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SURFACE AND SUBSURFACE RECONNAISSANCE AT NDONDONDWANE: PRELIMINARY RESULTS OF THE 1995-97 FIELD SEASONS

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ABSTRACT

In 1995, large-scale excavation and surface reconnaissance activities were conducted at the Early Iron Age (EIA) type-site of Ndondondwane, in the Thukela River valley of KwaZulu-Natal (South Africa) in order to increase our understanding of the intra-settlement economic and social organization of EIA communities in southern Africa. By the conclusion of the 1995 season, there was evidence that the site was divided into a central and a peripheral activity zones. The central zone comprises three activity areas: a livestock enclosure, a large hut floor, and an area reserved for specialized activities associated with iron smelting, ivory working, and various rituals. The peripheral zone included a series of domestic and other specialized activity areas (such as a charcoal and raw ore preparation area). The goal of the 1996 season was to further investigate these activity areas and the intervening space between the activity areas. Several techniques of surface and subsurface reconnaissance were employed to investigate spatial patterning at Ndondondwane. The results of the multiple systems of site exploration indicate that any single technique would have been insufficient to efficiently delineate the spatial patterns at the site.

INTRODUCTION

Most approaches to the surface and subsurface reconnaissance of stratigraphically complex sites usually employ either a single method of analysis (*e.g.* surface recovery of remains, geophysical survey, augering, etc.) or do not integrate the results of the various methods. The result is usually a one-sided picture of an otherwise complex three-dimensional situation. Each of the reconnaissance methods yields a different, but complementary picture of the subsurface condition. When several different analytical methods are employed on the same site, the combined result yields a more comprehensive picture of the subsurface condition. This is especially true on large and stratigraphically complex sites where there may be both vertically superimposed and laterally displaced deposits and periods of occupation. On such sites, the distribution of remains on the surface may not be a direct reflection of subsurface distributions. A variety of processes may alter the relationship between surface and subsurface distributions.

It has become commonplace for archaeologists throughout much of the world to use at least one reconnaissance method on their sites prior to or instead of excavation. The most commonly employed method is that of surface collection (Redman & Watson, 1970 Mueller, 1975b; Flannery, 1976; Cherry *et al.*, 1978; Whallon, 1979), since it can be accomplished by the archaeologists themselves. Less commonly employed are the various geophysical (Clark, 1996) and augering methods (Stein, 1986). When the latter two techniques are employed, their results are usually not fully integrated into the final analysis.

Throughout much of the world, however, most archaeologists continue to ignore the benefits of systematically employing a battery of pre-excavation reconaissance strategies. It is only through a combination of different techniques that the size and nature of complex and overlapping temporally-differentiated occupations in sites can be defined and the most potential areas of excavation be identified. As will be shown here, the use of such pre-excavation methodological frameworks are crucial to the efficient and successful execution of excavation strategies and recovery of targeted data sets.

The data from the site of Ndondondwane will be used to demonstrate the importance of using a battery rather than a single method of surface reconnaissance prior to excavation. This is the first time that a variety of methods have been systematically applied to a small, open-air, stratigraphically complex later prehistoric site in southern Africa. In this region, a battery of systematic pre-excavation reconnaissance techniques are rarely used and almost never to guide excavation strategies. Most investigations have usually been limited to a single pre-excavation survey method, the results of which are most commonly found in separate chapters or appendices of reports and are rarely compared to the results of other analyses (*e.g.* Whitelaw 1994; Van Schalkwyk & Rawlinson 1995).

PREVIOUS RESEARCH AT NDONDONDWANE

The site

Food producing societies spread to the eastern regions of southern Africa at the beginning of the Early Iron Age (c. AD 300-1100). During the almost 1500 years of the Iron Age (AD 300-1800), the internal economic and social organization of early food-producing communities underwent profound changes. However, these are still inadequately understood. Two dichotomous models have been hypothesized to describe and explain the nature of intra-community social and economic organization - the Central Cattle Pattern (Community Level of Organization of Production) and Domestic (or Household) Mode of Production (Hall 1987; Huffman 1990, 1993). The former postulates stability of intra-community organization from the Early to the Late Iron Age, while the latter postulates a rapid social and economic evolutionary transformation between the two time periods.

In order to investigate these two models, *Amafa aKwaZulu-Natali* (formerly the KwaZulu Monuments Council) and The University of Manitoba (Winnipeg, Canada) embarked in 1995 on a multi-year collaborative research program. One of the objectives of this research program is to test these two models through a three-year program of excavation and analysis of an Early Iron Age site in the region.

The site of Ndondondwane was chosen because previous excavations of the site (Maggs 1984; Loubser 1993, 1998) had revealed the well-preserved remains of a small, single-phase, short-term EIA settlement, with architectural and artifactual remains, including fauna and flora. It is the type-site for the Ndondondwane phase of the KwaZulu-Natal Early Iron Age sequence (c. AD 650-750, radiocarbon dates - Maggs 1984). Ndondondwane is located in the lower Thukela river basin, KwaZulu-Natal, South Africa (Fig. 1). This is an area intensively settled by EIA mixed-farming communities (Van Schalkwyk 1992, 1996). Analysis of the earlier data from the site indicated that Ndondondwane had the potential for the kind of large-scale horizontal excavation to specifically test spatial models of intra-community organization.

Ndondondwane was initially identified and test excavations were conducted in 1978 (Maggs 1984). The results of the excavations were used as an essential part of the construction of a regional culture history. Further excavations were conducted during 1982-83 (Loubser 1993, 1998). By the conclusion of the 1995 season, there was sufficient evidence to recognize a series of spatially-discrete activity areas across the site. These were grouped into two major zones: a central and a peripheral zone. The central zone comprises three activity areas, arranged in a line from north to south: a cattle byre, a large hut floor, and an area reserved for specialized activities associated with iron smelting, ivory working, and various rituals (Maggs 1984; Loubser 1993; Greenfield *et al.* 1997; van Schalkwyk *et al.* 1997; Greenfield 1998). Each of these major activity areas was within 40 m of each other. The peripheral zone is distributed in an arc around the central zone and separated from it by a large open space.

The two zones are separated by a distance of approximately 100 m. The peripheral zone can be divided into a series of domestic and other specialized activity areas. The three domestic activity areas (Middens 1-3) were located to the north and east of the central zone. The fourth peripheral activity area, a specialized charcoal and raw ore preparation area, was found in the southern end of the arc (Fig. 2).

The stratigraphy and distribution of remains at Ndondondwane are symptomatic of many Early Iron Age sites in southeastern Africa. Typically, such sites have little vertical superposition of cultural stratigraphy because of

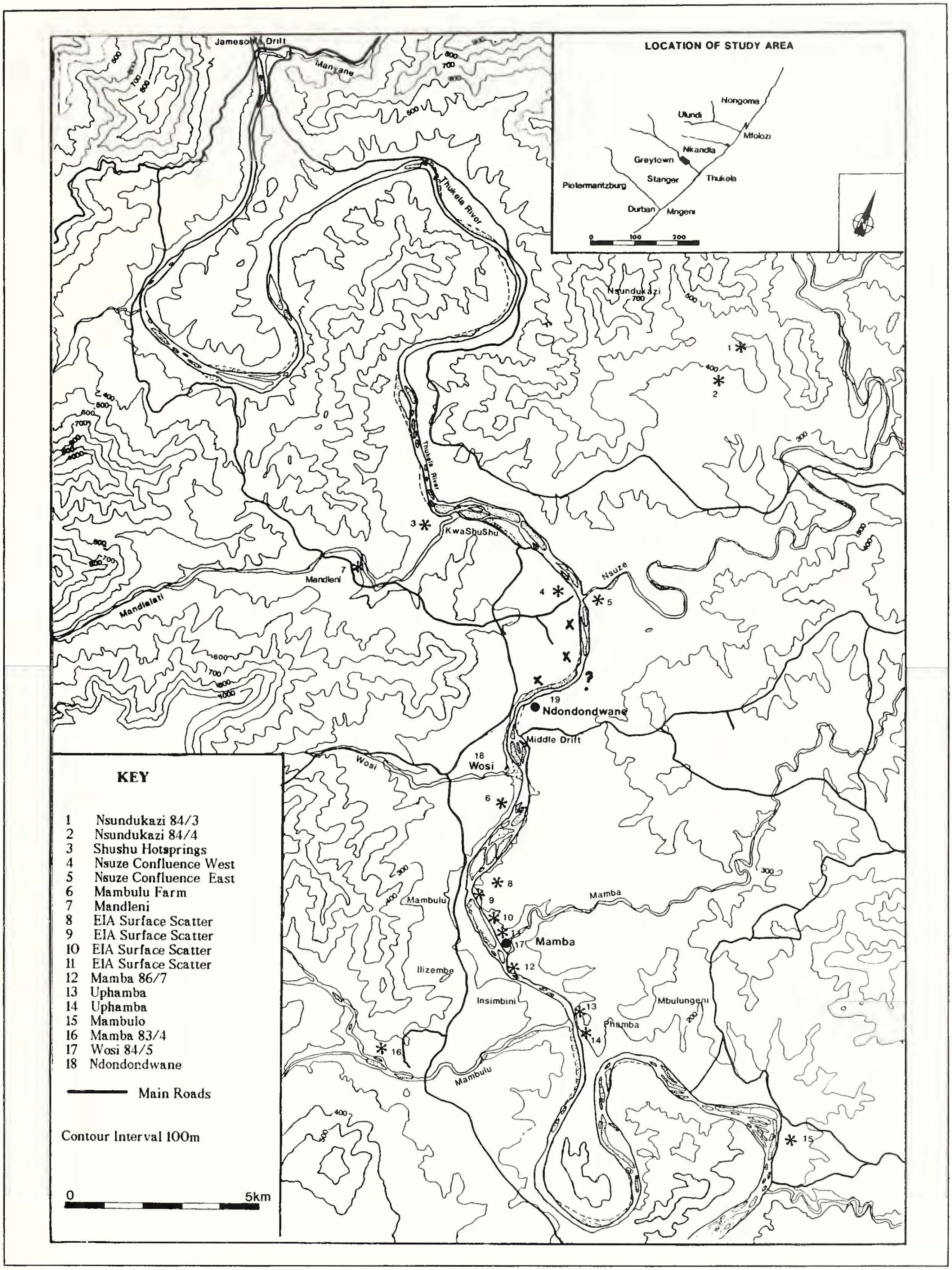

Fig. 1 Map of region (Lower Thukela Valley) and inset (Natal coast).

the nature and/or duration of occupation. Stratigraphy is usually laterally displaced rather than vertically superimposed, whether in single or multiple occupation sites. Very few sites have extensive vertical superposition of temporally differentiated deposits. Most such cases are confined to discrete intra-site midden deposits (Wosi, Ndondondwane; and Umsuluzi – Maggs 1980; Maggs & Ward 1984; Van Schalkwyk 1992; Whitelaw 1993). These result in a complex feature and artifact distribution that should be discerned and traced prior to excavation. The most appropriate manner in which to achieve this goal is through pre-excavation reconnaissance. The site at Ndondondwane was of a sufficiently large scale to require consideration of surface and subsurface reconnaissance. In our estimation, the battery of techniques described below when applied in a systematic and integrated fashion allowed us to tease apart discrete activity areas and other cultural foci prior to extending previous excavations (conducted by us and others - Maggs 1984a; Loubser 1993; van Schalkwyk *et al.* 1997; Greenfield *et al.* 1997). As Loubser (1998) has commented, it is essential to build upon the results of previous excavation initiatives. This is the first time that such an integrated battery of pre-excavation reconnaissance methods has been systematically applied to an Early Iron Age site in the southern African subcontinent. It has been used profitably elsewhere (Clark 1996; Greenfield 2000; McManamon 1984)

Goals of the reconnaissance activities

The goal of the 1996-97 reconnaissance activities at Ndondondwane was to collect information to test the validity of the perceived patterning in the data that was collected during the 1995 and earlier field seasons (1978, 1982-3). Several lacunae in the data were realized at the conclusion of the 1995 season (Greenfield *et al.* 1997; Van Schalkwyk *et al.* 1997). These were the following:

1. Extent of the site – to confirm the extent of the site and individual activity areas within the respective zones. There was an implicit assumption from Loubser's map of the site (1982) that the site was entirely encompassed within the fence surrounding the area.

2. Central Zone - There was the implicit assumption based upon the data from the previous excavations (1978, 1982-3, 1995) that the intervening space between the various central zone activity areas (Mound and Dung Areas) was devoid of features. The finding of the large hut floor in Transect 1 during the 1995 season cautioned us to not assume that the intervening space was empty. We thus had to embark upon a systematic examination of the intervening spaces in order to see if other features were present.

3. Peripheral Zone - A third gap was the definition of the extent and nature of each of the activity areas in the peripheral zone. In our initial report of the 1995 field season, we assumed that the middens in the peripheral zone (Middens 1-3) were domestic activity areas, and their extent was poorly defined. The first step to test the proposition that they could be identified as domestic activity areas required definition of their extent. It was hoped that evidence for hut floors or domestic structures, granaries and other storage facilities, and other activities could be identified through survey. This necessitated expanding our research around each of the domestic activity areas to ensure that the entire spatial locus was sampled.

   Space between the central and peripheral zones - onc of the major gaps included our lack of understanding of the contents and meaning of the space between the central and peripheral zones

4. The apparent low density of surface remains between these zones suggested that the space was potentially devoid of features. To test this, we had to embark upon a systematic examination of this space in order to define its nature and function.

Prior to embarking upon more extensive excavations, it was decided to utilize a multiple reconnaissance technique approach. A variety of surface and subsurface reconnaissance methods were used to collect data to test the above hypotheses. The methodologies and results are discussed below.

Reconnaissance Methodology

A variety of complementary survey techniques for the investigation of surface and subsurface distribution of features and artifact concentrations were applied during the field work at Ndondondwane - topographic survey, systematic surface collection, electrical conductivity survey, and soil auguring (Greenfield 2000). The selection and application of a battery of techniques was inherently dependant upon the results of the earlier seasons of excavations. They were used to test for and determine in a systematic fashion the boundaries of the site; the size, depth, and nature of cultural deposits; and the possible location of features and activity areas within the site. Their results enhanced our ability to eventually target excavation activities to areas with the highest potential for recovering cultural remains.

The application of each technique was designed to provide a hierarchy of feedback information while in the field, so that potentially interesting areas or spatial `hot spots' could be immediately or subsequently examined with other techniques. For example, the topographic survey was the first completed and implied that the west edge of the site should be coterminous with the river-

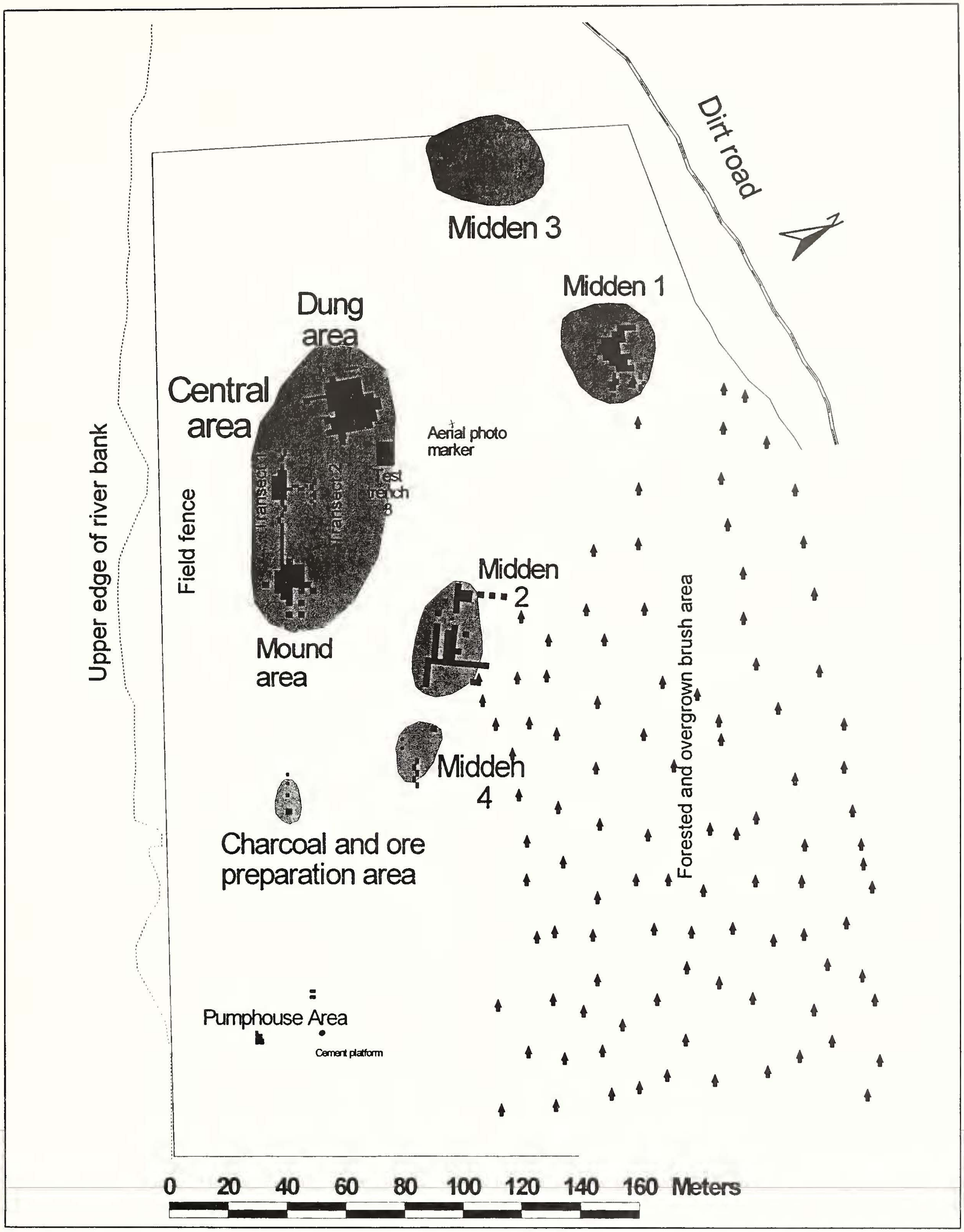

Fig. 2. Map of site (reflecting the areas investigated prior to and during the 1996 field season

bank. This hypothesis was tested by auguring, which showed sterile soils immediately beneath the plow zone, and surface collection which produced only a low volume (<less than pan-site noise) of highly eroded fragments of ceramic in this area (probably the result of down-slope wash). Conductivity anomalies were test with the auger to determine if the anomalies represented *daga* structures, artifact concentrations or deeper pits.

The latter were easily recognizable since they extended into the sterile soil horizons. Surface concentrations of artifacts above subsurface conductivity anomalies were found to be prime correlates for preserved subsurface deposits.As a result, excavation was targeted towards area with high potential for uncovering *in situ* deposits. The results of each of the techniques are discussed below.

Topographic survey

A topographic survey is the initial requirement for conducting any survey activities. It lays out the grid upon which all other activities are founded. The rise and fall of the terrain are mapped at various intervals. As noted previously (Van Schalkwyk *et al.* 1997), the earlier published map (Maggs 1984; Loubser 1993) was inadequate for our research goals. They were limited largely to the 1982-3 ploughed field areas. Our research quickly revealed that the site was infact more extensive than previously thought (to the N and E), but smaller in extent along the southern axis. As a result, we began a new topographic survey. The map in our 1995 field season simply show the distribution of features (excavated areas, activity areas, scrapes, *etc.*) (Van Schalkwyk *et al.* 1997, fig 2).

Surface collection

As noted previously, Loubser's (1993) map also did not contain sufficient quantitative surface distribution data to quantitatively map the distribution of remains across the site. As a result, a systematic surface collection across the site was embarked upon in order to identify surface concentrations. However, parts of the site were covered by dense thicket. These areas of the site had not been fully surveyed by previous investigators due to the impenetrability of the vegetation cover. As a result, two types of surface collections were made at the site - scrapes and ploughs.

In those areas of the site covered by a dense thicket (*Acacia* spp. and *Dichrostachys cinerea*), a Galion Road Grader was used to clear the surface. This area was mostly in the upslope areas of the site. These areas were last ploughed in the 1950's (Campbell Willmore, pers comm.) and had since become thicketed. After bush-clearing, the machine's blade scraped the top 10 cm of sediment to the side forming a win row. The win row was generally 2 m wide. Each win row was divided into 5 m long strips and all material found on the surface of the win row was collected. This system was used in Scrapes 1-3, and 5 (Van Schalkwyk *et al.* 1997).

The second type of surface collection was based upon ploughing or tining of areas. The plough would disturb remains up to a depth of 30 cm (Scrape 6, and all 1996-97 surface collected areas), while the tines from the large graders would reach up to 40 cm from the surface (Scrape 4). In these areas, a systematic intensive surface sampling strategy was employed because of the unknown nature of the distribution of remains the difficulty in estimating site limits, and the desire to collect a spatially-representative sample (Redman & Watson 1970; Redman 1974, 1975; Flannery 1976). To ensure spatial coverage across the site, the sample was stratified by transects. The transects were a by-product of the conductivity survey (described below). Transects were evenly spaced across the site and were 2 m wide. Each was subdivided into 5 m long units. Every other transect was surface collected across each area. All artifacts with the 2x5 m area were collected in a single bag. This was a form of 'cluster' sampling (where spatial units [not individual artifacts] are sampled within a universe of potential units - Mueller 1975a; Vescelius 1960). This maximum length of surface collection units chosen based on our experience during the 1995 season. It was designed to ensure that small potential activity areas were not skipped over and missed. The scheme employed ensured adequate coverage of the surface of the site. It also ensured relatively comparability between collection units from the 1995 scrapes (also 2x5 m).

All remains were identified to a class of material (ceramic, bone, daga, etc.), and counted and volumized (using water displacement). Maps of the distributions were produced with the use of SURFER (r), a contour drawing program. Areas with high densities of artifact distributions were hypothesized to be loci for possible subsurface concentrations. They potentially represented features and middens associated with the occupation of the site. Low density areas were hypothesized to be potential non-activity areas.

Electrical conductivity survey

The objective of the electrical conductivity survey was to identify potential subsurface features in order to target areas with high probability for excavation. Only one intact burnt clay hut floor has been found in the entire EIA of Natal, and this was at Ndondondwane. As a result of the knowledge of the low probability of finding burnt clay floors or high ceramic concentrations, we decided that a technique that was sensitive to soil changes may yield the best results. Conductivity and resistivity survey instruments have yielded good results where burnt clay concentrations (such as above) are lacking and features are largely of a pit-like nature filled with a low density of artifactual concentrations (*e.g.* semi-subterranean structures - Aitken 1969). Both conditions have been found at contemporary settlements. For example, burnt clay (*daga*) granary floors are common in EIA settlements from the region (Huffman 1990, 1993; Whitelaw 1993; Van Schalkwyk 1994a, b) and semi-subterranean features, such as storage pits with both low and high densities of ceramics and other artifacts have been found in sites throughout the region and at Ndondondwane.

A Geonics EM38 conductivity instrument was used in the survey, with a digital data logger. The advantage of this machine was that it can be used in uneven terrain (since it can be lifted off the ground) and can be nulled to an artificial zero to limit day-to-day variation and other sources of interference. The digital data logger enabled preliminary maps of each surveyed areas to be rapidly produced at the conclusion of each day of fieldwork. This enabled the goals of subsequent fieldwork days to be adjusted with respect to any apparent patterning in the data. As a result, the survey was eventually extended into areas that were originally not intended to be surveyed (*e.g.* under existing back dirt), while other areas of the site were not surveyed when it became apparent that they would not be productive (over the deeply buried strata along the western edge of the site - from Transect 1 to the river's edge).

The soil type and subsurface geology of the site was favourable for conductivity survey since the rock formations were generally far enough from the surface not to interfere with the readings and the soil was generally a mixed of sandy to clayey loams. The machine was able to read to a depth of 1.5-2 m beneath the surface. Readings were taken at 1 m intervals across the site. The conductivity machines readings are given in ms/m (millisiemens/metre). High ms/m indicate high conductivity (low resistance), while low ms/m indicate low conductivity (high resistance).

The site was divided into 2 m wide transects. Readings were taken at 1 m intervals along each transect. Control point readings were taken every 40 m from a point outside of the area being surveyed and not on top of know features in order to allow for corrections in the intensity of the earth's magnetic field during a transect's survey. This yielded residual readings for each coordinate, which were then used in the construction of the maps. SURFER ® was used to produce contour maps of the residuals to identify areas with significant anomalies.

Parts of the site had been excavated and the trenches left open through the two decades of research. Each of the excavated areas to be conductivity surveyed was backfilled prior to the conductivity survey (Mound Area, Midden 1 and 2, Charcoal Preparation Area). The basal features were often left intact in order to determine if the conductivity instrument could measure their presence (*e.g.* Midden 1, Charcoal Preparation Area).

Soil augering methodology

Soil auguring is an easy way of testing the depth and nature of subsurface deposits without large-scale excavation (Stein 1986). It can recover soil sequences and associated artifacts, allowing a cultural stratigraphic sequence to be constructed. A ten cm wide-mouth, hand-turned soil recovery auger was used. Each type of soil was identified and traced across the site. In general, it was found that the distribution of features was so widely spaced and so small that the site would have to be Swiss-cheesed in order to find all of the features with this method. It was largely used to test surface artifact concentrations and conductivity anomalies. The mouth of the auger was wide enough to enable ceramics, stone, and soil to be recovered in their stratigraphic position. The distribution of different artifact categories was then plotted in relationship to the different soil horizons to map out the extent of the area of occupation.

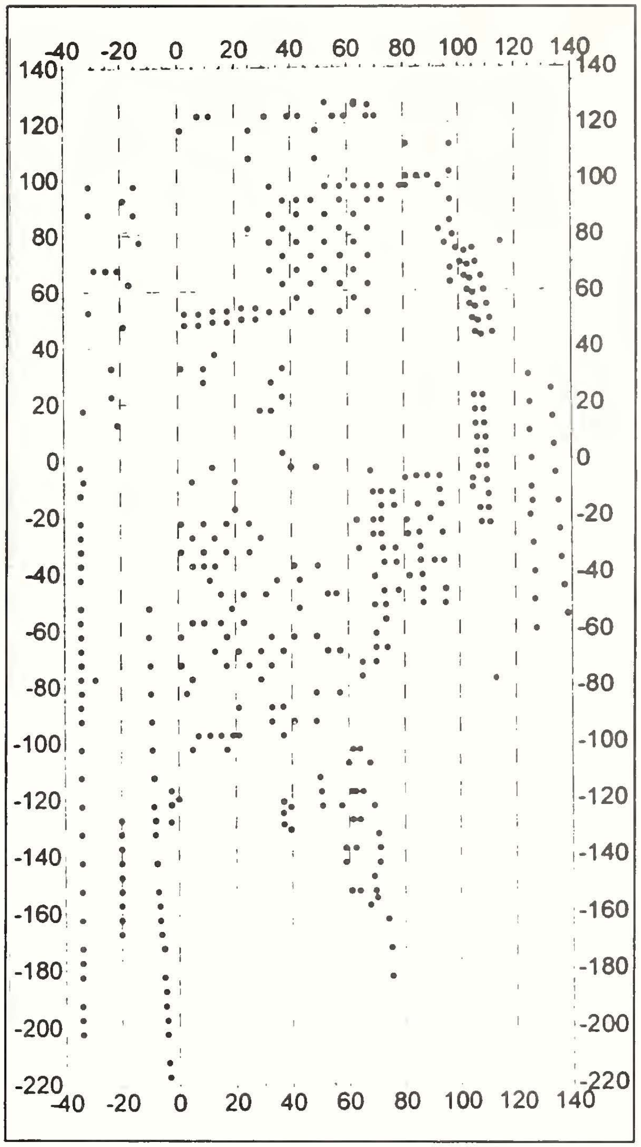

Fig. 3. Map of the distribution of surface collection units from the 1995-1996 seasons.

Reconnaissance Results

Topographic Survey

The topographic survey indicated that the site was not flat at all. This confirmed Loubser's 1982-3 survey of the site (1993). The western half of the site slightly rose from west to east (from 40 m W, along the river's edge, to +40 m E). Beyond this point, the terrain rose at a more rapid rate and the effects of soil erosion were greater. The consequence was that erosion was taking place to the east of this line, and soil deposition was occurring to the west. As a result, the soil horizon above and protecting the cultural deposits in the areas to the east of +40 m were very thin and disturbed by ploughing. The soil horizons above and protecting the cultural deposits in the areas to the west of +40 m were

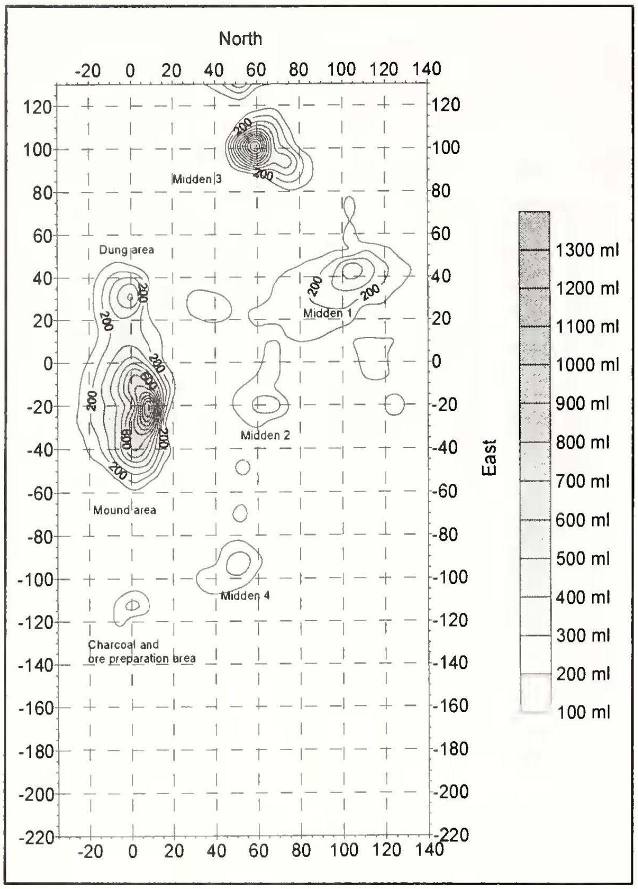

Fig. 4. Map of surface ceramic distributions from 1995-96. The results of the 1995-96 seasons were combined for the purposes of this map. Intervals are in millilitres of displaced liquid volume; 100 ml is the interval used in this analysis.

thicker, thereby more effectively protecting the cultural deposits from plough and other disturbances.

Surface Collection Results

The results from over 200 surface collection units were analyzed using SURFER ® (Fig. 3). The combined results from the 1995-96 surface collection proved fruitful in establishing the dimensions of activity areas previously identified around the periphery of the site (Charcoal Preparation area, domestic Middens 1-3). In addition, it showed that a scatter of debris continued from Midden 2 for a substantial distance to the south (almost 100 m) (Fig. 4). This scatter culminated in another previously unidentified concentration of surface materials that was tentatively identified as the Midden 4. Even though a mask fragment was found on the surface of the area, it is unlikely that it derived from this area. The fragment was possibly dropped by a visitor who picked it up off the surface in the proximity of the Mound Area. The pathway through the site goes along the east edge of Midden 4. Subsequent test excavation of this area, however, proved that the surface concentration extended only into upper plough zone (top 10 cm of soil) and that it was a deflated deposit. The density of material was extremely low indicating that this would a more ephemeral activity area than the other middens in the peripheral zone. It is postulated that this was another domestic midden, but the remains are too scant and scattered to positively determine its nature.

The surface material showed that the activity areas in the center zone of the site really formed a single large area that extended from the north edge of the Dung Area to the south edge of the Mound Area. The burnt hut in Transect 1 and the eroded hut in Transect 2 (see below) did not stand out as easily distinguishable concentrations of remains. Instead, they were masked by the higher concentrations of debris from the two activity areas to their north (Dung) and south (Mound).

Most of the area between the central and peripheral zones had a significantly lower density of debris. Tongues of debris scatter, however, extend down hill (to the west) from Midden 1. The reason that the tongue exists only in this area can be ascribed to two possibilities: 1) Midden 1 is located on a more steeply sloping terrain than any of the other peripheral deposits; or 2) the down hill tongue (from the excavated area) represents the discard location and that the excavated area represents the area of occupation. We ascribe the tongue in this area to be a function of slope movement since the tongue does not pass the contour line common to Middens 2 and 3 (where the slope flattens).

Conductivity Results

A number of anomalies are visible in the map of electromagnetic conductivity values (Fig. 5). Only positive values are used since they best reflect the presence of subsurface cultural deposits on the site.

In the center of the site, the conductivity was able to confirm the presence and extent of the two large excavation areas from previous seasons of research at the site. Each of these areas had very thick (>1 m) and extensive deposits, with high artifact and feature concentrations:

1. The Dung Area, an area with thick dung deposits; and,
2. The Mound Area, an area with thick cultural deposits, but partially excavated already. It is visible by a cluster of low positive residuals (<10 ms/m).

In between these two areas, a large but lower level anomaly was identified by the conductivity survey - this was the concentration of *daga* remains and artifacts in Transect 2. It was not a deeply buried deposit, but was found largely within 1 m of the surface.

Around the periphery of the site, the presence and extent of three of the domestic middens and special activity areas already known through excavation and survey were confirmed as low-level positive anomalies. Each of these areas has deposits close to the surface and dense concentrations of artifacts. These were:

1. Midden 2 (a domestic midden to the east);
2. Midden 3 (a domestic midden to the north); and
3. Charcoal and ore preparation area.

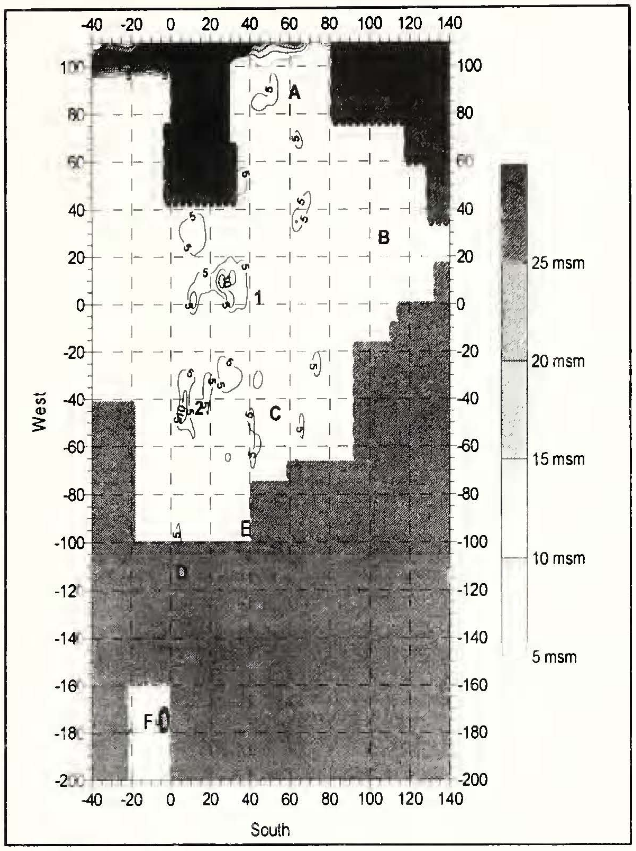

Fig. 5. Map of distribution of electromagnetic conductivity anomalies. Only the positive values of the residuals are employed in this analysis. Areas not surveyed are blanked out. 1 = Dung Area; 2 = Mound Area; A = Midden 3 Area; B = Midden 1 Area; C = Midden 2 Area; D= Charcoal Preparation Area; E = Midden 4 Area; and F = Modern Pump House Area.

A number of areas with known feature concentrations, however, were not identified by the conductivity survey. These include:

1. The burnt hut in Transect 1 (deeply buried beneath 1.5 m of deposit); and
2. The domestic area in Midden 1 (a fully excavated out area with storage pits cut into the subterranean rock).

The reasons that these features did not show up on the conductivity maps are specific to each area. The burnt hut in Transect 1 was too deep (>1.5 m). The subsurface rock basement came too close to the surface masking the presence of the subterranean features in Midden 1 (this area had to be entirely deleted from the analysis).

Conductivity analysis of the soil often yields ambiguous results. On its own, it is usually difficult to determine the nature of an anomaly. It is best used in conjunction with other reconnaissance techniques, such as surface collection and coring. The conductivity survey was successful in identifying the presence of some major features (*e.g.* Dung Area), but it missed other major features. It appears to be a poor identifier of:

1. deflated middens, even though there are substantial quantities of artifactual remains (ceramics) close to the surface (*e.g.* Middens 2 and 3); and,
2. deeply buried features (>1.5 m below the surface), even though there were substantial burnt clay floors (*e.g.* the burnt house in Transect 1).

Even though the conductivity survey did not identify all of the anomalies, it was useful in identifying the location and extent of several previously unknown features.

Augering Results

Augering activities were directed at investigating the `open' space between the central and peripheral zones. A series of auger holes were sunk throughout much of this area. Potential subsurface conductivity anomalies and surface concentrations were preferentially investigated following the site grid.

The results were that a pan-site stratigraphy was discernible. It allowed for the first time for the various areas to be temporally linked. Five major horizons were identified (Fig. 6):

1. Plough zone, with an upper (10 cm thick) and lower (15 cm thick) component. The plow zone became thinner as one moved up hill (between Middens 1 and 2);
2. Cultural horizon 1 (CH 1) - this was the latest temporal component of EIA occupation at the site. It linked to the third phase of occupation in the Dung (Upper of the Middle horizon), Transect 2 (Cultural Horizon 1), and Mound (Loubser 1993, fig. 7; pers. comm. 1999) Areas;
3. Cultural horizon 2 (CH 2) - this was the second temporal component of EIA occupation at the site. It linked to the eroded hut in Transect 2, to the second phase of occupation in the Dung (Middle of the Middle and Upper Loose and Compact Dung horizons), Transect 2 (Cultural Horizon 2) and Mound (Loubser 1993, figs 5 & 6; pers. comm. 1999) Areas;
4. Cultural horizon 3 (CH 3) - this was the earliest EIA occupational horizon at the site. It was stratigraphically linked to the burnt hut in Transect 1, the earliest occupation in the Dung (Lower of the Middle and Lower Loose and Compact Dung horizons), Transect 2 (Cultural Horizon 3), and Mound (Loubser 1993, figs 2 & 3; pers. comm. 1999) Areas; and,
5. Sterile base - this was the pre-EIA occupation sedimentary horizon.

It was difficult to stratigraphically connect these

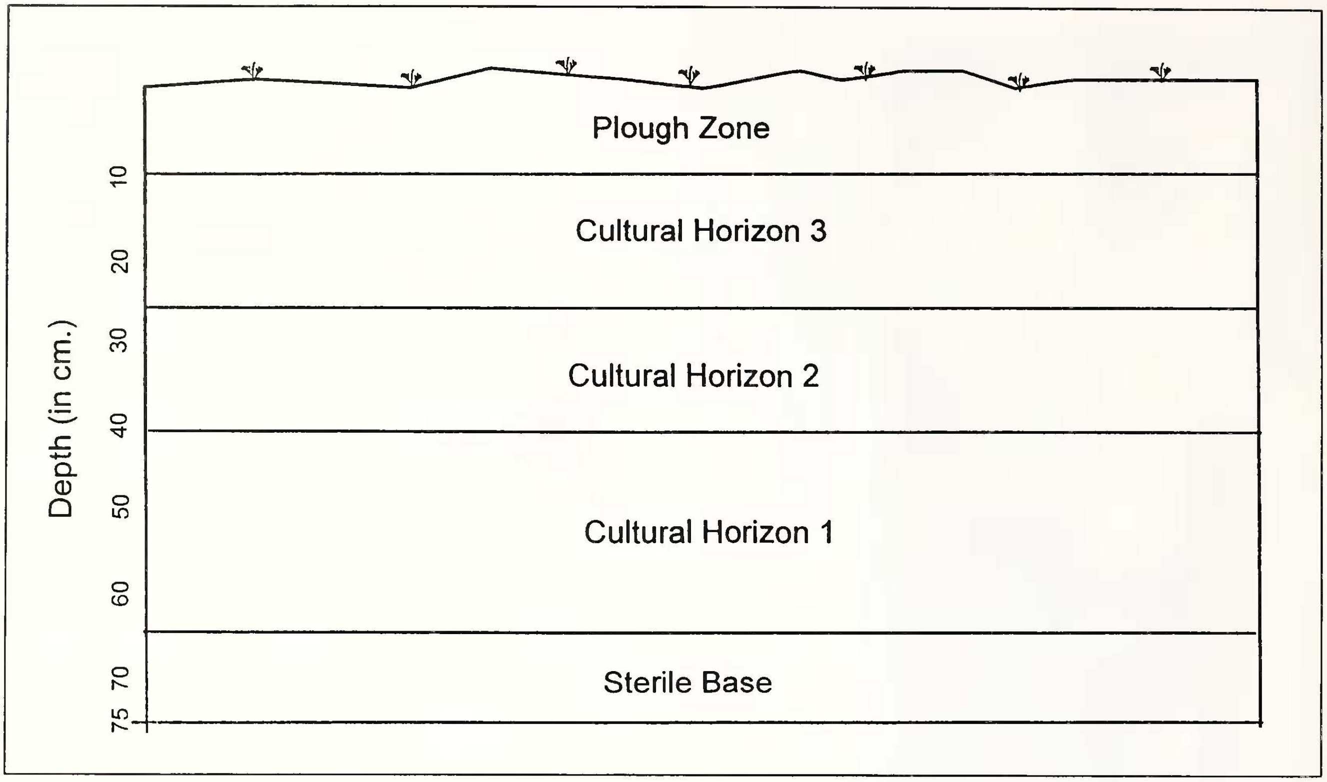

Fig. 6. Schematic profile of pan-site stratigraphy.

cultural horizons with the middens features in the peripheral zone. Deposit deflation and ploughing destroyed much of the direct stratigraphic linkages. For example, Middens 2, 3 and 4 and the Charcoal Preparation area were found entirely in the plough zone. No preserved cultural horizons were found beneath the plough zone in these areas. However, it is possible to reconstruct when each of the peripheral deposits began through analysis of their basal deposits. Each of the peripheral activity areas was located directly above the sterile EIA basal horizon. All of the features in Midden 1 (south hut floor and central slag concentration; and Ash 1), 2 (granary and hut floor), and Charcoal preparation area begin on the sterile base. What is lost in most cases through ploughing, deflation and erosion are the vertically accumulated deposits. Midden 1 deposits were thicker and better preserved than the other peripheral middens. While internal stratigraphy in the Midden 1 could not be discerned, there was internal stratigraphy within each of the features (Ash 1, Pits 1-3). In Ash 1 and Pit 3, there were also three major horizons (Greenfield *et al.* 1997; Van Schalkwyk *et al.* 1997). Coring of the soils across this area indicates that the three horizons phenomenon is not a pan-site occurrence. The top horizon peters out to the east after about 30 m (before reaching the track that crossed the site). Only the two lower horizons (CH 2 and 3) continue to link to the deposits in Midden 2.

Empty Space

The distance between each of the peripheral middens was relatively similar - ca 70 m. This spacing is similar but smaller than the distance of each peripheral midden to the centre of the site, as measured by the one area that remains constant throughout the occupation. The Dung Area was c. average of 100 m from each of the peripheral middens. Surface collection, conductivity survey, and augering did not indicate the presence of any significant loci of cultural activity through the area between each of the peripheral middens. The conductivity survey did indicate the presence of an anomaly along the 80 m east line, to the north of Midden 1. A small test trench (L-shaped) was opened above the anomaly at the mid-point between Middens 1 and 3 (Figure 2). The excavations confirmed the lack of remains beneath the surface. Almost no remains were found on the surface, fewer were found in the plough zone, and none in the underlying matrix. This trench confirmed the hypothesis of "empty" space between domestic complexes. It would appear that middens were highly localised and material was intentionally limited to discard loci near each midden for disposal.

CONCLUSION

Several techniques of surface and subsurface reconnaissance were employed to investigate spatial patterning at Ndondondwane. The results of the multiple systems of site exploration indicate to us that any single technique would have been insufficient to efficiently delineate the spatial patterns at the site.

Analysis of the surface collection data indicated both extent of the site and the presence of several subsurface concentrations. The site is more extensive than previously thought (to the N and E), but smaller in extent along the southern axis. It is almost 300 m long (north-south) and 200 m wide (east-west). It extends north of the northern fence line, but falls far short of the southern and eastern fence lines.

Several subsurface concentrations were found close to the surface in and around the Mound, Dung, Charcoal Preparation and Midden 1-3 areas. This type of analysis, however, did not identify subsurface concentrations that were too deeply buried to appear on the surface (Transects 1 and 2). The remains in Transect 1 and 2 were too deeply buried for the plow or erosion to bring to the surface. These areas had to be identified through conductivity, augering and subsequent test trenching. The surface collection also indicated the absence of deposits in the 50 m space between the central and peripheral zones. This hypothesis was confirmed through the other reconnaissance techniques.

Augering, on its own, can only be used to obtain an image of the gross stratigraphic relationships across an area. It allowed us to tie together the various deposits across the site into an overall pan-site series of horizons without having to conduct expensive, time-consuming, and labour-intensive excavation. Augering, however, is an inefficient way to find subsurface features over a large area since the site must in essence be swiss-cheesed. For example, we did not immediately recognize the hut floor in the east edge of the Dung area when we augered through its centre. The density of remains was too low to have a high probability of being picked up in the 2 cores and the soil in the cored areas of the hut was not easily differentiated from that around the hut. Only small areas of the floor were burnt enough allow easy visual identification of its function. Augering, however, was extremely helpful in confirming the presence of the activity area in Transect 2. It appeared originally as a conductivity anomaly, but was too deeply buried to appear as a surface concentration. The presence of more than the usual number of cultural horizons in the auger confirmed the existence of something unusual at this location. Excavation then confirmed suspicions based upon the conductivity and augering.

Conductivity analysis of the soil was best used in conjunction with the surface collection and augering. On its own, it is usually difficult to determine the nature of a geophysical anomaly (Greenfield 2000). The conductivity survey was successful in identifying the presence of major features or activity areas, such as the hut at the east edge of the Dung Area and the activity area in Transect 2. It missed, however, minor features such as the fire pit in Midden 1, and gave false readings for the many small anomalies that were tested by coring around the Midden 2. It also did not yield any evidence of anomalies around Midden 1 or 3. It is unlikely that these areas are devoid of any subsurface features, given the concentration of remains on the surface in these areas and the results of excavations on the various peripheral domestic middens. Time and the need to complete other priorities in the research program precluded further investigation of what we suspected would prove to be very ephemeral remains (*e.g.* the hearth and hut floor in Midden 1).

In conclusion, the application of any single technique would have resulted in misleading conclusions concerning the nature and distribution of subsurface remains. The nature and extent of the site and various activity areas at Ndondondwane were efficiently determined through the use of multiple reconnaissance techniques.

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