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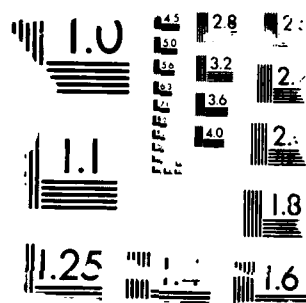
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**PROTON MAGNETOMETER SURVEY
OF SITE 3MS105
EAKER AIR FORCE BASE, ARKANSAS**

by
Linda Wadleigh and Kevin W. Thompson

Proton Magnetometer Report No. 1

**Archaeological Services
Western Wyoming College
Rock Springs, Wyoming**

**Prepared for
U.S. Air Force
AFRCE-
Norton Air Force Base, California**

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ABSTRACT

A proton magnetometer survey was conducted over portions of Site 3MS105, a 75-acre multicomponent prehistoric village site in northeast Arkansas. The magnetometer survey was used as a nondestructive means of locating subsurface archaeological features. Archaeologists from Mid-Continental Research Associates (MCRA) conducted an intensive recordation of the site in January and February of 1988, partially concurrent with the magnetometer survey. Surface cultural material included arrow points, ceramics, human skeletal material, faunal remains, shell, and historic glass and metal. Prehistoric cultural affiliation was determined to be of the Woodland (Baytown) and Mississippian periods. The site was estimated to be twice the size of similar sites in the area. Anticipated subsurface cultural materials include cemeteries, houses, very deep middens, and possibly evidence of fortifications (palisade walls, trenches). A metric grid system was established on the site and 20 by 20 m magnetometer survey units were incorporated into the archaeological grid system. The grids were located in areas that MCRA felt were most likely to contain subsurface cultural deposits, based upon the results of their survey and surface collections. Forty magnetometer grids encompassing 16,000 sq m were magnetically surveyed. These grids were divided into 12 segments for analytical purposes. Analyses of the data identified 84 magnetic anomalies thought to have cultural features as their source, including houses, middens, cemeteries, pit features, fortification trenches, and a mound remnant. Excavation of seven anomalies substantiated the prediction that the selected anomalies are associated with cultural features. If feature density in the surveyed areas is representative of the rest of the site, some 400 prehistoric houses and more than 1,000 related features may remain buried at the site.

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CONTENTS

INTRODUCTION	1
PRINCIPLES OF MAGNETOMETER SURVEYING	1
The Earth's Magnetic Environment	2
Magnetic Anomalies	2
Anomaly Interpretation	4
Magnetometer Survey Techniques	5
Data Processing and Manipulation	6
RESULTS AND INTERPRETATION	7
Previous Magnetometer Studies	7
Magnetometer Survey Results	8
Discussion	42
REFERENCES CITED	50

LIST OF FIGURES

1	Placement of Magnetometer Grids on Site 3MS105, Eaker AFB, Arkansas	11
2	Color Density Map of Magnetometer Segment 1 at Site 3MS105, Eaker AFB, Arkansas	12
3	Color Density Map of Magnetometer Segment 2 at Site 3MS105, Eaker AFB, Arkansas	14
4	Color Density Map of Magnetometer Segment 3 at Site 3MS105, Eaker AFB, Arkansas	17
5	Color Density Map of Magnetometer Segment 4 at Site 3MS105, Eaker AFB, Arkansas	19
6	Color Density Map of Magnetometer Segment 5 at Site 3MS105, Eaker AFB, Arkansas	22
7	Color Density Map of Magnetometer Segment 6 at Site 3MS105, Eaker AFB, Arkansas	25
8	Color Density Map of Magnetometer Segment 7 at Site 3MS105, Eaker AFB, Arkansas	28
9	Color Density Map of Magnetometer Segment 8 at Site 3MS105, Eaker AFB, Arkansas	30
10	Color Density Map of Magnetometer Segment 9 at Site 3MS105, Eaker AFB, Arkansas	33
11	Color Density Map of Magnetometer Segment 10 at Site 3MS105, Eaker AFB, Arkansas	35
12	Color Density Map of Magnetometer Segment 11 at Site 3MS105, Eaker AFB, Arkansas	38
13	Color Density Map of Magnetometer Segment 12 at Site 3MS105, Eaker AFB, Arkansas	40
14	Color Density Map of Magnetometer Segment 12.1 at Site 3MS105, Eaker AFB, Arkansas	41

LIST OF TABLES

1	Magnetic Anomalies From Segment 1, Site 3MS105, Eaker AFB, Arkansas	13
2	Magnetic Anomalies From Segment 2, Site 3MS105, Eaker AFB, Arkansas	15
3	Magnetic Anomalies From Segment 3, Site 3MS105, Eaker AFB, Arkansas	18
4	Magnetic Anomalies From Segment 4, Site 3MS105, Eaker AFB, Arkansas	20
5	Magnetic Anomalies From Segment 5, Site 3MS105, Eaker AFB, Arkansas	23
6	Magnetic Anomalies From Segment 6, Site 3MS105, Eaker AFB, Arkansas	26
7	Magnetic Anomalies From Segment 7, Site 3MS105, Eaker AFB, Arkansas	29
8	Magnetic Anomalies From Segment 8, Site 3MS105, Eaker AFB, Arkansas	29
9	Magnetic Anomalies From Segment 9, Site 3MS105, Eaker AFB, Arkansas	34
10	Magnetic Anomalies From Segment 10, Site 3MS105, Eaker AFB, Arkansas	36
11	Magnetic Anomalies From Segment 11, Site 3MS105, Eaker AFB, Arkansas	39
12	Magnetic Anomalies From Segment 12, Site 3MS105, Eaker AFB, Arkansas	42
13	Summary of Magnetic Anomalies Identified During the Magnetometer Survey of Site 3MS105, Eaker AFB, Arkansas	43
14	Results of Testing Magnetic Anomalies, Site 3MS105, Eaker AFB, Arkansas	45

INTRODUCTION

Eaker Air Force Base (AFB), Arkansas is being considered as one possible location for the siting of Peacekeeper Rail Garrison facilities. The prehistoric Eaker site (3MS105) is located on the base in an area of potential impact. The Air Force Regional Civil Engineer-BMS requested that the site be professionally documented and evaluated. Evaluation of the site involved several processes all oriented towards determining the extent of the site and its eligibility for inclusion on the National Register of Historic Places (NRHP). This report provides the results of the proton magnetometer survey conducted in order to verify the presence of subsurface cultural features, one of the criteria used for determining NRHP eligibility. The magnetometer survey was also utilized to help determine the extent of the site using the absence/presence of magnetic anomalies as indicators of the site boundary. Magnetometer survey was adopted in lieu of extensive test excavations for preliminary site assessment to minimize disturbance to the site. A detailed description and assessment of the Eaker site is provided by Lafferty and Cande (1989).

The magnetometer survey was conducted in January and February 1988 by Linda Wadleigh and Kevin W. Thompson of Archaeological Services of Western Wyoming College.

PRINCIPLES OF MAGNETOMETER SURVEYING

Magnetometer surveying is a passive geophysical technique employed by archaeologists for the identification and location of subsurface cultural features. The technique requires no substantial disturbance of the site elements or of the natural setting surrounding the site. The method entails measuring the local geomagnetic field over a preset grid of regular units. The magnetic information measured over an area reflects the complex interaction between several different sources: geological, archaeological, geomorphological, and pedological. It is the task of the magnetometer specialist to isolate the magnetic anomalies caused by past cultural activities from those caused by other nonarchaeological sources. The cultural activities generally result in very subtle changes in the total geomagnetic field in comparison to geological, geomorphological, and pedological sources.

The Earth's Magnetic Environment

Local anomalies of the geomagnetic field can occur near sources of intense magnetism, such as igneous rock formations of volcanic areas. The area affected will depend upon the size and intensity associated with the source. Topographic and geological formations not associated with high quantities of ferromagnesian igneous rock will produce less intense, regional perturbations. Other sources of magnetic interference may be found in the form of recent human introductions to the magnetic environment, such as barbed wire fences, electrical wires, transformers, and buried pipelines.

Magnetic Anomalies

A magnetic anomaly is a local perturbation in the earth's magnetic field which exhibits a contrast of magnetic intensity relative to surrounding areas. Anomalies may be of any shape, size, or amplitude, but are considered to be one of two general forms: monopolar or dipolar. Monopolar anomalies are those which have contrasting higher or lower intensities than surrounding areas. Dipolar anomalies are those which have, closely associated, both a lower and a higher intensity area.

The source of a magnetic anomaly may have multiple causal factors, including geomorphological, geological, pedological, and/or cultural phenomena. Isolation of the anomalies produced by cultural factors is sometimes difficult in environments of large intensity gradients. The net effect of any specific cultural activity on the magnetic environment is dependent upon the magnetic background from nonarchaeological sources (e.g., geological formations) in comparison to the amplitude of the anomaly produced. The anomaly amplitude is, in part, dependent upon the magnetic susceptibility of the ambient soils. Magnetic susceptibility is a measure of a substance's magnetic properties; large magnetic anomalies are generated from materials with a high susceptibility contrast. Soils with high magnetic susceptibility provide a matrix capable of retaining a high intensity contrast when enhanced by cultural activities. In areas of low magnetic background, the magnitude of the contrast will be of less importance than in areas with considerable magnetic noise.

There are several ways in which cultural activity may produce a magnetic anomaly capable of detection in the ambient magnetic field:

- Remnant magnetization - Heating activities, such as from domestic fires or pottery fires, cause changes in the surrounding soils by producing minerals with high magnetic susceptibilities (e.g., magnetite, maghemite, and hematite) which are magnetically oriented in the earth's magnetic field. Due to the strong magnetic orientation of the material, these features will typically produce dipolar anomalies.
- Anaerobic decomposition - Areas with abundant humic material, such as midden areas or trash pits will, in time, cause chemical changes to the magnetic structure by the percolation of water through the organic material to the earthen base. Typically, these features will produce positive monopolar anomalies. However, chemical alteration can often result in magnetically oriented material, as heating does, and produce dipolar anomalies.
- Depositional activity - Activities involving the excavation of portions of the A and B soil horizons, such as pithouse construction, will produce a contrast to the surrounding magnetism as the excavated area is gradually filled by material with different magnetic susceptibility. Typically, a monopolar anomaly results.
- Compaction - Areas having compacted soil matrices, such as interiors of structures, roadways, plazas, or frequently traveled trails, can produce a magnetic contrast to the surrounding uncompacted areas.
- Historical human activity - Areas which contain recent man-made materials, such as iron implements, live electrical wires, and barbed wire fences, will often produce substantial changes in the magnetic environment. When conducting magnetometer surveys on historic components, this is a desirable characteristic. However, during prehistoric magnetometer surveys, it is a source of additional noise which can cause problems in isolating culturally related anomalies. This type of anomaly is usually dipolar.

Anomaly interpretation

Each anomaly has a "signature" characterizing its shape, size, amplitude, and form (monopolar or dipolar). The signature is distinctive for different objects, thereby often enabling the differentiation of various types of archaeological features.

Several general guidelines are employed when attempting to identify the source of a magnetic anomaly. It is of primary importance to have a working knowledge of the cultural and geological history of the area under study and to understand the geophysical mechanism(s) which might cause a particular type of anomaly. With this combined information, plus use of previous studies in similar areas, models of anticipated anomaly signatures can be formulated for different feature types. When attempting to determine the characteristics of buried cultural features using their magnetic signatures, one must consider:

- Polarization - anomalies with equal positive and negative intensity amplitudes usually indicate ferrous metal objects: iron tools, barbed wire, etc. Cultural sources producing dipolar anomalies generally have negative poles approximately 10 percent of the positive amplitude (Weymouth and Huggins 1985).
- Dipole orientation - In the northern latitudes, culturally produced dipoles, such as kilns, will be oriented with the negative pole to the north of the positive pole. Non-northerly dipole orientation is usually an indication of recent trash or sources no longer retaining in situ magnetic orientation.
- Amplitude - Culturally produced anomalies generally range from 1 to 100 gammas in contrast with the magnetic background. Cultural anomalies are predominantly positive but may be negative depending upon cultural and geologic characteristics (Huggins 1983).
- Shape - The shape of the anomaly will be reminiscent of the cultural feature shape. Distortion may occur, however, from other agencies or complex stratigraphy. It is important to have survey intervals appropriate to the size of the cultural features anticipated so that a number of readings will be collected from any given source.

- Symmetry - Because cultural features are usually symmetrical, single-source anomalies resulting from them will tend to be symmetrical. Where burning is indicated, amplitudes may vary with the depth of the feature and the homogeneity of the firing across the feature.
- Size - The size of the anomaly will be proportional to the size and depth below the present surface of the feature.

Magnetometer Survey Techniques

The total magnetic field over Site 3MS105 was measured by a proton precession magnetometer (Geometrics Model G856). The apparatus consists of a sensor, which measures the magnetic field, and an instrument box, which records and stores the information. The magnetometers are capable of measurement of 0.1 gamma units, with an estimated survey accuracy of ± 0.25 gamma. A detailed description of the principles and mechanics of the proton precession magnetometer is available in Breiner (1973).

To account for the effects of diurnal magnetic variation, two magnetometers were employed simultaneously. One instrument was used as a stationary sensor to record the diurnal magnetic variation in the magnetic field. The second magnetometer was positioned at regular intervals over the survey area and the data from each station were stored in the magnetometer. The pertinent variables measured in this mode (moving mode) included the time, the measurement value, and the spatial coordinates. On Site 3MS105, a sensor height of 0.5 m above the ground was employed. When the magnetometer reached storage capacity, the information was offloaded into a field computer and stored on tapes. The difference between the two magnetometer values recorded at near-synchronous times (the total magnetic field measured at each collection point minus the diurnal variation recorded at the time) provides the magnetic intensity variation for each measurement point in the survey area. The raw data from the two instruments were processed using CLRMAT software (Huggins 1984c) and color density magnetic contour maps were generated.

The collection areas on Site 3MS105 were partitioned into 20 by 20 m survey grids oriented to magnetic north and incorporated into the sitewide coordinate system. The southwest corner of each grid was the reference point and the provenience at this corner provided the grid designation. The grids were grouped into segments for analytical

purposes and the placement of segments on the site is illustrated in Figure 1. Magnetometer survey areas were determined in consultation with Mid-Continental Research Associates archaeologists in response to the results of surface mapping. Magnetometer segments were located to investigate areas of high artifact density, to search for fortification features near the site margins, and to verify the landfill boundary southeast of the site.

The distance between the measurement points in the survey grid is dependent upon the resolution desired from the magnetometer survey. The incomplete measurement of a feature's magnetic properties will distort the shape and intensity of the mapped anomaly. Because a complete magnetic survey of a site is usually impractical, a measurement interval is selected which permits detection of the anticipated cultural features without excess time expenditure. Determination of the appropriate sampling interval involves the consideration of the size of typical cultural features in the study area. A 1.0 m interval was used on Site 3MS105.

Four 20 m ropes were employed to provide spatial control within each survey grid. The ropes were marked in the 1.0 m survey intervals. Two stationary ropes were used to mark intervals along parallel grid borders, the other two ropes, extending perpendicular to the first two ropes, were moved in 1.0 m intervals from one end of the grid to the other. The estimated positional error in regular, unvegetated terrain is ± 0.1 m for 1.0 m surveys and slightly higher for vegetated areas.

Data Processing and Manipulation

The data collected in the field and stored on tapes are brought into the laboratory and transferred to a color processing computer (Terak models 8510 and 8600). The information transferred is the difference between the stationary and the moving magnetometer data. Processing consists of reducing the moving and stationary data values by the total field (approximately 60,000 gammas) to obtain balanced values of equal positive and negative amplitude (Huggins 1984c). The result of this process is a magnetic "background" with higher and lower intensities balanced. Color density maps are then produced from this data set with shades of red representing higher magnetic intensities and shades of blue representing lower magnetic intensities. Shades of yellow and green are used to offset each intensity level. Pastels and whites indicate the background intensity. A total of 50 color intervals are possible with this system,

enabling excellent resolution of magnetic intensity changes (magnetic anomalies). Separate maps were generated for each analytical segment.

RESULTS AND INTERPRETATION

Previous Magnetometer Studies

Proton magnetometer survey techniques have been used successfully in archaeological contexts since the early 1960s (Weymouth and Huggins 1977:193). Most early applications of the technique were in other parts of the world (e.g., Lerici 1961; Breiner and Coe 1972), but magnetometers have since been used on a variety of site types throughout North America. In the process, considerable effort has been directed at the correlation of magnetic anomalies with specific kinds of archaeological features.

Weymouth has identified earth lodges in a Hidatsa village on the northern Plains (Weymouth 1976; Weymouth and Nickel 1977) and a variety of features at historic forts (Weymouth and Woods 1984; Weymouth and Huggins 1977). Extensive work at Anasazi sites in the Southwest has resulted in the identification of pithouses, surface rooms, fire hearths, pits, and midden deposits (Huggins and Weymouth 1970; Huggins 1984a). Studies in the Northwest have succeeded in correlating anomalies with prehistoric rock-lined roasting pit features (Huggins 1983, 1984b; Hatheway and Burtchard 1985). Although these studies involve some cultural remains and soil conditions not found in northeast Arkansas, they provide invaluable comparative data for estimating the range of anomalies that can be expected to result from the occupation of prehistoric and historic sites.

No magnetometer surveys have been conducted in the immediate vicinity of the present project area. However, cultural remains similar to those at the Eaker site have been studied in the Caddoan area (Huggins, Martin, and Bruseth 1984) and at the Toltec site (3LN42) near Little Rock, Arkansas, about 150 miles southwest of Blytheville (Kaczor and Weymouth 1981). Site 3LN42 is located near an old river channel, similar to Site 3MS105, which is adjacent to Pemiscot Bayou. Alluvial deposits are present on both sites. Nine magnetometer grids were surveyed on the Toltec Site in anticipation of identifying subsurface cultural features such as discrete activity areas, house floors, storage pits, mound remnants and middens; features also anticipated at Site 3MS105. The survey was successful in identifying midden areas and most pit features. Remnant

mounds were identified by the presence of high positive magnetic anomalies, and nonactivity areas were indicated by the lack of anomalies. Another magnetometer survey was conducted in Ramey Field, at Cahokia State Park, Illinois (Weymouth 1985). Anomalies associated with houses, activity/midden areas, and palisade trenches were identified. Because of the general similarity of Mississippian cultural remains throughout the central Mississippi drainage, the studies at the Toltec site and Cahokia are especially valuable for the insights they provide for the interpretation of magnetic anomalies at the Eaker site.

Magnetometer Survey Results

This report includes a series of 13 color density maps representing the 16,000 m² survey area. Each map illustrates the magnetic field over one of the 12 analytical segments. Two maps at different contour intervals are provided for Segment 12. Along with each map is an interpretation of the magnetic anomalies identified in terms of their potential archaeological significance. The identification of anomalies with archaeological potential involves classifying each anomaly on the basis of its magnetic signature and the level of confidence associated with each anomaly being cultural in origin. Following is a brief definition of certain terms used to describe the magnetic anomalies:

- Gamma: the measurement unit of magnetic intensity. The earth's total field is approximately 60,000 gammas. Cultural features generally range from 1 to 100 gammas. Anomalies associated with prehistoric features are usually less than 40 gammas.
- Dipole: a magnetic anomaly possessing both a positive and negative field. Prehistoric features rarely appear as dipolar anomalies but when they do (heavily burned clay hearths for example), they are referred to as normal dipolar anomalies and are apparent as a pair of high and low values, with the low value north of the high value and the low value being approximately one-tenth the value of the high. Nonnormal dipole anomalies are identified by their obvious pair of high and low values, and usually indicate ferrous objects. The anomalies from ferrous materials are generally not oriented north-south. Pin-flags produce a very diagnostic nonnormal, dipolar anomaly.

- **Monopole:** a magnetic anomaly with only a negative or positive field observed. Generally, in situ cultural features possess a positive magnetic field due to magnetic enhancement of the soil matrix in some manner. Burning is an especially prevalent method of magnetic enhancement, as is the decomposition of organic materials and water percolation through organic residues.

Annotations used in this report reflect the initial interpretation, prior to testing of anomalies. They provide a way to discriminate between anomalies of different size, intensity, and general shape. They are not intended to be a definitive description of the anomalies. The annotation categories were selected as representing the types of subsurface cultural features anticipated. The following annotations were used:

- **H:** anomalies possibly attributable to subsurface house structures.
- **R:** anomalies possibly related to superimposed house clusters, middens, cemeteries, or larger scale activity areas.
- **F:** anomalies possibly caused by smaller scale cultural activities such as hearths, storage pits, or localized activities.
- **T:** anomalies which may be associated with a fortification trench or wall.
- **I:** anomalies of indeterminate source(s), but of potential interest to archaeologists. These anomalies may represent geologic features or unique/unusual cultural features.
- **a-z:** these characters distinguish between anomalies on each color density map with the same annotation for purposes of description.

A breakdown of selected anomalies for each segment are presented in table form. In addition to the annotated description, other pertinent information is given concerning each anomaly identified on the contour maps. This information includes: dimensions north-south and east-west, center coordinates of the anomaly, magnetic intensity in gammas, polarity, a short verbal description of the anomaly and possible cultural affiliations, and any further salient comments concerning the anomaly or its

interpretation. Archaeological testing by MCRA archaeologists consisted of the excavation of three trenches and thirteen core holes (of concern to the magnetometer data). The core holes were placed in the center of selected anomalies. Several control core holes were placed in areas which did not exhibit anomalies to test the accuracy of the method.

A discussion of the magnetic survey of each segment follows. All of the segments are in an area which has been under cultivation for an unknown period of time and therefore farming implements can be anticipated on all grids. All visible metal was removed prior to the magnetometer survey.

Segment 1. Segment 1 consists of four contiguous 20 by 20 m blocks aligned in a linear manner to magnetic north. Based on the sitewide coordinate system, the four grids are: 300N/230E, 320N/230E, 340N/230E, and 360N/230E (Figure 1). The grids were established near the middle of the site with the high point on the site located to the east. Surface cultural remains within Segment 1 are predominantly Mississippian in age. Figure 2 illustrates the magnetic field over Segment 1. Table 1 presents other pertinent data about Segment 1 data collection and describes the anomalies identified.

The total magnetic intensity variation over Segment 1 is 88 gammas. Five anomalies were identified as possibly having cultural features as their source. One possible house structure anomaly (Ha) was selected for its similarity in shape and size to known structures in the American Southeast (Morse and Morse 1983). The size and magnetic intensity of these anomalies is similar to house features identified in other regions using magnetometry. Two anomalies (Ra and Rb) were selected as being possibly associated with middens or areas of heavy utilization. Two other anomalies (Ia and Ib) may have archaeological affiliation but their magnetic intensities are higher than most anomalies encountered on Site 3MS105. Anomaly Ia falls within the range of typical, culturally related anomalies (32 gammas) so it may represent a midden or house feature that is closer to the surface than most other features. It could also possibly represent a house that was heavily burned, resulting in an enhanced magnetic intensity. Anomaly Ib has a magnetic intensity of 72 gammas. It appears to be monopolar which is atypical for metal, but it is out of the range for most archaeologically related anomalies. At this date, no anomalies from this segment have been tested.

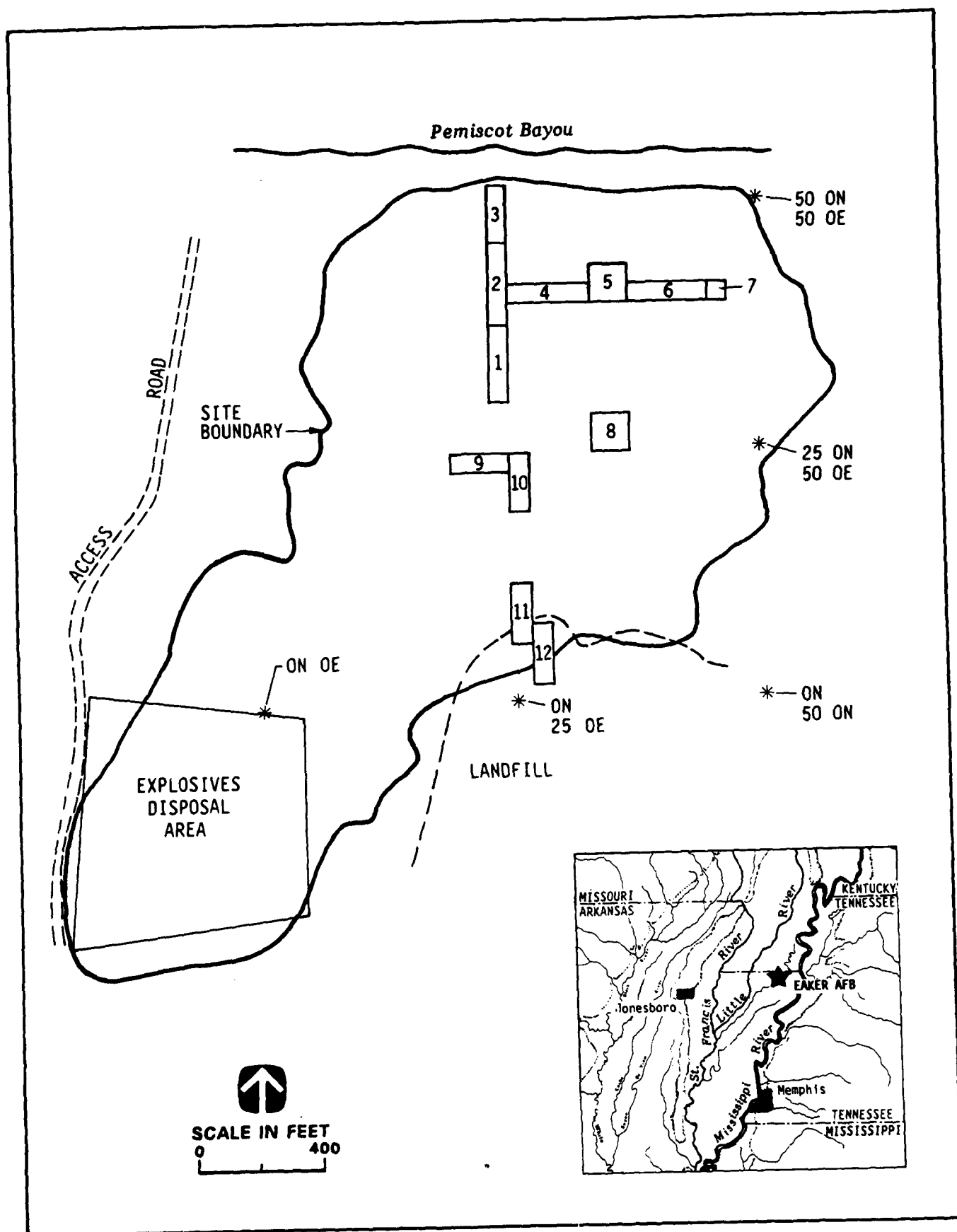


FIGURE 1 PLACEMENT OF MAGNETOMETER GRIDS ON SITE 3MS105,
EAKER AFB, ARKANSAS

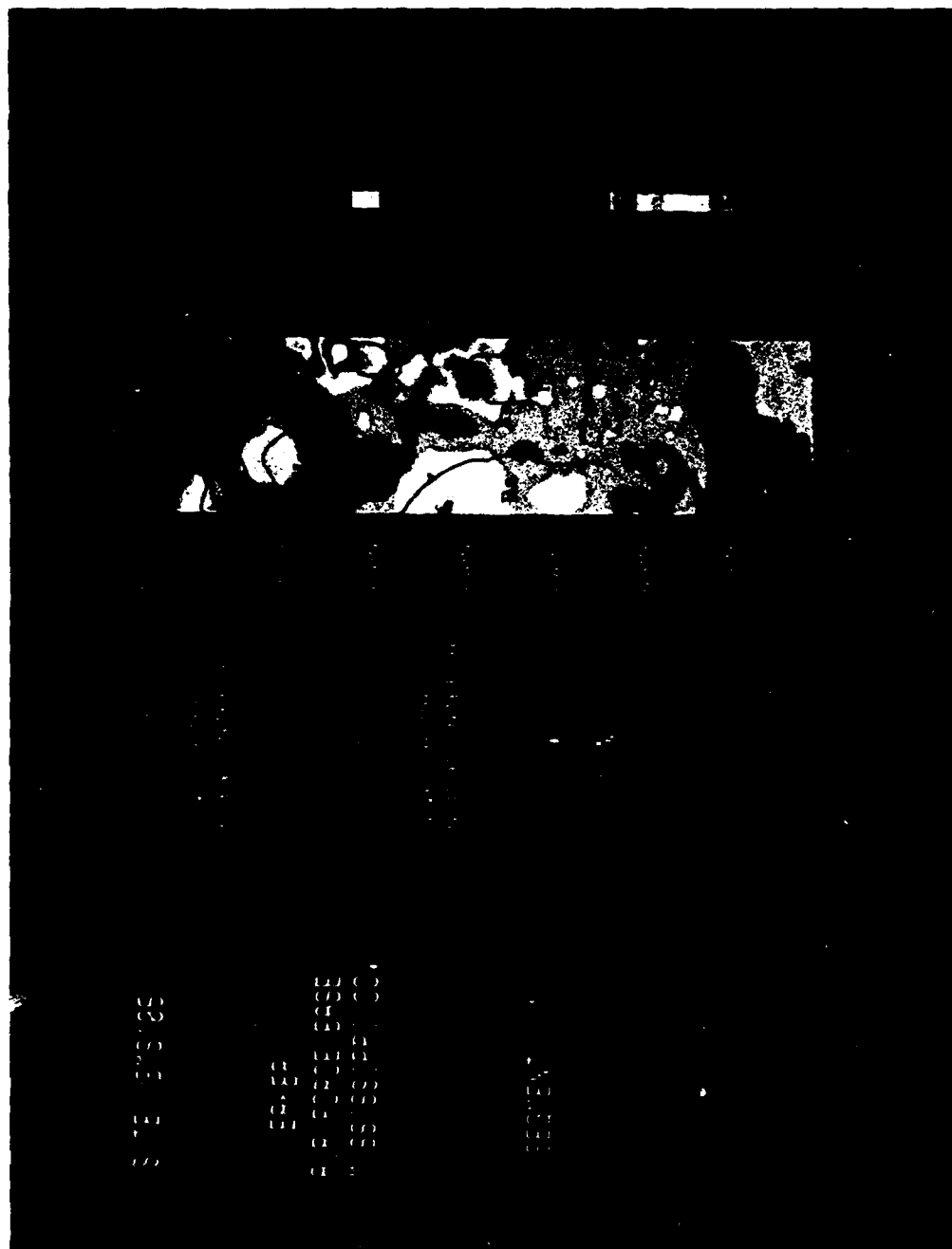


FIGURE 2 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 1 AT SITE 3MS106, EAKER AFB, ARKANSAS

Table 1
Magnetic Anomalies From Segment 1, Site 3MS105
Eaker AFB, Arkansas

Area of Coverage: 1,600 m²

Survey Dates: January 28 and 29, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	362N/236E	13	monopole	possible house structure
Ra	20 x 7	335N/233E	16	monopole	midden or activity area
Rb	3 x 4	368N/232E	8	monopole	midden or activity area
Ia	5 x 5	339N/345E	32	monopole	burned house?
Ib	5 x 5	353N/248E	72	monopole	indeterminate

Segment 2. Segment 2 is composed of four 20 by 20 m blocks oriented to magnetic north. Segment 1 is located to the south and is contiguous. A distinction was made between Segments 1 and 2 for ease in analysis. Grids 380N/230E, 400N/230E, 420N/230E, and 440N/230E were included in Segment 2 (Figure 1). The segment lies in the north-central part of the site and slopes to the north towards Pemiscot Bayou. The highest part of Site 3MS105 lies to the east and southeast. Cultural material noted on the surface primarily includes Mississippian remains (prehistoric) and limited historic debris. Figure 3 illustrates the total magnetic field over Segment 2 presented as a color density map. Table 2 presents other pertinent information concerning data collection on Segment 2 and describes the magnetic anomalies.

The total magnetic intensity variation over Segment 2 is 43 gammas. Seven anomalies were identified as possibly having archaeological features as their source. One possible midden area was identified (Ra). Within this midden area, two anomalies were noted as possibly being cultural in origin (Ia, Ib). They are normal dipoles which usually indicate

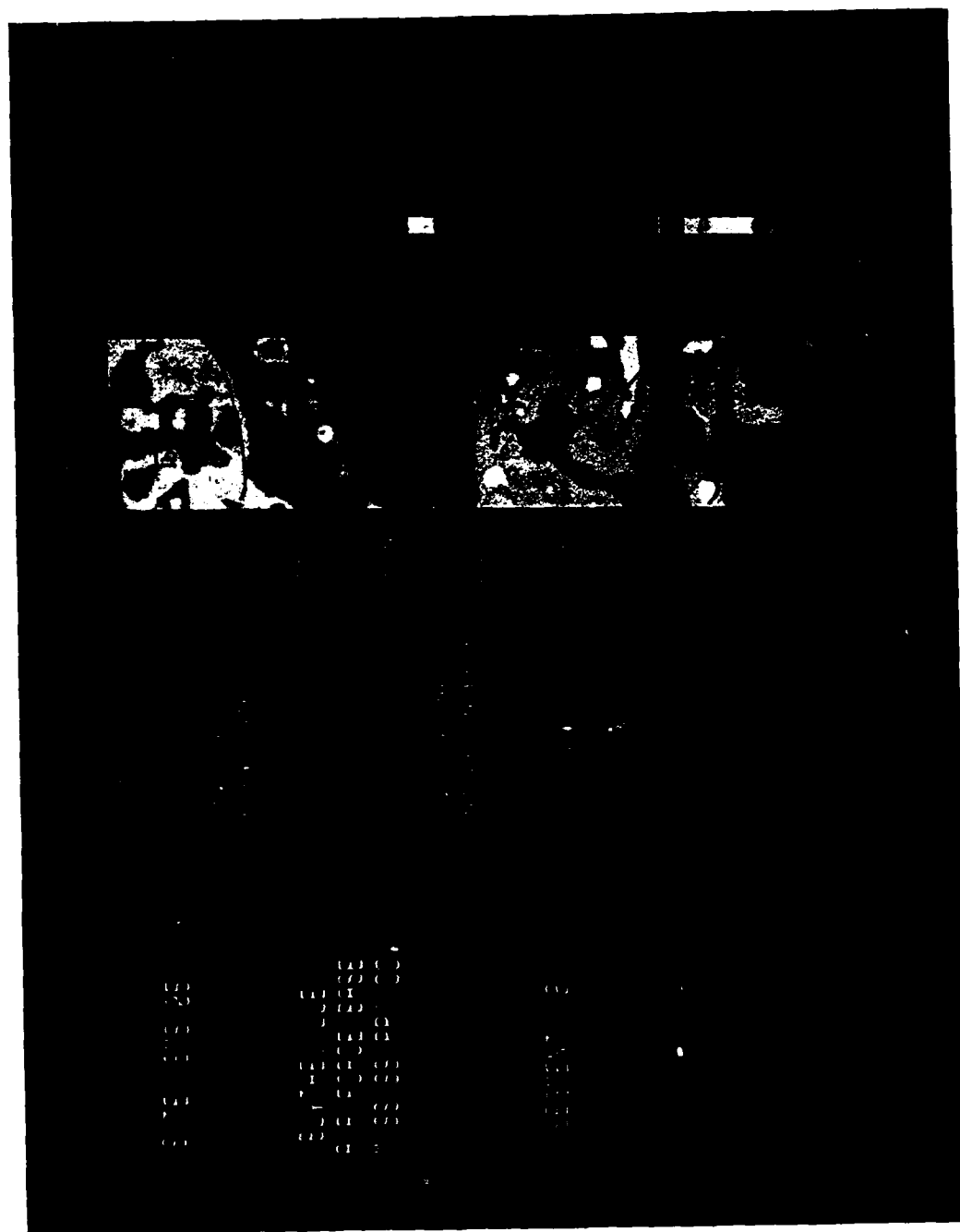


FIGURE 3 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 2 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 2

Magnetic Anomalies From Segment 2, Site 3MS105
Eaker AFB, Arkansas

Area of Coverage: 1,600 m²

Survey Dates: January 30 and February 2, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ra	15 x 20	452N/240E	12	monopole	midden area
Rb	3 x 3	442N/248E	19	monopole	midden or very large storage pit(?)
Ia	3 x 3	447N/239E	39	dipole	in situ metal or heavily burned hearth
Ib	3 x 3	468N/233E	33	dipole	in situ metal or heavily burned hearth
Ic	3 x 3	393N/231E	5	monopole	small midden or activity area
Id	2 x 8	402N/248E	5	monopole	small midden or activity area
Ie	3 x 2	394N/249E	5	monopole	large storage pit or midden

cultural features. However, they could represent metal which happens to be oriented in a north-south manner. Anomaly Rb is 19 gammas in intensity and may represent a midden or a very large storage pit. Anomalies Ic, Id, and Ie represent miscellaneous areas of low magnetic contrast, which may indicate midden or activity areas. They do not stand out as well as other anomalies thought to be associated with similar sources, thus the I (Indeterminate) annotation as opposed to R. No anomalies from this segment have been tested.

Segment 3. Segment 3 consists of three 20 by 20 m blocks oriented to magnetic north in a linear fashion. Segments 1 and 2 are aligned directly south of Segment 3. The placement of these three analytical segments resulted in a linear alignment 220 m in length extending from near the center of the site and continuing north to within approximately 15 m of Pemiscot Bayou (Figure 1). It was anticipated that these segments would be likely to cross any large, linear cultural features, such as palisade walls or other evidence of fortification, in a roughly perpendicular manner. The grids associated with Segment 3 are 460N/230E, 480N/230E, and 500N/230E. This northernmost segment is relatively level and the paucity of cultural material suggests that the site limits are nearby. Cultural material noted was primarily Late Mississippian in age, although some historic debris was noted. Figure 4 illustrates the total magnetic field over Segment 3 as a color density map. Table 3 provides a description of the anomalies.

The total magnetic intensity variation over Segment 3 is 185 gammas. Eight anomalies were classified as having possible cultural features as their origin. Metal is visible as a nonnormal dipole in the southeast portion of the contour map (463N/245E) and is the source of the high magnetic intensity variation.

Anomaly Ia may represent a large midden area but more likely is related to a natural phenomenon such as an old meander channel of Pemiscot Bayou. Anomaly Ra may be a house or midden area located in the old channel. The Late Mississippian occupation on the site is presumed to be located in the northern extent of the site. If the channel has been migrating to the north, it is possible that the old channel and the associated point bar were selected as a locale for occupation. Anomalies Fa, Fb, Fc, Fd, Rb, and Rc may represent exterior features or activity areas associated with this occupation.

Anomaly Ra was investigated by MCRA archaeologists with a 2 by 2 m trench (Trench 3). The test excavation revealed the presence of staining, likely attributable to prehistoric cultural occupation. Plow scars were identified within an area of mottled staining.

Segment 4. Segment 4 consists of four contiguous 20 by 20 m blocks and shares a common side with Segment 2 along the 250E grid coordinate line. The four blocks (400N/250E, 400N/270E, 400N/290E, and 400N/310E) are aligned perpendicular to magnetic north (Figure 1). This configuration was chosen in an effort to locate potential fortifications (palisades) and house clusters associated with the prehistoric components. The area is relatively level with a slight downslope to the north toward Pemiscot Bayou.

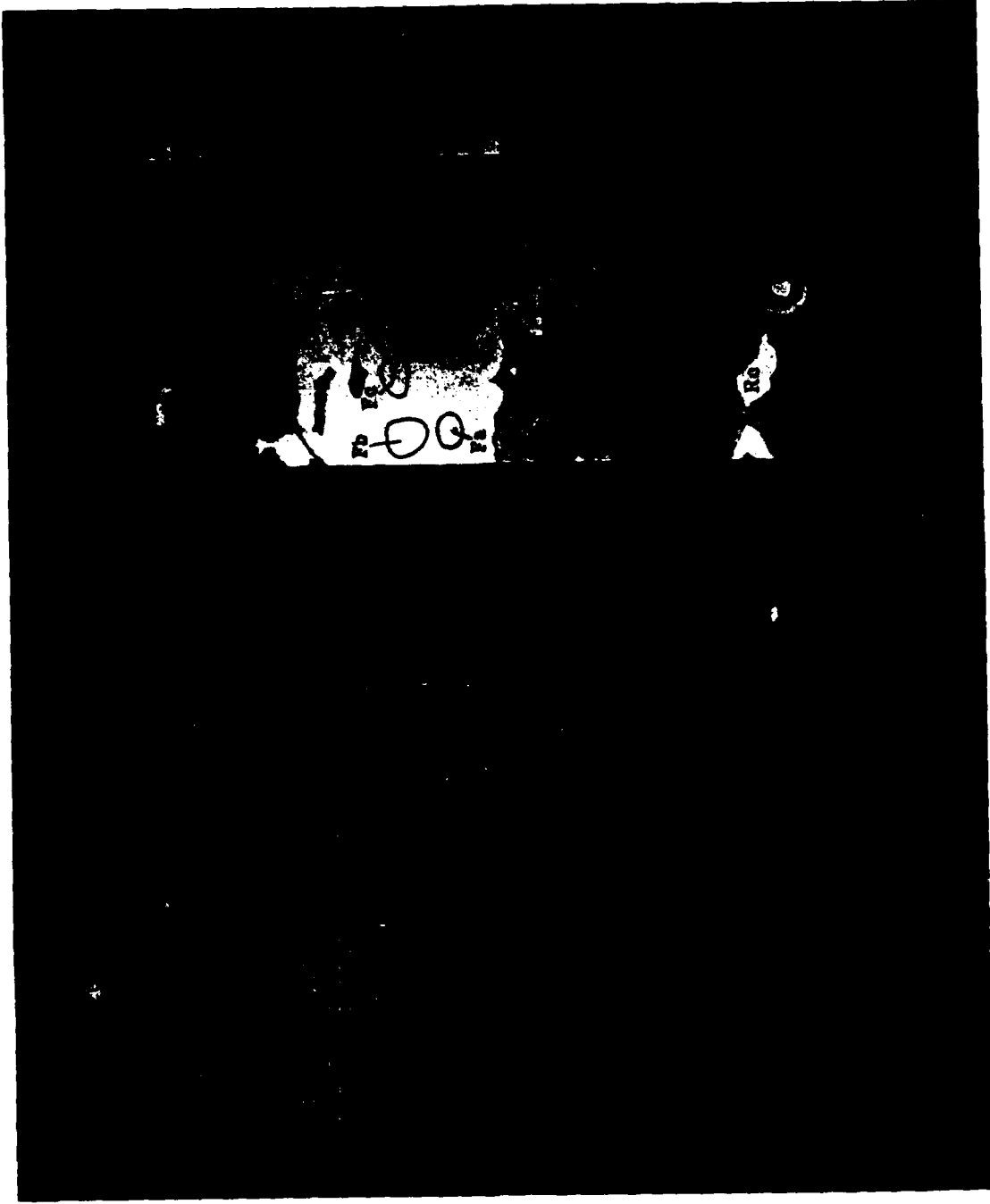


FIGURE 4 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 3 AT SITE 3MS105, EAKER AFB, ARKANSAS

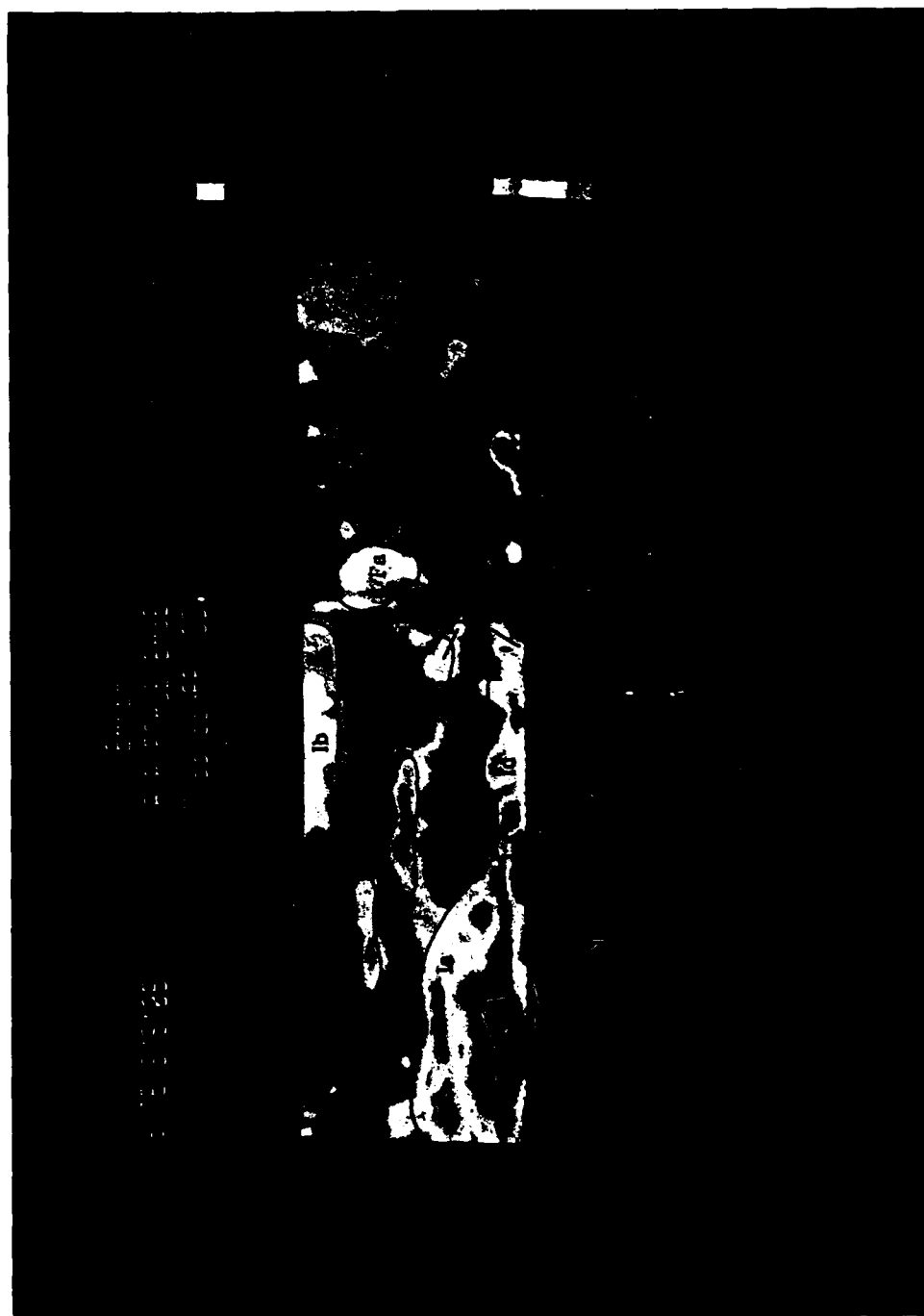


FIGURE 5 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 4 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 4

**Magnetic Anomalies From Segment 4, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,600 m²

Survey Dates: January 30, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ra	10 x 6	415N/338E	8	monopole	midden, extends into Segment 5 (?)
Fa	5 x 3	414N/311E	4	monopole	storage pit or midden
Fb	3 x 3	408N/294E	4	monopole	storage pit or midden
Ia	10 x 20	405N/260E	13	monopole	possibly midden or activity area
Ib	2 x 20	419N/285E	8	monopole	midden
Ic	2 x 10	411N/278E	5	monopole	midden
Id	4 x 15	402N/286E	6	monopole	midden
Ie	2 x 8	414N/268E	5	monopole	midden
If	3 x 5	402N/322E	8	monopole	midden?, not completely documented

The total magnetic intensity variation over Segment 4 is 20 gammas. Nine anomalies were identified as potentially having cultural features as their source. Anomaly Ra is possibly related to a midden or house feature. In Segment 5, which is adjacent to Segment 4 (see Figure 1), an anomaly is apparent (Rb) which appears to be a continuation of Anomaly Ra. Anomaly Ra was tested with a core hole and a highly mottled and disturbed matrix was noted to 87 cm below present ground surface (BPGS). A core hole was also placed 10 m west of the first in an area where no anomaly was identified. The soil encountered was lighter in color, not heavily disturbed, and appeared to be normal soil development to 2.5 m BPGS. Anomalies Fa and Fb may represent storage pits or

small midden areas. Anomaly Ia is somewhat amorphous and possibly contains small or more subtle anomalies associated with cultural features which are difficult to discern. Anomaly Id appears to be a continuation of anomaly Ia or is a similar phenomenon. Anomalies Ic and Ie are long linear anomalies. Unlike those which are thought to possibly be fortification trenches, these linear anomalies are of positive magnetic intensity, contrast, not negative (see Segment 5 Discussion). Their cause is unknown but they possibly represent midden areas. Anomaly Ib extends out of the survey unit and was not completely recorded. It appears to represent a midden or heavy activity area. Anomaly If also extends out of the survey unit and was incompletely documented. This anomaly may also represent a midden or activity area.

Segment 5. Segment 5 consists of four 20 by 20 m blocks. These blocks were not linear as were the previous segments, but were surveyed as a square, 40 m on a side. Part of the west wall of the segment abuts the east wall of Segment 4 along the 330E grid line. The grids in Segment 5 are: 400N/330E, 400N/350E, 420N/330E, and 420N/350E (Figure 1). The configuration of this segment was dictated by the desire to locate a palisade line and/or house clusters on the site. The high point on the site lies to the south. The surface in Segment 5 slopes gently to the east to a small drainage channel which empties into Pemiscot Bayou.

Cultural material noted on the surface is predominantly prehistoric, dating to the Mississippian period. Human bone, lithic tools, ceramics, fire-cracked rock, and other evidence of occupation are all present in this area. Historic debris is limited in this area. Figure 6 illustrates the total magnetic field over the segment as a color density map. Table 5 presents the anomalies identified on the map.

The total magnetic intensity variation over Segment 5 is 48 gammas. Thirteen anomalies were identified as potentially having cultural features as their sources. This segment was particularly interesting in that it appears to document a series of house features or living areas. Anomalies Ha, Hb, Hc, and Hd all appear likely to represent house features. Similar to anomaly Ha in Segment 1, they possess characteristics (size and shape) similar to known house features in the Southeast. Anomalies Fa, Fb, Fc, Fd, and Fe may represent external features such as hearths or storage pits associated with the house structures. Anomalies Ra and Rb look as if they may represent midden areas or other associated activity areas. Anomaly Ia is of unknown origin. It appears to be monopolar but it is rather high in intensity to be cultural in origin. The lack of dipolarity

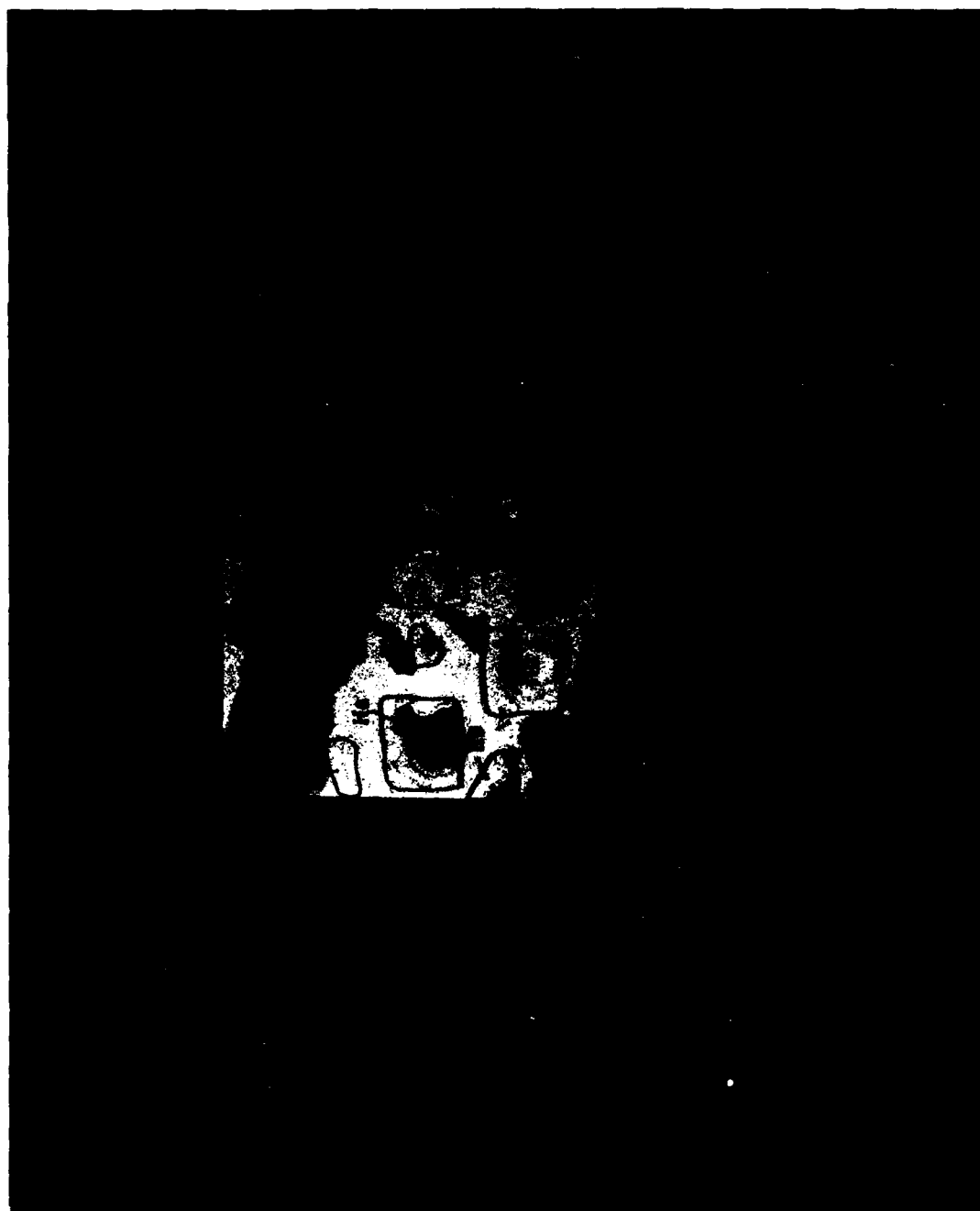


FIGURE 6 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 6 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 5

**Magnetic Anomalies From Segment 5, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,600 m²

Survey Dates: January 31 and February 1 and 3, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	426N/334E	13	monopole	house within midden or activity area and exterior features
Hb	5 x 5	418N/339E	12	monopole	house with exterior features
Hc	5 x 5	413N/351E	12	monopole	house with exterior features
Hd	5 x 5	406N/365E	12	monopole	house with exterior features
Ra	4 x 6	425N/345E	7	monopole	midden area
Rb	2 x 3	421N/331E	13	monopole	not completely visible, extends into Segment 4 (?)
Fa	2 x 3	432N/332E	6	monopole	exterior feature or small midden area
Fb	2 x 2	426N/341E	12	monopole	hearth
Fc	2 x 2	414N/344E	6	monopole	exterior feature or midden
Fd	2 x 2	409N/355E	6	monopole	exterior feature or midden
Fe	2 x 2	406N/360E	8	monopole	hearth
Ia	3 x 3	421N/350E	48	monopole?	part of house or midden
Ta	2 x 10	410N/345E	-8	monopole	fortification trench

makes it seem doubtful that metal is the source. It could be a heavily burned hearth or midden area which is closer to the surface than the surrounding features and thus has a stronger magnetic signature.

There is a linear anomaly (Ta) of slightly lower magnetic intensity (marked with dotted lines on Figure 6) which appears to represent a palisade trench associated with the fortification of the site. A similar anomaly appears on Segment 9.

A 1 by 10 m trench (Trench 2) was excavated on this segment. The trench crossed anomalies, Hc, Fc, and Ta. The excavations revealed cultural features which correlated with the magnetic anomalies. Abundant amounts of daub, bone, and carbon were found at 16 cm BPGS in the area of anomaly Hc (412.5 to 413.5N and 348 to 350E). In the areas which displayed a lower magnetic contrast (412.5 to 413.5N, 347 to 348E), the amount of carbon, daub, and bone was decreased. Anomaly Fc was associated with a midden area, evident as scattered daub, sherds, bone, and carbon in darkly stained soil (412.5 to 413.5N, 344 to 347E). In the vicinity of anomaly Ta (412.5 to 413.5N and 341 to 344E), the soil was a light brown sand, very clean with few intrusions. This deposit was strikingly different than the surrounding matrix which was darker and full of cultural material. This phenomenon is thought to represent a fortification trench (Lafferty and Cande 1989:92).

Segment 6. Segment 6 is a linear alignment of four 20 by 20 m blocks oriented perpendicular to magnetic north. The west wall, along the 370E grid, abuts the east wall of Segment 5. The grids in Segment 6 are: 400N/370E, 400N/390E, 400N/410E, and 400N/430E (Figure 1). The slope in this area is to the east and north towards a small tributary of Pemiscot Bayou. The configuration of this segment extended the effort to locate the site limits and to identify interior activity areas. Surface cultural materials are almost entirely Mississippian in age. Historic and recent materials appear to be limited. Figure 7 illustrates the total magnetic field over Segment 6. The anomalies identified in the grids are described in Table 6.

The total magnetic intensity variation over Segment 6 is 27 gammas. Six anomalies were identified as having potential cultural affiliation. Anomaly Ha looks similar to Ha in Segment 1 and may also represent a house structure. Anomaly Ra may represent another house structure but more likely represents a midden or heavy activity area. Anomalies Ia, Ib, and Ic were incompletely documented because they are located on the edge of the

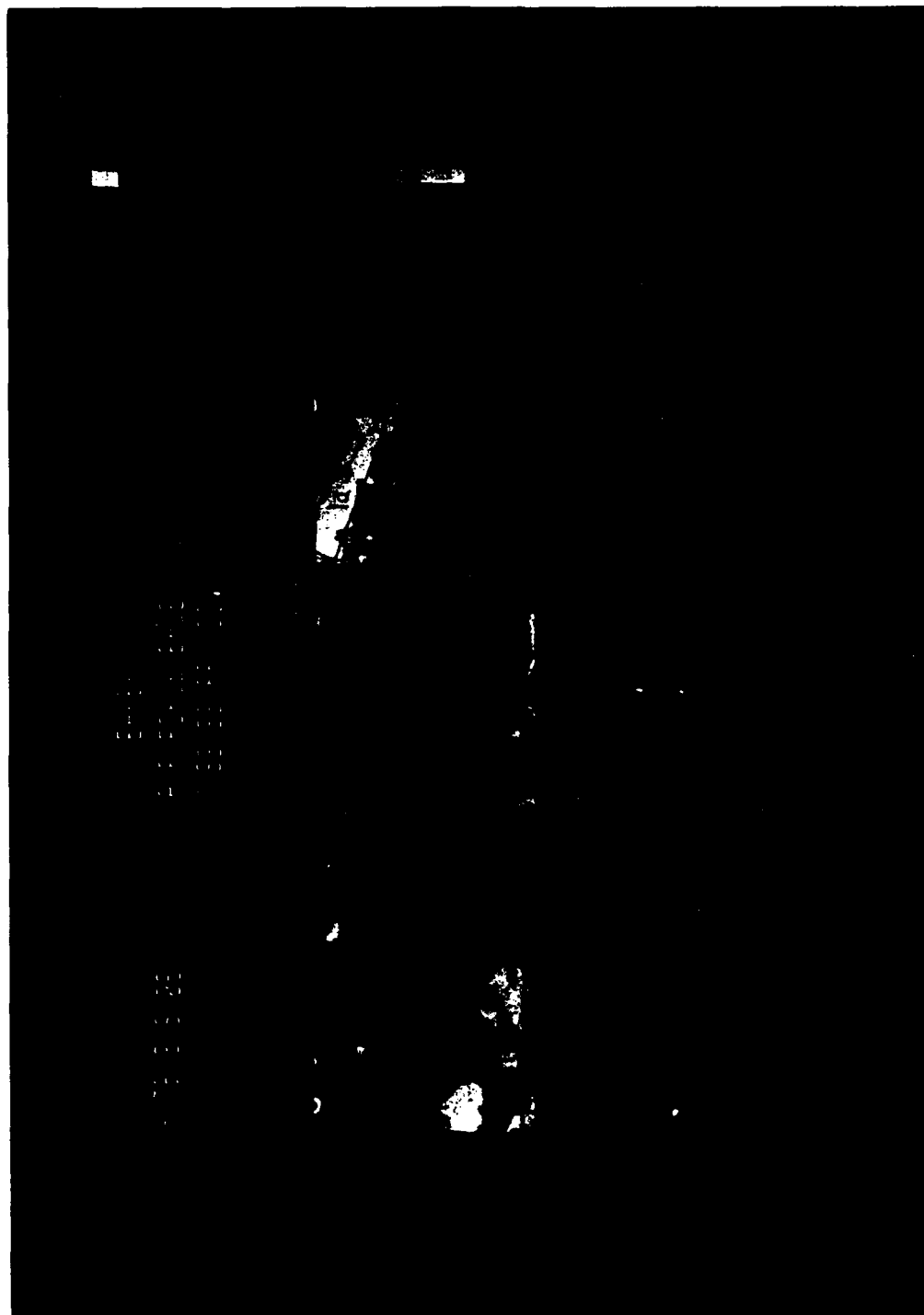


FIGURE 7 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 6 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 6

**Magnetic Anomalies From Segment 6, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,600 m²

Survey Dates: February 3 and 4, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	470N/372E	5	monopole	house
Ra	5 x 8	404N/381E	13	monopole	midden
Ia	3 x 2	401N/370E	6	monopole	not completely documented, indeterminate
Ib	2 x 4	401N/398E	7	monopole	not completely documented, indeterminate
Ic	1 x 3	400N/410E	12	monopole	not completely documented, indeterminate
Id	10 x 30	415E/435E	14	monopole	geologic or possible mound remnant

data collection unit. The area south of this grid was not magnetically surveyed and possible sources are difficult to assess. Anomaly Id is only partially mapped, as it extends east into Segment 7, and north for an undetermined distance. Although the anomaly consists of a high positive monopole suggesting a cultural origin, it is much larger than the other anomalies at the site. Based on its very large size, a geologic origin might be suggested. However, the anomaly is also consistent with a pattern that could be expected from a large mound. At the Toltec site, Kaczor and Weymouth (1981:122) reported a pattern of extremely high and low magnetic values in mound areas as a result of construction loading of soils. The anomaly in Segments 6 and 7 may represent the remnants of a large mound situated at the northeast corner of the site. The anomaly corresponds to the location of a square soil pattern, about 70 m on a side,

identified on aerial photographs and interpreted as a mound by Lafferty and Cande (1989:143). The surrounding areas of low magnetic values may reflect B horizon soils (Kaczor and Weymouth 1981) exposed during mound construction. No test excavations were conducted on this segment.

Segment 7. Segment 7 consists of one 20 by 20 m block situated east of Segment 6 along the 450E grid line. The grid coordinates are 400N/450E (Figure 1). It was hoped that this grid would contain evidence of a palisade wall thought to encircle the Late Mississippian-age component. Slope in the area is gently to the east running towards the small drainage which lies about 10 m further east. The highest portion of the site is located to the south and west. Artifact density is markedly decreased in this area, as compared to other areas further west. Very few Woodland or historic artifacts were noted in this area. Figure 8 shows the total magnetic field over Segment 7 presented as a color density map. Table 7 describes the magnetic anomalies located in Segment 7.

The total magnetic intensity variation over Segment 7 is 41 gammas. Only one anomaly was noted, a continuation of the one mapped in Segment 6. The positive magnetic anomaly, low artifact density, and high density of human bone in the area (Lafferty and Cande 1989:143) are consistent with the interpretation of the feature as a mound remnant. No evidence of fortifications is present in the magnetometer map; present interpretations suggest that any palisades or trenches in this area would be adjacent to the mound, just east of Segment 7 (Lafferty and Cande 1989:148-149). No other smaller, more subtle anomalies were noted. No test excavations were conducted on Segment 7, although such work should be a priority if the northeast portion of the site is affected by future development.

Segment 8. Segment 8 consists of a square block of four 20 by 20 m grids located south of the major concentration of magnetometer units and along the southern slope of the highest point on the site. Grid designations are: 250N/330E, 250N/350E, 270N/330E, and 270N/350E (Figure 1). This area was chosen for magnetometer surveying based on the high density of prehistoric artifacts noted on the surface. It was hoped that the magnetic survey would record undisturbed functional areas, most likely house clusters. Mississippian artifacts predominate but Woodland ceramics are present. Historic material is scarce in this area. Figure 9 illustrates the total magnetic field over Segment 8 as seen in a color density map. Table 8 provides a description of the magnetic anomalies.



FIGURE 8 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 7 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 7
Magnetic Anomalies From Segment 7, Site 3MS105
Eaker AFB, Arkansas

Area of Coverage: 400 m²

Survey Dates: February 6, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ia	10 x 20	415N/460E	7	monopole	possible mound

Table 8
Magnetic Anomalies From Segment 8, Site 3MS105
Eaker AFB, Arkansas

Area of Coverage: 1,600 m²

Survey Dates: February 1, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	278N/355E	8	monopole	house
Ra	12 x 10	285N/360E	6	monopole	midden or super-imposed cluster of houses/features/midden
Rb	5 x 5	275N/364E	5	monopole	midden
Rc	10 x 10	280N/335E	2	monopole	midden/activity area
Rd	10 x 5	263N/358E	4	monopole	midden
Re	3 x 8	252N/353E	6	monopole	not completely documented
Rf	3 x 5	288N/332E	4	monopole	not documented, midden/house
Fa	3 x 3	264N/368E	6	monopole	storage pit?
Fb	2 x 2	254N/362E	6	monopole	storage/hearth



FIGURE 9 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 8 AT SITE 3MS105, EAKER AFB, ARKANSAS

The total magnetic intensity variation over Segment 8 is 20 gammas. Nine anomalies were selected as having potential cultural affiliation. Anomaly Ha possibly represents a house structure, once again similar to others identified on this site. Anomalies Ra-Rf all represent anomalies possibly associated with middens or high activity areas. Anomaly Ra could also represent a superimposed cluster of house features. Anomalies Re and Rf were located on the edge of the survey unit and were not completely documented. Anomalies Fa and Fb may represent large hearths or storage pits.

Two anomalies were tested in Segment 8 with a 1 by 10 m trench (Trench 2) and three core holes. The trench was located at 276 to 287N and 350 to 360E, cutting through the location of anomaly Ha (278N/355E). The trench revealed several features. A pit was located at 277.5N/351.5E (center coordinate) at 16 cm BPGS. The pit was approximately 1.0 by 1.0 m in size and was filled with daub, sherds, and carbon in a fine brown silt. The pit extended approximately 46 cm BPGS. It is apparent as a low, circular anomaly adjacent to anomaly Ha to the west. Next to this pit was a wall trench with post molds. The trench is approximately 30 to 40 cm thick and extends to approximately 56 cm BPGS. The trench is filled with a pale yellow sand. A thin (10 cm) midden lens was noted on the east edge of the trench. From 353E to about 359E, a grayish brown fine silt deposit was noted. An area of more intensely burned soil, with abundant daub was noted in the center of this stained silt. On the east end of the trench, at about 358.5E two more post molds were noted. To the east of the post molds, the deposit was clayey silt as opposed to a fine silt. Plow scars were also noted. Another pit was noted outside of the post molds as well as possible evidence of another wall trench, though it was not as apparent as the trench to the west. So in looking at Figure 9, the magnetic intensity contour map of Segment 8, it would appear that anomaly Ha represents a house feature, with post molds on the east and west, not apparent on the maps, and exterior features, perhaps evident as low, negative anomalies on either side of anomaly Ha. A core hole was placed in anomaly Ha, north of the trench. The core sample revealed sherds and burned midden to 67 cm BPGS.

Another core was placed in anomaly Rc (280N/335E). Artifacts were located to 100 to 110 cm BPGS. A control core was placed in an area which exhibited no anomaly and the artifacts stopped at 20 cm BPGS.

Segment 9. Segment 9 consists of a linear alignment of three 20 by 20 m blocks located south of the main investigation area and southwest of the high point on the site. Grid

designations are: 230N/190E, 230N/210E, and 230N/230E (Figure 1). This area was of interest for magnetometer surveying because of its proximity to denser surface concentrations of Woodland ceramics as well as to the surface indications of the landfill areas to the southeast. Cultural materials consisted of chipped lithic tools, ceramics, daub, bone, ground basalt artifacts, and fire-cracked rock fragments dating to both Woodland and Mississippian occupations. Both historic and recent implements are also present in low densities. Figure 10 shows the total magnetic field over Segment 9 in the form of a color density map. Table 9 lists the anomalies identified. No anomalies were tested on Segment 9.

The total magnetic intensity variation over Segment 9 is 29 gammas. Fifteen anomalies have possible cultural affiliation. As in Segment 5, there appears to be a series of house structures. Anomalies Ha, Hb, Hc, Hd, and He represent these possible features. Anomalies Ra, Rb, Rc, and Rd represent possible midden or activity areas surrounding these house features. Anomalies Fa, Fb, Fc, Fd, and Fe are anomalies which may be associated with middens, fire hearths, or storage pits. There is a linear anomaly (Ta), marked on Figure 10 with dotted lines, of comparatively lower magnetic intensity that may represent some sort of cultural phenomenon, possibly a trench. A similar pattern is present on Segment 5.

Segment 10. Segment 10 consists of a linear group of three 20 by 20 m blocks oriented to magnetic north. It contains grids 190N/250E, 210N/250E, and 230N/250E (Figure 1). The west side of grid 230/250E shares a common side with the easternmost edge of Segment 9. Segments 9 and 10 were placed in an area with higher densities of Woodland ceramics and somewhat north of the landfill as shown on the Eaker AFB maps. It was hoped that the magnetometer survey would locate the extent of the landfill as well as document any intact prehistoric features. Cultural materials are similar to those found on Segment 9; ceramics, lithics, bone, and other miscellaneous artifacts. Figure 11 shows the total magnetic field over the segment in the form of a contour density map. Table 10 contains a description of the anomalies from this segment.

The total magnetic intensity variation over Segment 10 is 30 gammas. Six anomalies were identified as being possibly associated with cultural features: one possible house structure (Ha); four possible midden or activity areas (Ra, Rb, Rc, and Rd); and one extraneous feature, perhaps a fire hearth or storage pit (Fa). Anomaly Fa is unusual in that it is encircled by an area of relatively low magnetic intensity. The reason for this is

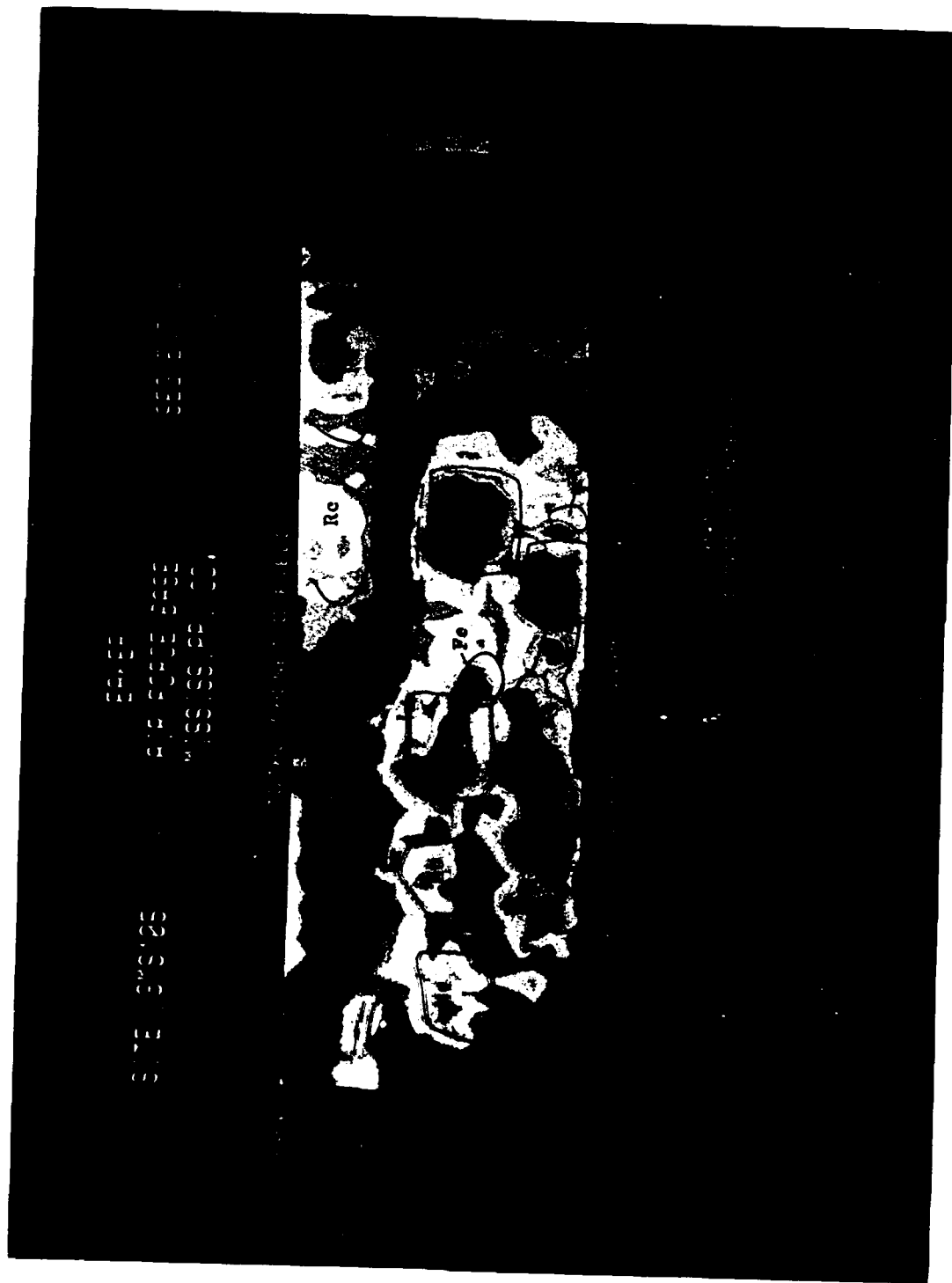


FIGURE 10 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 9 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 9

**Magnetic Anomalies From Segment 9, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,200 m²

Survey Dates: February 6 and 7, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	6 x 6	239N/228E	9	monopole	house
Hb	6 x 6	240N/212E	7	monopole	house
Hc	5 x 5	233N/208E	8	monopole	house
Hd	5 x 5	233N/225E	9	monopole	house
He	6 x 6	238N/195E	7	monopole	house
Ra	5 x 10	235N/214E	6	monopole	midden/activity area around houses
Rb	5 x 5	241N/205E	3	monopole	midden/activity area
Rc	5 x 10	247N/229E	3	monopole	midden
Rd	5 x 10	247N/240E	4	monopole	midden
Fa	3 x 3	245N/195E	4	monopole	midden (?)
Fb	2 x 2	233N/203E	6	monopole	hearth/storage pit
Fc	2 x 2	237N/218E	7	monopole	hearth/storage
Fd	2 x 1	233N/229E	6	monopole	hearth/storage pit
Fe	3 x 3	243N/243E	5	monopole	midden (?)
Ta	3 x 60	345N/220E	-8	monopole	trench

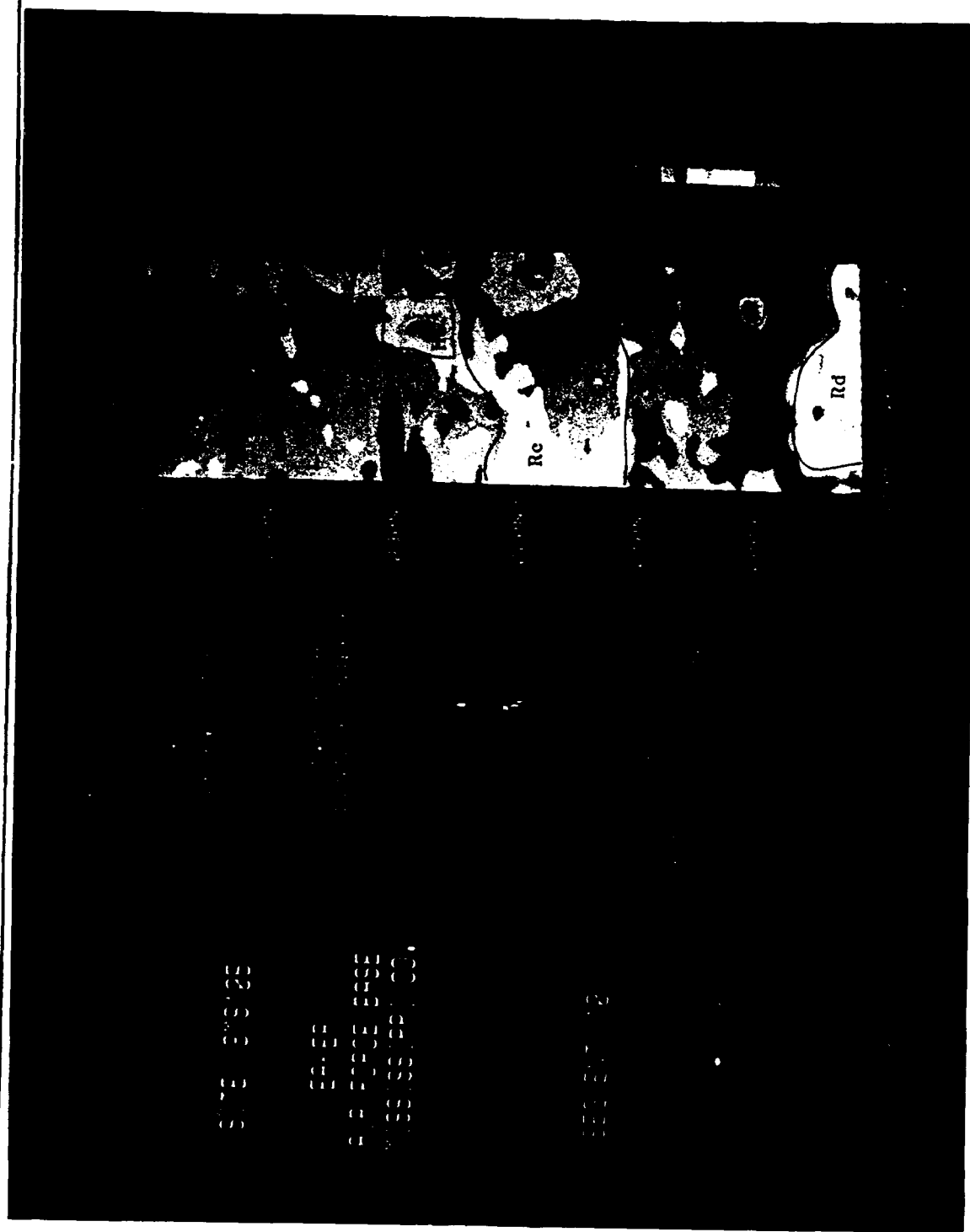


FIGURE 11 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 10 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 10

**Magnetic Anomalies From Segment 10, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,200 m²

Survey Dates: February 4, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	227N/264E	11	monopole	house
Ra	8 x 5	235N/268E	13	monopole	midden
Rb	3 x 3	226N/269E	8	monopole	large feature/house, not completely mapped
Rc	10 x 20	206N/260E	5	monopole	midden
Rd	5 x 20	193N/260E	12	monopole	midden, not completely mapped
Fa	2 x 2	199N/266E	21	monopole	heavily burned hearth?

unknown at the present time, but it is possibly caused by a heavily burned hearth. No anomalies were tested on Segment 10.

Segment 11. Segment 11 consists of a linear alignment of three 20 by 20 m grids aligned to magnetic north. The grid designations are: 60N/250E, 80N/250E, and 100N/250E (Figure 1). The segment is located along the southern edge of the site near the grenade range and the landfill as shown on the Eaker AFB baseline maps. Additionally, the presence of higher densities of Woodland period ceramics in the area suggested the possibility that buried material relating to that period might be present. The main purpose for Segment 11 and Segment 12, which shares a contiguous border to the southeast, was to locate the boundary of the disturbance associated with the landfill. In the area, the slope is generally to the south and east. Surface cultural material in the area includes prehistoric, historic, and recent remains. The prehistoric

assemblage is similar to that described from the rest of the site. Historic materials are scarce, and consist primarily of brick, domestic ceramics, and metal fragments. The recent material is typical of dumps and includes chunks of asphalt, concrete, pipe, and larger pieces of indeterminate metal objects. It was anticipated that this trash material was associated with the landfill. Figure 12 shows the total magnetic field over the segment in the form of a color density map. Table 11 lists the anomalies from the segment and contains a brief description of each.

The total magnetic intensity variation over Segment 11 is 146 gammas. Three anomalies are possibly associated with cultural features (Ra, Rb, and Ia). Metal at 82N/252E is the source of the high variation. Surface examination during the magnetometer survey showed no visible metal in this area, so it is probably buried and associated with the landfill. Further indication of the landfill is shown by anomaly Ia. This anomaly could be caused by a prehistoric midden, but its proximity to the boundaries of the landfill make it more likely to be associated with the landfill. Anomalies Ra and Rb both were chosen as possibly having cultural affiliation (prehistoric) because of their magnetic intensity in contrast to surrounding areas. Their actual correspondence to cultural features is indeterminate, but could possibly be midden areas or areas of intense occupation. No anomalies were tested in Segment 11.

Segment 12. Segment 12 consists of three 20 by 20 m grids oriented to magnetic north. Segment 12 is situated southeast of Segment 11 and shares a common boundary along the 60N/270E line. The grids comprising this segment include 20N/270E, 40N/270E, and 60N/270E (Figure 1). This segment is located along the approximate edge of the site limits and hopefully overlaps well into the landfill area. Drainage is to the southeast. The density of prehistoric cultural materials is notably lower in this area than to the north. Conversely, the recent trash is more prevalent, consisting of asphalt, bricks, concrete, plastic, metal, and other assorted modern debris. Figures 13 and 14 are color density maps representing the total magnetic field over Segment 12. Figure 13 shows all three grids at a relatively high contour interval (10 gammas) to emphasize the location of the landfill area. Figure 14 shows only the northern three-quarters of Segment 12, designated as Segment 12.1, and a smaller contour interval (1.5 gammas) to show any smaller, more subtle anomalies which may be present. Table 12 is a list of the magnetic anomalies from Segment 12 with brief descriptions of each.

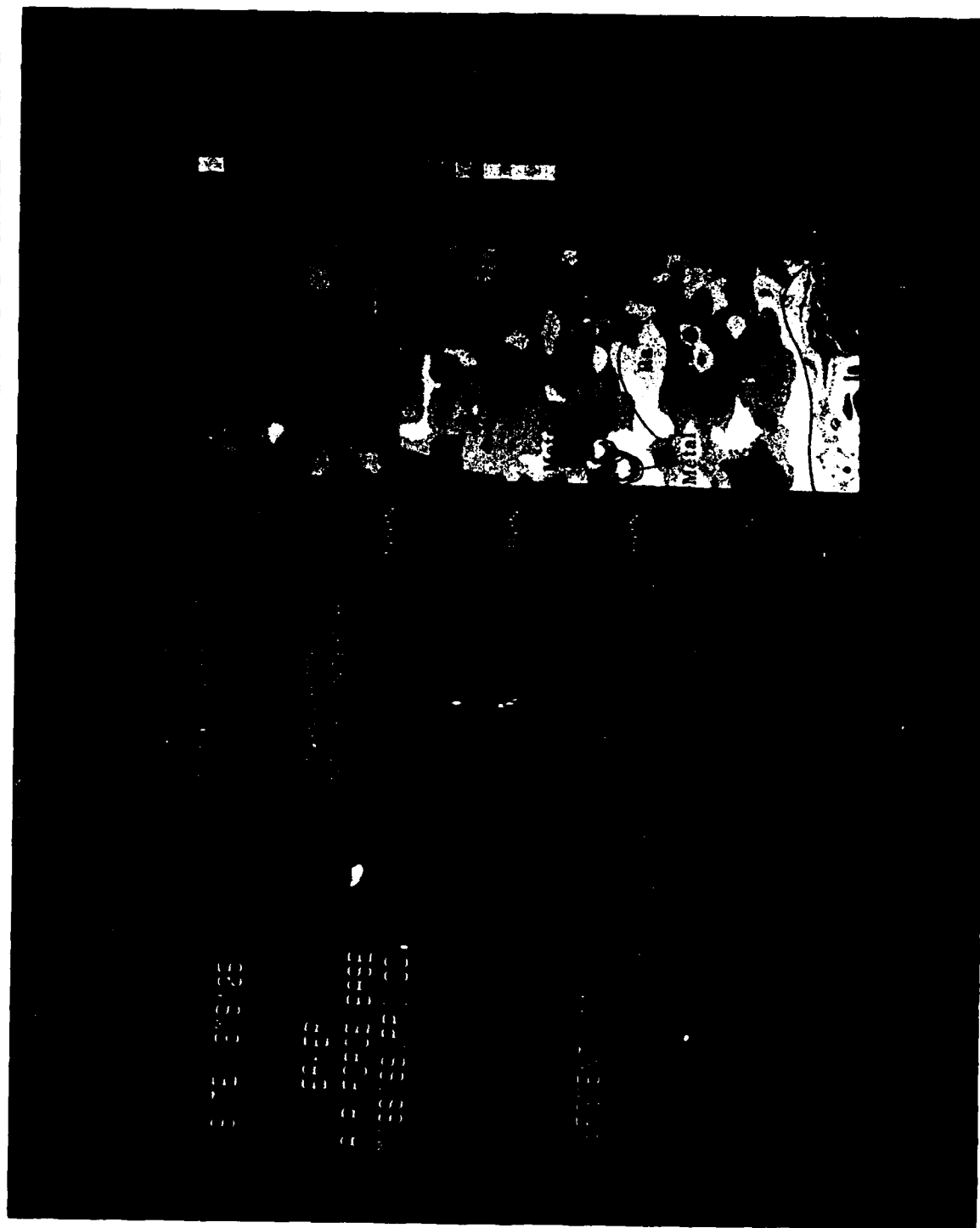


FIGURE 12 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 11 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 11

**Magnetic Anomalies From Segment 11, Site 3MS105
Eaker AFB, Arkansas**

Area of Coverage: 1,200 m²

Survey Dates: February 5, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ra	4 x 10	79N/258E	4	monopole	midden
Rb	3 x 3	93N/269E	8	monopole	midden, not completely visible
Ia	6 x 20	63N/260E	13	monopole	edge of landfill disturbance or prehistoric midden

The total magnetic intensity variation over Segment 12 is 6,444 gammas. This extremely large variation is due to the location of a modern landfill south of Site 3MS105 which apparently extends into the site area. A surface scatter of modern trash gives some indication of the northern boundary of the landfill, but the magnetometer survey confirmed that the landfill extends out to at least 40N. This is shown by the very high readings, apparent as dark green on Figure 12 (anomaly Ia). Miscellaneous high readings indicate that remnants of metal are present throughout the entire segment, but the highest concentration is to the south and slightly west. Figure 14 shows a contour map at a lower contour interval. One anomaly thought to be associated with a prehistoric cultural feature is noted (Ha). This anomaly is similar in size, intensity (magnetic contrast), and shape to anomalies thought to be associated with other structures at Site 3MS105 and elsewhere in the Southeast.

The obvious strong, dipolar anomaly in the southwest portion of Figure 14 is associated with the landfill. No anomalies were tested on Segment 12.

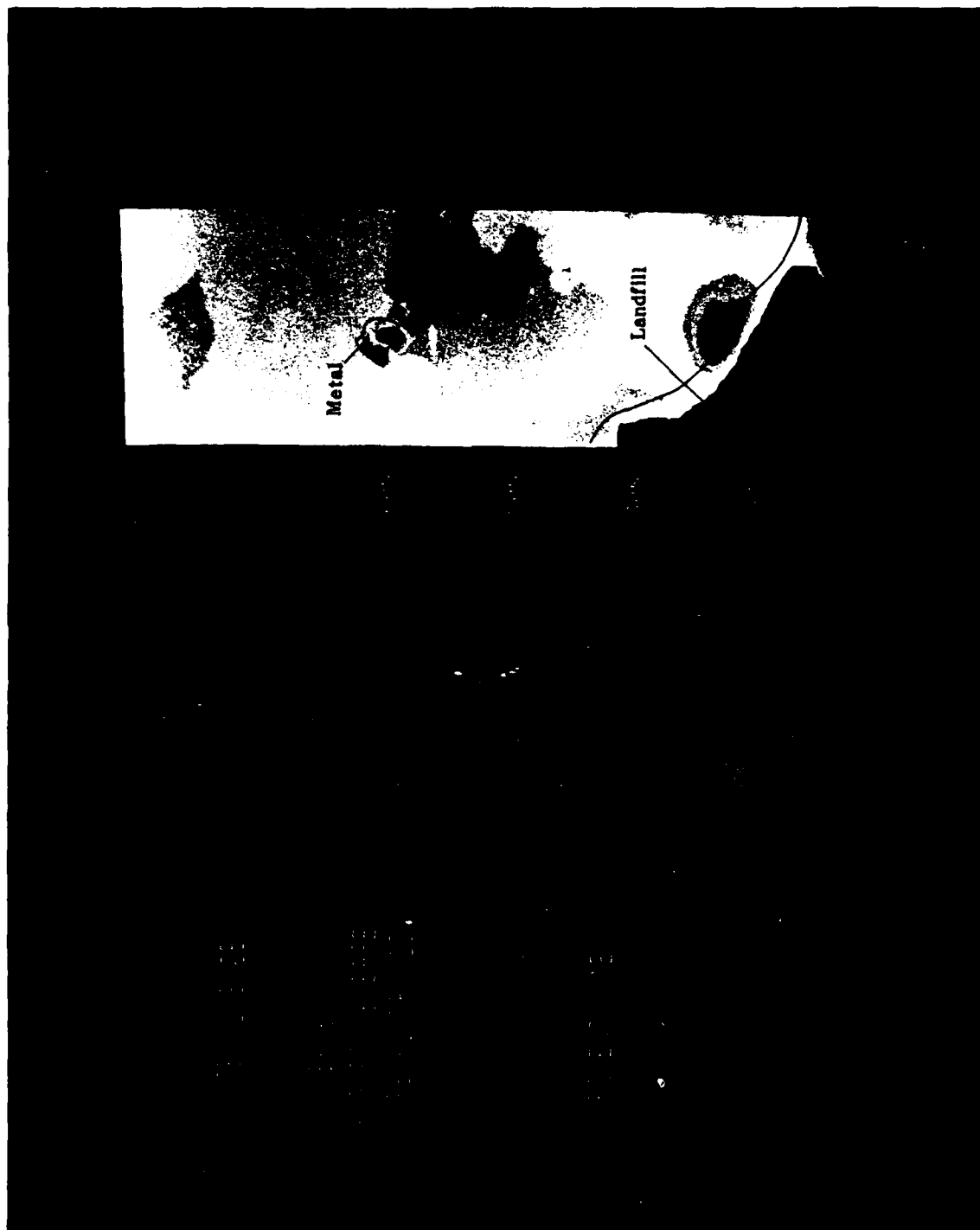


FIGURE 13 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 12 AT SITE 3MS105, EAKER AFB, ARKANSAS

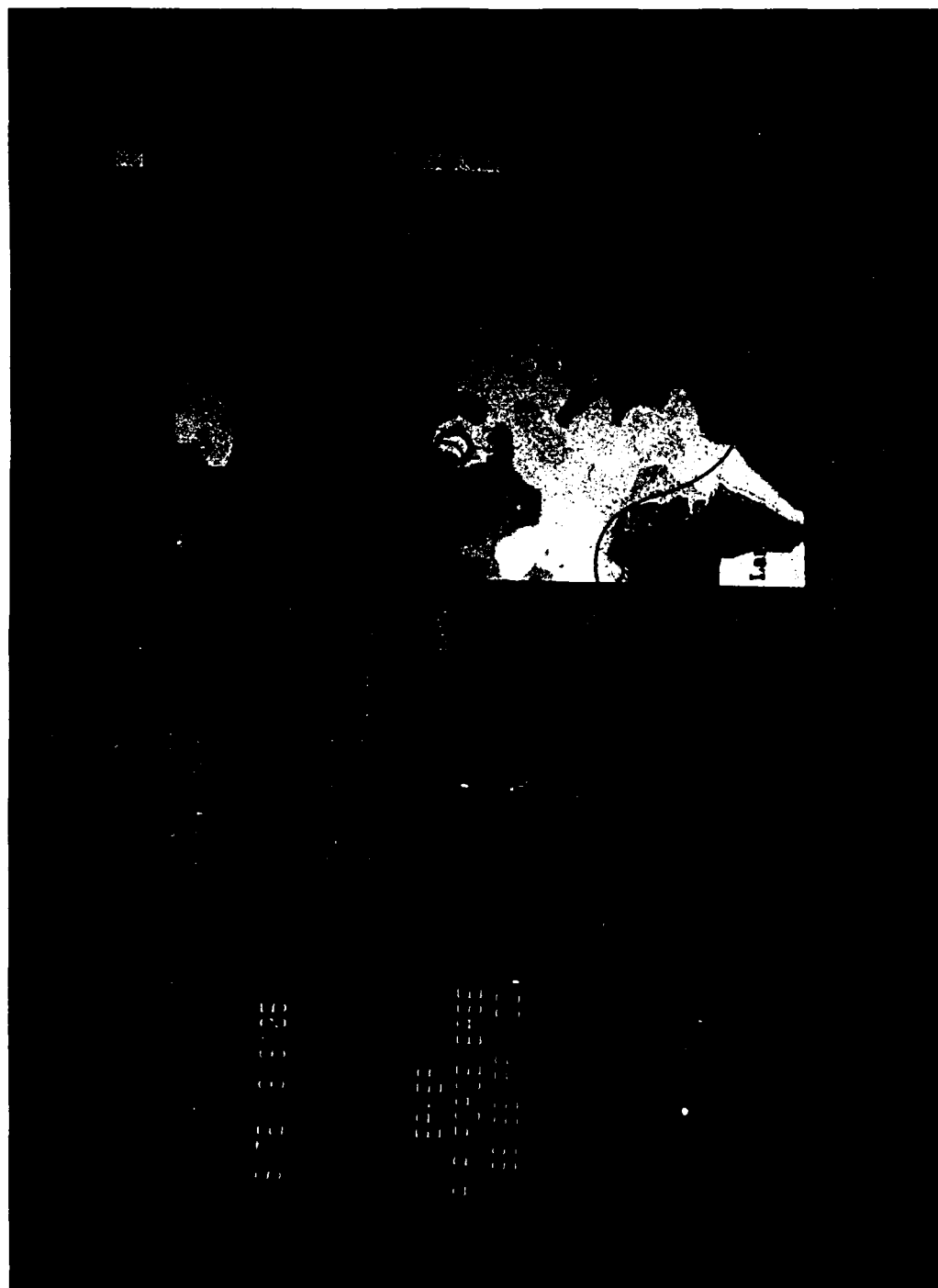


FIGURE 14 COLOR DENSITY MAP OF MAGNETOMETER SEGMENT 12.1 AT SITE 3MS105, EAKER AFB, ARKANSAS

Table 12

Magnetic Anomalies From Segment 12, Site 3MS105
Eaker AFB, Arkansas

Area of Coverage: 1,200 m²

Survey Dates: February 5 and 6, 1988

Special Data Treatment: None conducted at the present time

Survey Interval: 1.0 m

Sensor Height: 0.5 m

Anomaly	Dimensions (m) N-S x E-W	Center Coord.	Intensity (gammas)	Polarity	Comments
Ha	5 x 5	75N/280E	6	monopole	house
Ia	25 x 20	20N/280E	3224	dipole	landfill

Discussion

A total of 84 magnetic anomalies were identified during the proton magnetometer survey of Site 3MS105 as potentially having cultural features as their origins. Table 13 provides a breakdown of these anomalies by type as they were originally annotated. Table 14 provides the results of the testing of selected anomalies by MCRA archaeologists. Based upon the testing results, the applicability of these annotations is discussed.

Fourteen anomalies were given an "H" annotation, implying that these anomalies have house features as their source. The "H" anomalies occur primarily in Segments 5 and 9 (9 of 14, 64%). Segments 1, 6, 8, 10, and 12 each have one "H" anomaly. It is unknown if this represents an actual pattern of house distribution or if it is due to the arbitrary nature of the annotation system. The "H" anomalies ranged in magnetic intensity variation from 5 to 13 gammas (mean 8.6 gammas). Two sizes were present, 5 by 5 m (11) and 6 by 6 m (3). In segments 5 and 9, the "H" anomalies are fairly close together and on both of these segments there is a large linear, negative anomaly (Ta) thought to be associated with some type of fortification trench. The placement of houses near fortification walls is compatible with known site patterns of the Late Mississippian Nodena Phase (Morse and Morse 1983:287). Many of the "H" anomalies have smaller anomalies nearby, possibly representing exterior features related to the houses.

Table 13

Summary of Magnetic Anomalies Identified During the Magnetometer Survey of Site 3MS105
Baker AFB, Arkansas

Segment	Dimension (N-S x E-W in meters)				Intensity (gammas)					
	H	R	F	T	I	H	R	F	T	I
1	(n=5)	5 x 5	20 x 7 3 x 4	-- --	5 x 5 5 x 5	13	16	-- 8	-- --	32 72
2	(n=7)	--	15 x 20 3 x 3	-- --	3 x 3 3 x 3 3 x 3 2 x 8 3 x 2	-- -- -- -- --	12 19	-- -- -- -- --	-- -- -- -- --	39 33 5 5 5
3	(n=8)	--	5 x 10 4 x 2 3 x 10	-- -- --	25 x 20 -- -- --	-- -- -- --	7 5 9	3 3 3 3	-- -- -- --	8 -- -- --
4	(n=9)	--	10 x 6	--	10 x 20 2 x 20 2 x 10 4 x 15 2 x 8 3 x 5	-- -- -- -- -- --	8	4 4 -- -- -- --	-- -- -- -- -- --	13 8 5 6 5 8
5	(n=13)	5 x 5 5 x 5 5 x 5 5 x 5	4 x 6 2 x 3	10 x 2 -- -- -- --	3 x 3 -- -- -- --	13 12 12 12	7 13	6 12 6 6 8	-8 -- -- -- --	48 -- -- -- --
6	(n=6)	5 x 5	5 x 8	--	3 x 2 2 x 4 1 x 3 10 x 30	5 -- -- --	13	-- -- -- --	-- -- -- --	6 7 12 14
7	(n=1)	--	--	--	10 x 20	--	--	--	--	7

Table 13 Continued, Page 2 of 2

Segment	Dimension (N-S x E-W in meters)				Intensity (gammas)			
	H	R	F	T	H	R	F	T
8	(n=9)	5 x 5	12 x 10	3 x 3	8	6	6	--
		--	5 x 5	2 x 2	--	5	6	--
		--	10 x 10	--	--	2	--	--
		--	10 x 5	--	--	4	--	--
		--	3 x 8	--	--	6	--	--
9	(n=15)	6 x 6	5 x 10	3 x 3	9	6	4	-8
		6 x 6	5 x 5	2 x 2	7	3	6	--
		5 x 5	5 x 10	2 x 2	8	3	7	--
		5 x 5	5 x 10	2 x 1	9	4	6	--
		6 x 6	--	3 x 3	7	--	5	--
10	(n=6)	5 x 5	8 x 5	2 x 2	11	13	21	--
		--	3 x 3	--	--	8	--	--
		--	10 x 20	--	--	5	--	--
		--	5 x 20	--	--	12	--	--
		--	4 x 10	--	--	4	--	13
11	(n=3)	--	3 x 3	--	--	8	--	--
		--	--	--	--	--	--	--
12	(n=2)	5 x 5	--	--	6	--	--	3224
		--	--	--	--	--	--	--
TOTAL:	(n=84)	14	27	19	2	27	19	2
					22			22

Table 14
Results of Testing Magnetic Anomalies, Site 3MS105, Eaker AFB, Arkansas

Magnetometer Data				Archaeological Data						
Magnetometer Segment	Anomaly	Center Coord.	Dimensions (m) N-S x E-W	Intensity (gammas)	Testing Method	Feature	Coordinates	Dimensions N-S x E-W	Depth (BPGS)*	Comments
3	Ra	495N/245E	5 x 10	7	Trench 3 (2 x 2 m)	mottled soil	493-495N 243-245E	2 x 2 M	16 cm to ?	Linear midden stains and abundant stained/mottled soil.
4	None	415N/328E	--	--	Core Sample 13	light tan soil	415N/328E	3-4 in.	2.5 cm	Core sample revealed normal soil development to 2.5 m.
4.5	Ra	415N/338E	5 x 3	8	Core Sample 12	mottled soil near trench	415N/338E	3-4 in.	87 cm	Core sample revealed heavily disturbed mottled deposit to 87 cm.
5	Hb	418N/339E	5 x 5	12	Core Sample 11	midden	421N/339E	3-4 in.	88 cm	Core sample revealed midden deposits to 88 cm. Probable house
5	Hc	413N/351E	5 x 5	12	Trench 2 (1 x 10 m)	midden	412.5-413.5N, 345-350E	1 x 4 m	16 cm to ?	Midden deposits, abundant daub, bone, and carbon. Probable house
5	Hc	413N/351E	5 x 5	12	Core Sample 4	midden	413N/351E	3-4 in.	16 to 38 cm	Midden, burned clay to 38 cm. Probable house.
5	Fc	414N/344E	2 x 2	6	Trench 2 (1 x 10 m)	midden	412.5-413.5N, 342-347E	1 x 5 m	16 cm to ?	Midden, abundant amounts of bone, daub, and carbon.
5	Ta	410N/345E	2 x 35	-8	Trench 2 (1 x 10 m)	palisade trench	412.5-413.5N, 340-344E	1 x 4	16 cm to 1.0 m	Trench filled with clean, pale brown sand.
5	Unlabeled	425N/360E	5 x 35	-8	Core Sample 5	possible ditch	420N/365E	3-4 in.	1.9 m	Light brown soil to 1.9 m.
8	Ha	278N/355E	5 x 5	8	Trench 1 (2 x 10)	pit	277.5N/351.5E	1 x 1 m	46 cm	Dark gray fine silt with carbon.
8	Ha	278N/355E	5 x 5	8	Trench 1 (2 x 10)	wall trench	276-278N, 352.5E	1 x 0.5 m	56 cm	Trench filled with pale yellow sand; post molds noted within.
8	Ha	278N/355E	5 x 5	8	Trench 1 (2 x 10)	house (midden)	276-278N, 353-357E	1 x 4 m	16 cm to ?	Dark gray fill with abundant amounts of daub, and bone.
8	Ha	278N/355E	5 x 5	8	Trench 1 (2 x 10)	pit	276-277N, 360E	.5 x .5 m	16 cm to ?	Possible exterior pit. Not fully exposed.
8	Ha	278N/355E	5 x 5	8	Trench 1 (2 x 10)	possible wall trench	276-277N, 360E	.5 x .5 m	16 cm to ?	Possible wall trench. Not fully exposed.
8	Ha	278N/355E	5 x 5	8	Core Sample 3	house	279N/355E	3-4 in	67 cm	Sherds, burned soil, midden to 67 cm.
8	Rc	280N/335E	10 x 10	2	Core Sample 1	artifacts, staining	279N/335E	3 in.	100-110 cm	Artifacts and stained soil to 100-110 cm.
8	Rc	280N/335E	10 x 10	2	Core Sample 14	artifacts, staining	279N/335E	3 in	97 cm	Burned earth and artifacts to about 97 cm.
8	None	270N/335E	--	--	Core Sample 2	--	270N/335E	3 in.	20 cm	Control core in area not exhibiting anomaly. Artifacts to 20 cm - nothing below.

Three "H" anomalies were tested by MCRA archaeologists. Trench 1 was placed over anomaly Ha on Segment 8. Core hole #3 was also placed in the center of anomaly Ha, just north of Trench 1. Excavation of the trench revealed what appear to be the remains of a prehistoric house and associated exterior features. From west to east, the 10-m-long, 2-m-wide trench revealed a pit filled with daub, bone, and carbon; a wall trench with post molds in it; a large stained area approximately 5 m wide with an area of darker stained, more intensely burned soil (house fill) in the middle of it; another group of post molds; another exterior pit; and the remains of another wall trench. While each individual feature was not apparent as an anomaly on the magnetic contour map, the identification of the larger house feature led to the discovery of associated features and activity areas. The larger feature has likely masked the smaller, more subtle features.

Anomaly Hc on Segment 5 was also tested. Trench 2 was situated over the west edge of the anomaly and core hole #4 was placed in the center of the anomaly. An abundance of daub, bone, and carbon was found in the vicinity of anomaly Hc, decreasing in quantity away from the anomaly. Core hole #4 revealed midden and burned clay to 38 cm BPGS. More data are needed to determine the exact nature of the feature associated with anomaly Hc, but it is indeed cultural, probably a house or midden which was identified by the magnetic survey. Anomaly Hb in Segment 5 was also tested. Core hole #11 was placed in the center of the anomaly. Carbon and burned soil was found to 87 cm BPGS.

All three "H" anomalies which were tested were 5 by 5 m in size. Anomaly Ha (Segment 8) has an intensity of 13 gammas, anomaly Hb has an intensity of 12 gammas, and anomaly Hc has an intensity of 8 gammas. While anomaly Ha can be identified as a house feature with greater confidence than anomaly Hc, this distinction may reflect the fact that more of the area around anomaly Ha was uncovered than around anomaly Hc. The testing of anomaly Hb only confirmed that there was indeed a cultural feature associated with it, but the nature of the feature has yet to be determined. Thus, at this level of testing the interpretation of "H" anomalies as houses appears to be a fairly valid description of what cultural features are likely to be associated with these anomalies.

Twenty-seven anomalies were given an "R" annotation. As defined earlier in this report, "R" anomalies are believed to be associated with superimposed house clusters, large middens, cemeteries, or large-scale activity areas. The "R" anomalies ranged in intensity from 2 to 19 gammas (mean of 7.5 gammas). The size of the "R" anomalies varied from 2 by 3 to 15 by 20 m. Only two segments (7 and 12) did not have "R" anomalies identified. Three "R" anomalies were tested.

Anomaly Ra on Segment 3 was tested with a 2 by 2 m excavation unit (Trench 3). The test excavations revealed no discrete features but an area of mottled, sandy silty loam was identified, bisected by five or six plow scars. The deposits were fairly homogeneous, a dark yellow brown, in the north half of the trench. The south half was most heavily disturbed by the plow scars and the mottled dark gray and reddish brown deposit was revealed. It is unknown what this phenomenon represents, but the mottled/stained soil is probably associated with prehistoric cultural activity. Anomaly Ra on Segment 4 was tested with core hole #12. The core sample showed a highly mottled and disturbed deposit to 87 cm BPGS. Very little cultural material was noted but the deposits did not represent normal soil development. A control core (core hole #13) was located 10 m west of core hole #12 in an area which did not exhibit a magnetic anomaly. This core sample revealed a lighter colored deposit, no staining, and normal soil development to 2.5 m BPGS. Anomaly Rc on Segment 8 was tested with core hole #1. The core sample revealed cultural material to 100 to 110 cm BPGS within a stained soil. A control core hole was placed in an area south which did not exhibit a magnetic anomaly. Artifacts were retrieved to 20 cm BPGS with little or no stained soil noted.

The testing verified the presence of cultural features associated with selected R anomalies. It did not confirm or negate the accuracy of the description, however. Further investigations are necessary to determine the extent and characteristics of the features associated with the anomalies.

Nineteen anomalies were defined as "F" anomalies. Fire pits or large storage pits are the suggested sources of the "F" anomalies. The "F" anomalies ranged in magnetic intensity from 3 to 21 gammas (mean of 5.7 gammas). They ranged in size from 2 by 1 to 5 by 3 m. Anomaly Fc (Segment 5) was tested with the excavation of Trench 2. In the vicinity of anomaly Fc, a heavy daub concentration was noted within an area of scattered daub, bone, and carbon at 16 cm BPGS. The midden area, a dark grayish brown loam, extends to approximately 1.0 m BPGS. The area of heaviest daub concentration is approximately 1.0 m wide. The large midden area is approximately 6.0 m wide.

Two anomalies were designated as "T" anomalies, implying that a fortification trench is the source of the anomaly. Both are long, linear, negative monopole anomalies. One is on Segment 5 and the other is on Segment 9. Both have a magnetic intensity of

-8 gammas. Anomaly Ta was tested on Segment 5 with the excavation of Trench 2. A 1.0- to 1.5-m-wide trench was revealed that was filled with pale brown sand, strikingly different than the surrounding dark midden soil. The trench, designated Feature 2 by the MCRA archaeologists, is approximately 1.0 m deep, filled with this very clean, pale brown sand (Lafferty and Cande 1989:92-93). The similar anomaly in Segment 9 was not tested.

The trench designation appears to be an accurate description of the anticipated feature. Feature 2 was filled with a deposit that had weaker magnetic susceptibility than the surrounding matrix, thus producing the "negative" anomaly. The location of the trench near presumed house features (anomaly Hc, Segment 5) is compatible with known settlement patterns for this time period (Morse and Morse 1983:289).

Twenty-two anomalies were given an "I" annotation. The "I" category incorporated those anomalies that did not "fit" into the other categories. The "I" anomalies were larger and/or more intense than the other selected anomalies. The magnetic intensity variation ranged from 5 to 3,224 gammas (mean 62 gammas). The very high reading is from an anomaly (Ia, Segment 12), very likely associated with the landfill. None of the "I" anomalies were tested.

The magnetometer survey was successful in identifying 84 possible cultural features (Table 13) which were not apparent on the surface. The location of the test trenches and core holes was structured around the presence/absence of magnetic anomalies. Each anomaly that was tested had at least one cultural feature associated with it. Houses and surrounding activity areas were identified during testing.

The data gathered by this survey are a valuable contribution to future research in the Southeast. Fourteen anomalies were identified as probably representing prehistoric houses, and the findings at three anomalies tested are not inconsistent with that interpretation. Another seven "R" and "I" anomalies are similar in size and shape to those identified as houses, suggesting that as many as 21 houses may have been recorded during the survey. The magnetometer survey sample is not adequate to determine whether the recorded feature density is representative of the site as a whole; additional mapping and testing would be necessary. However, if feature densities on the rest of the site are similar to those recorded during this study, some 400 prehistoric houses may remain buried at the site (Lafferty and Cande 1989:152). Following the same line of

argument for the other anomalies, as many as 1,200 other features may remain at the site. While much additional research would be required to verify these projections, it seems clear that sufficient buried features exist at Site 3MS105 to provide significant research potential. The information gained from testing can be applied to similar anomalies on Site 3MS105, allowing for the postulation of settlement patterns and/or the location of the site's boundaries based on the distribution of the anomalies. Portions of the site which do not contain anomalies indicate areas of low activity level, while those with many anomalies indicate areas of higher levels of activity. The results indicate that magnetometer techniques have considerable potential in this region and the data will be invaluable for interpreting anomalies identified on future magnetometer surveys in the area.

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