The lack of extensive movements by brook trout in this study indicates that the repopulation of rehabilitated stream sections now either void or with limited brook populations may take a long time. Additional monitoring will be required to determine possible downstream immigration of YOY (Hunt, 1965; Phinney, 1975) and effects of floods on the distribution of brook trout (Elwood and Waters, 1969), but our results suggest that if park managers want to repopulate rehabilitated areas quickly, it will probably be necessary to transplant brook trout downstream into these areas. Since exotic rainbow trout were not eradicated, although their populaton densities were drastically reduced (Moore et al., 1983), such transplanting may be an attractive management strategy to retard and perhaps eliminate the repopulation of rainbow trout in these study areas.

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THE ADAMS, TENNESSEE MAGNETIC ANOMALY

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ABSTRACT

The standard geophysical techniques of horizontal magnetic gradient analysis and second derivative mapping were applied to a prominent elliptical magnetic anomaly in northeastern Montgomery County near Adams, Tennessee. The positive magnetic anomaly, labeled the Adams Magnetic High, appears to be a roughly rectangular rock body measuring 9.5 km by 6.5 km. Magnetic susceptibility

estimates average 0.0043 cgs units. Depth estimates to the magnetic anomaly average 2.3 km. below sea level and are consistent with published data on depth to magnetic crystalline basement for the region.

A mafic pluton with lower than average magnetite content is proposed for the Adams Magnetic High based on both magnetic and gravity data. Gravity data suggest an effective density contrast between the sialic crystalline basement and the Adams Magnetic High in the range of 0.1-0.2 g/cm³.

INTRODUCTION

The aeromagnetic and Bouguer gravity maps of northwestern middle Tennessee (Figs. 1 and 2) show several strong, parallel, correlative (positive-positive; negative-negative) trends (Johnson and others, 1979; Johnson and Stearns, 1967). The magnetic trends and, to a lesser extent, the gravity trends continue north and northwest across western Kentucky (Johnson and others, 1978; Keller and others, 1978) and much of southern Illinois (Ahbe, 1978).

This paper examines the character and possible source of a positive magnetic anomaly on the northwest flank of the Nashville Dome near Adams, Tennessee (See Fig. 1). Several strong correlative geophysical trends pertinent to the Adams magnetic anomaly also are discussed.

GEOPHYSICAL TRENDS

Magnetic: The aeromagnetic map of northwest middle Tennessee shows a strong north-south magnetic grain that continues north and northwest across western Kentucky and southern Illinois. One strong linear magnetic anomaly marks the boundary in Tennessee between the Mississippi Embayment and the Nashville Dome. The 10-20 mile (16-32 km) wide magnetic ridge averages 800-1000 gammas in amplitude with a gradient of 65-75 gammas/mile (40-47 gammas/km) along its western boundary that borders the Mississippi Embayment and 100-125 gamma/mile (62-78 gammas/km) along its eastern boundary on the Nashville Dome. Two magnetic highs occur on the ridge averaging 150 to 300 gammas of closure, respectively. This same magnetic ridge runs northward into Western Kentucky where it transects the New Madrid Rift; it then continues northwestward across Kentucky and Southern Illinois (Hildenbrand and others, 1982).

A broader, lower amplitude, somewhat parallel companion magnetic ridge trends northward along the eastern portion of the Western Highland Rim. The east magnetic ridge, averaging 400 to 600 gammas in amplitude, parallels the west magnetic ridge across the new Madrid Rift then turns northwestward across western Kentucky and into southern Illinois (Hildenbrand and others, 1982). The amplitude of the east magnetic ridge increases northward reaching 1000 gammas in the Madisonville, Kentucky, area. The east magnetic ridge gradient averages 30 to 80 gammas/mile (18.7-50.0 gamma/km) in the vicinity of the Adams anomaly, but exceeds 100 gamma/mile (62 gammas/km) farther north. It is the east magnetic ridge that contains a strong elliptical magnetic high near Adams, Tennessee (See Fig. 1).

Sandwiched between the northward trending, parallel magnetic ridges is a trough-like magnetic low averaging 400 to 600 gammas in relief. The trough-like magnetic low crosses western Kentucky and southern Illinois, including the New Madrid Rift (Hildenbrand and others, 1982). Several small circular lows occur within the trough. Both magnetic ridges and the intervening magnetic low are truncated to the south by a strong southwest magnetic trend probably associated with the residual basement structure of the Pascola Arch.

Gravity: The major Bouguer gravity feature in northwest middle Tennessee is a north-south, roughly rec-

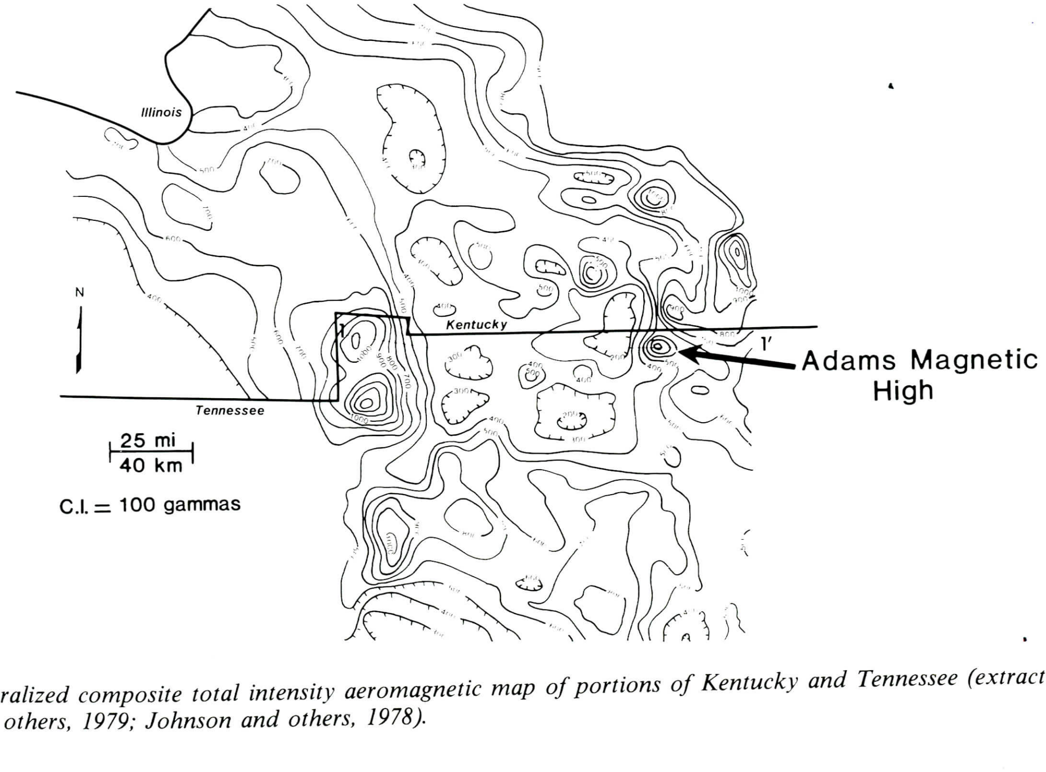

FIG. 1. *Generalized composite total intensity aeromagnetic map of portions of Kentucky and Tennessee (extracted from Johnson and others, 1979; Johnson and others, 1978).*

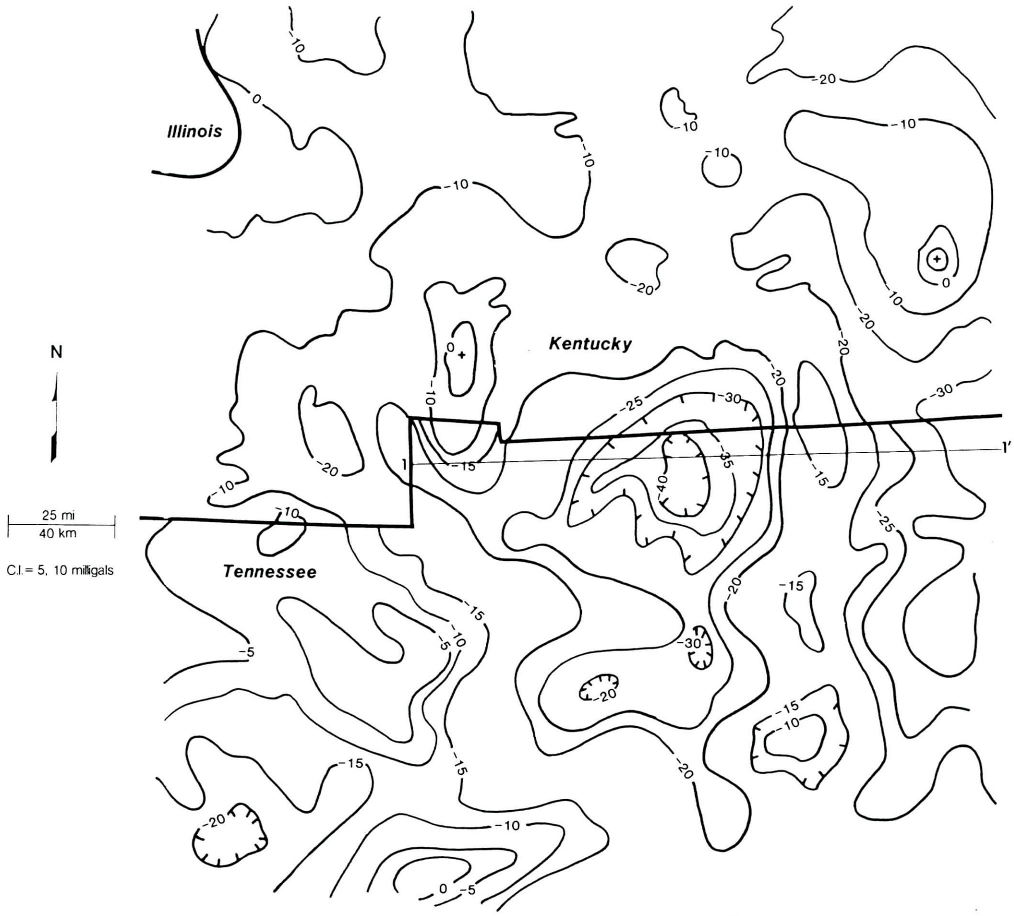

FIG. 2. *Generalized composite Bouguer gravity map of portions of Kentucky and Tennessee (extracted from Keller and others, 1978; Johnson and Stearns, 1967).*

tangular low ranging form -30 to -35 mgals in west-central middle Tennessee to -40 to -45 mgals along the Tennessee Kentucky boundary (See Fig. 2). The Bouguer gravity map shows the same north-south grain as the aeromagnetic map in northwest middle Tennessee and southern Kentucky. The Bouguer gravity trend does not parallel the magnetic grain across western Kentucky. The gradient along the regional low averages 2 mgals/mile (1.24 mgals/km) in the south to 3 mgals/mile (1.87 mgals/km) in the north along the Tennessee-Kentucky boundary. The trough-like gravity low corresponds closely with the regional magnetic low described earlier (Fig. 3).

Two small gravity highs bound the regional gravity low. The ridge-like gravity high on the west side of the gravity low has an amplitude of 10 to 15 mgals. The less prominent companion gravity high bounding the east side averages 5 to 10 mgals in amplitude. The east-bounding gravity high corresponds closely to the strong positive magnetic anomaly labeled as the Adams Anomaly (Fig. 3).

METHODOLOGY

The standard techniques of horizontal magnetic gradient comparison and second derivative mapping were applied to the Adams Magnetic High (AMH) (Vacquier and others, 1951). The horizontal magnetic gradient technique involves comparing the observed magnetic anomaly with a theoretical anomaly produced by vertical prisms of various dimensions and by different orientations of the earth's ambient magnetic field. The magnetic field produced by a magnetic anomaly of known dimensions, magnetic susceptibility, magnetic inclination, and depth can be theoretically modeled using Vacquier's technique and compared with the observed magnetic anomaly. When the areal shape of the observed anomaly matches that of a theoretical anomaly, the maximum depth to the magnetic source is determined by comparing the lengths of hori-

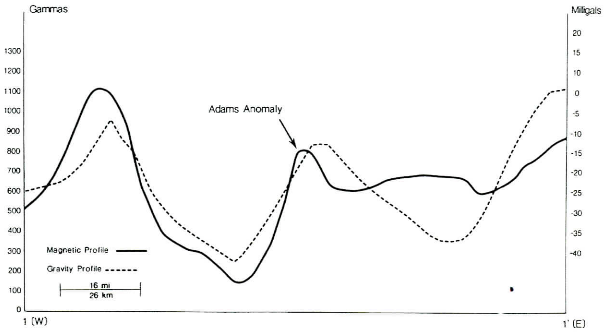

FIG. 3. *Bouguer gravity and magnetic profiles along the line 1-1' through the Adams, Tennessee anomaly.*

zontal magnetic gradients of the known theoretical anomaly with the observed anomaly. Since this technique assumes vertical sides on the anomaly and geologic contacts are almost always sloping, the Vacquier estimate frequently over estimates the depth to magnetic basement on the average of 10 percent. The Vacquier estimate of the depth to magnetic basement at the AMH was compared with available regional data (Hildenbrand and others, 1979).

A second-derivative map of magnetic intensity with respect to horizontal distance (d^2H/dz^2) was constructed using the method outlined by Vacquier and others (1951) Fig. 4). The second derivative shows the magnetic field curvature produced by magnetic anomalies after the regional field component has been removed. The greater the contrast in magnetic susceptibility between rock units the greater will be the curvature of the magnetic field around the rock unit containing the iron-bearing mineralization. The zero-curvature line frequently approximates the boundaries of the rock body responsible for the magnetic anomaly (Vacquier and others, 1951). The depth to magnetic basement can be estimated from the horizontal distance between the magnetic field curvature maxima and minima and the zero-curvature contour using the procedure outlined earlier (Vacquier and others, 1951). The second-derivative map (Fig. 4), the aeromagnetic map, and the U.S. Geological Survey's estimates of the depth to magnetic basement were utilized for preliminary modeling of the AMH.

RESULTS

The AMH consists of a 220 gammas elliptical closure located on the 660 gamma amplitude east magnetic ridge described earlier. The magnetic gradient of the AMH averages 160 to 170 gammas/mile (100-105 gammas/km) on the west side of the anomaly and 100-110 gammas/mile (62-69 gammas/km) on the east side, respectively. The steeper magnetic gradient along the west side of the anomaly and its attendant magnetic ridge reflect either a greater dip in the geologic contact between rocks differing in magnetic susceptibility or a shallower depth to magnetic basement on the west side of the anomaly. A steeper contact or high angle gravity fault is considered to be a better interpretation. Northward along the same magnetic boundary in western Kentucky, Hildenbrand and others (1982) relate the magnetic gradient to an extension of the Ste. Genevieve Fault.

Estimates of the depth to magnetic basement on the AMH were made using the Vacquier technique and the Peters half-slope method (Peters, 1949). As a cross check, the depth estimates calculated above were compared to a regional map of the depth to magnetic basement (Hildenbrand and others, 1979). The depth to basement at the AMH ranged from 2.1 to 2.4 km (below sea level) compared to the regional magnetic depth map of 2.0 to 2.5 km. A depth of 2.3 km (below sea level) to magnetic basement was used for modeling purposes.

The second-derivative map (Fig. 4) suggests that the rock body responsible for generating the AMH approximates a rectangular mass measuring 9.5 km (6.0 mi) by 6.5 km (4.0 mi) with its long dimension oriented N 30°W. A magnetic susceptibility contrast of 0.0022 cgs units was computed, assuming a uniform magnetic contrast induced by the earth's magnetic field on a Vacquier block model of infinite depth extent.

Several attempts were made to model the anomaly after removing the regional magnetic component. An average magnetic susceptibility of 0.0021 cgs units was used in the calculations based on values from volcanic and related epizonal intrusive rocks from the St. Francis Mountains (Phelan 1969). Given the magnetic susceptibility contrast calculated above and the average magnetic susceptibility of 0.0021 cgs units, the crystalline rock body responsible for the AMH has an estimated magnetic susceptibility, value, k, of 0.0043 cgs units. Although rock types cannot be identified from the k value alone, Lindsley and others (1966) suggest a magnetic susceptibility of 0.0043 cgs units is within the broad category of mafic plutonic rocks, probably with a lower than average magnetite content. Given the mean depth to magnetic basement, an estimated magnetic susceptibility k value of 0.0043 cgs units, and the approximate dimensions of the rock body producing the AMH, several of the standard geometries were tried including the vertical slab, horizontal cylinder, and the vertical cylinder. No unique solution exists although the vertical slab and vertical cylinder models most closely approximated the residual magnetic profile.

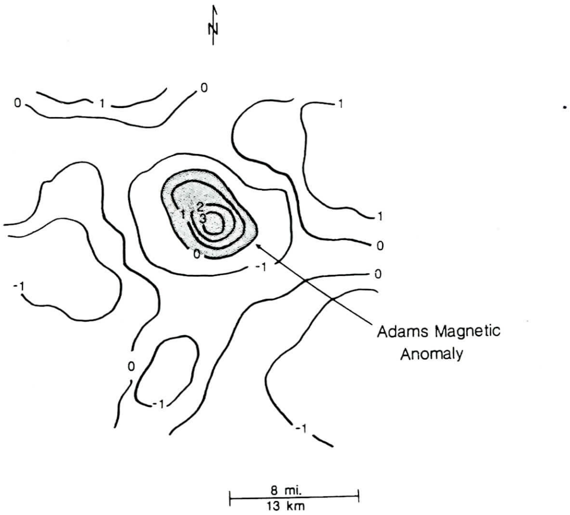

FIG. 4. *Second derivative map (d^2H/dz^2) of the Adams magnetic high.*

The analysis of the aeromagnetic data provided several clues about the rock body responsible for the AMH for use in crude gravity modeling. The estimated dimensions of the rock body, depth to magnetic basement, and axial trends were used to estimate the effective density contrast required to produce the small 10 gamma amplitude gravity high correlative with the AMH. All gravity calculations were based on the mean density of the Precambrian felsic basement averaging 2.7 g/cm^3. The vertical slab, vertical cylinder, and horizontal cylinder gravitational field equations were compared with the observed residual gravity profile (Nettleton, 1976).

The vertical slab model, based on the aeromagnetic information, best fits the gravity profile with an effective density contrast equal to 0.1-0.2 g/cm^3. This effective contrast range implies that the density of the rock body responsible for the AMH ranges from between 2.8-2.9 g/cm^3.

CONCLUSIONS

A reasonable first-approximation geophysical model for the AMH would be a marginally mafic intrusion with a lower than average magnetite content flush with the felsic crystalline basement. The Adams intrusive body may be the result of magma injection along a fault related to the Ste. Genevieve Fault as it extends into soutwest Kentucky.

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A CHECKLIST OF THE VASCULAR PLANTS ON THE DEPARTMENT OF ENERGY OAK RIDGE RESERVATION

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ABSTRACT

Plants have been collected on the Department of Energy Oak Ridge Reservation for over 30 years in conjunction with environmental research at Oak Ridge National Laboratory. The site includes a wide diversity of habitats, ranging from open water to mesic forests, including several cedar barrens. The vascular plant checklist of the site contains 114 families, 458 genera, and 842 species, subspecies, and varieties, and includes a number of rare species. A summary of numbers of species in different habitats indicates that the greatest diversity occurs in open woods or thickets or mesic sites.

DESCRIPTION OF THE STUDY AREA

The Department of Energy (DOE) Oak Ridge Reservation, including the Oak Ridge National Environmental Research Park (NERP), consists of approximately 15,000 ha in Anderson and Roane counties, Tennessee (Fig. 1). The reservation, purchased from individual landowners in 1942 for the Manhattan Project, provides buffer zones for nuclear production and research facilities operated for DOE at Oak Ridge. Environmental research has been conducted at the site for many years. The area is bordered on the south, west, and east by the Watts Bar and Melton Hill Lake impoundments of the Clinch River and on the north and northeast by Black Oak Ridge and the city of Oak Ridge. The study area includes most of the originally purchased reservation land, except for that occupied by the residential portion of the city of Oak Ridge.

The reservation lies within the Ridge and Valley Province of the southern Appalachians and is characterized by parallel southwest-northeast ridges of sandstone, shale, and cherty dolomite separated by valleys underlain by less weather-resistant limestone and shale (McMaster, 1963). Elevations range from approximately 230 m along the river to over 400 m at the crest of Copper Ridge, one of the six major ridges traversing the site. The gently sloping valleys are at approximately 260 m. Soils are primarily Ultisols with Inceptisols in the major drainages (Mann and Kitchings, 1982).

The general ecology of the area was previously described (Kitchings and Mann 1976) and will only be outlined in this paper. Except for forest management, the reservation has been relatively undisturbed since the early 1940's, although it was extensively farmed prior to that time. Approximately one-third of the total acreage either has been planted in pine, primarily *Pinus taeda*, or is in natural pine (*Pinus echinata* and *P. virginiana*). In many locations the natural pine is being replaced by upland hard-

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