units. Field evidence indicates that the Toxaway Gneiss contains abundant magnetite in many places and is the likely anomaly-prodcuing unit. Northwestward thickening of an otherwise almost horizontal mass of Toxaway Gneiss would accentuate the anomalies along the northwest edge of this body (see interpretative cross section A-A'). The implication of this interpretation is that the Toxaway Gneiss extends beyond its outcrop pattern beneath the Tallulah Falls Formation to the northwest, as shown in section A-A', and to the southwest along strike. The anomalies decrease in amplitude over the Tallulah Falls Formation, which may reflect greater depth to the source rocks.

An alternative but less likely explanation is that the linear anomalies originate from ultramafic bodies, several of which occur in the appropriate location within the Tallulah Falls Formation. This would require that these bodies occupy, in the subsurface, a volume many times that indicated by their small surface expression.

The double magnetic anomaly near the northwest end of aeromagnetic profile A-A' may be due to a magnetic phase of the Tallulah Falls Formation. The rocks exposed there, however, appear to be similar to those of the same unit found in other parts of the study area. It is also possible that these two anomalies may be caused by buried bodies of more magnetically susceptible rocks such as the Toxaway Gneiss.

A mild correspondence exists between the Warwoman lineament and segments of magnetic anomaly gradients along about 40 mi (65 km) of the lineament in Georgia, within and outside the study area, but no anomalies are clearly offset. If the lineament is produced by a fault, the lack of significant effect on the magnetic field indicates that either it is not a deep feature or it does not juxtapose rocks of large magnetic susceptibility contrast.

The airborne radiometric profile along A-A' shows the highest intensity level over the exposure of Toxaway Gneiss, which probably reflects a higher potash feldspar content than the Tallulah Falls Formation. Peak values over the Toxaway Gneiss occur close to two areas of high intensity mapped by a reconnaissance ground scintillometer survey (see map) (Luce and others, 1985). The ground survey was conducted to test the extent of mineralization associated with the site of a uranium-thorium prospect. Anomalously high values for uranium and thorium were measured in rock samples from the areas of high ground intensities (Luce and others, 1985). The highest peaks on the aeroradiometric profile A-A' may reflect the folding and duplication of layers rich in radioactive minerals.

ACKNOWLEDGMENTS

The authors thank Robert D. Hatcher, Jr., for access to unpublished field information concerning the Toxaway Gneiss - Tallulah Falls Formation contact.

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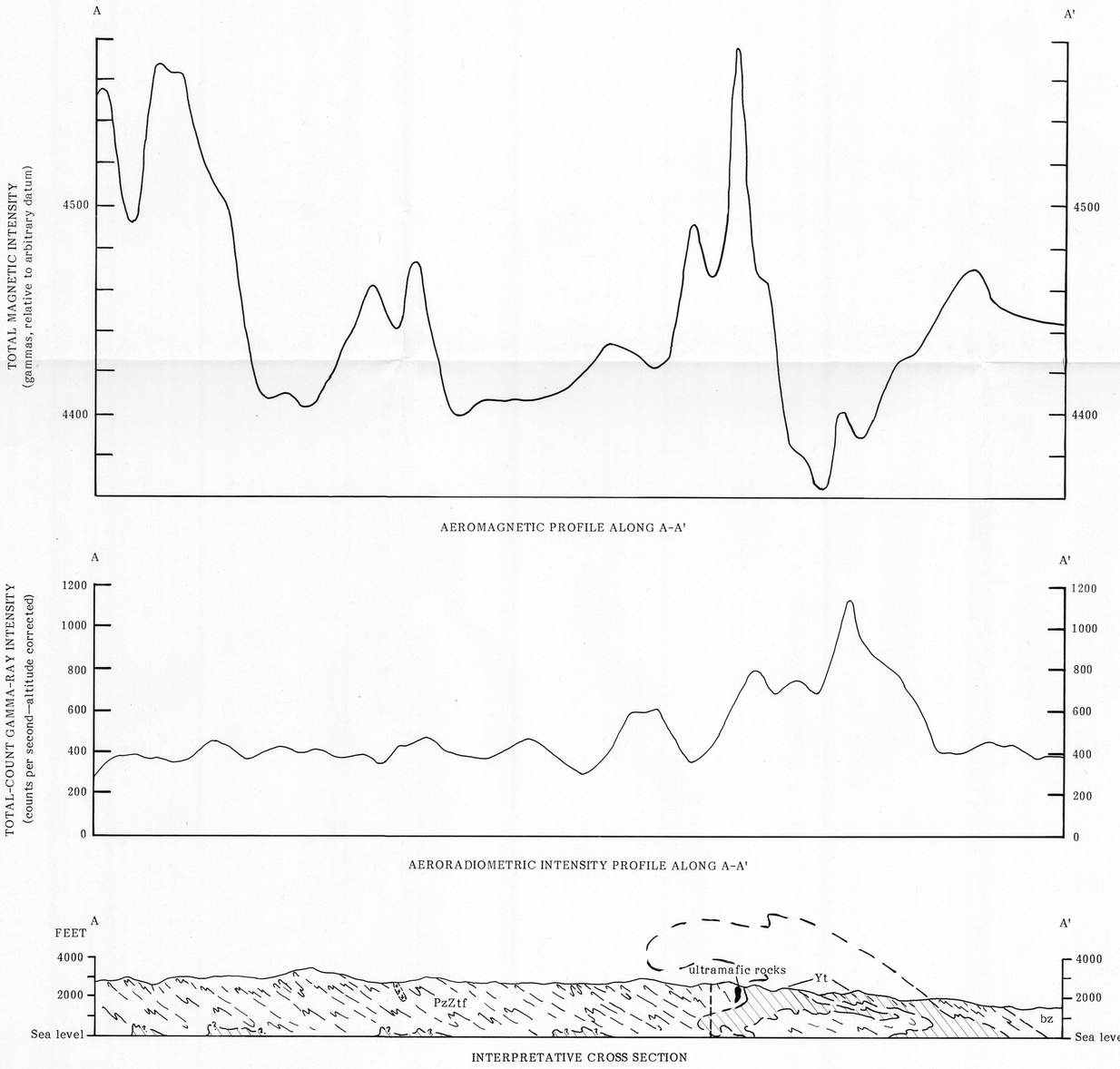
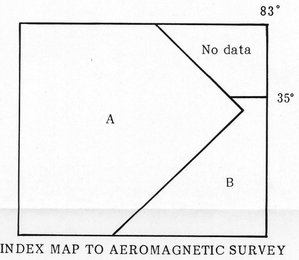
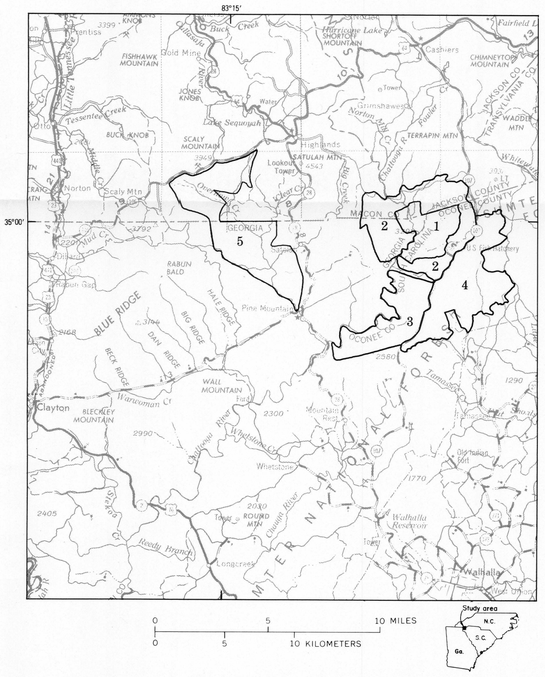




INDEX MAP TO AEROMAGNETIC SURVEY

Flight specifications	Area A	Area B[1]
Flight-line direction	NW-SE	E-W
Flight-line spacing	0.5 mile	1 mile
Flight-line altitude	500 ft above mean terrain	500 ft above mean terrain

[1] From Riggle and others (1980)



Index map showing location of the Ellicott Rock Wilderness and additions: 1. Ellicott Rock Wilderness; 2. Ellicott Rock Extension (A8031); 3. Ellicott Rock Expansion (08112); and 4. Persimmon Mountain Area (L8116). The nearby Overflow Roadless Area (5) is also shown.

AEROMAGNETIC MAP AND SELECTED AERORADIOMETRIC DATA FOR THE ELLICOTT ROCK WILDERNESS AND ADDITIONS, SOUTH CAROLINA, NORTH CAROLINA, AND GEORGIA

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1985

INTERIOR—GEOLOGICAL SURVEY, RESTON, VA.—1985
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