# The Scale and Complexity of Earthmoving at Feltus (and Beyond!)

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**Feltus (22Je500) is a well preserved Coles Creek period mound site in Jefferson County, Mississippi. It is situated on a high loess bluff overloooking the Mississippi valley and originally had four mounds arranged around a plaza. Three mounds (A, B, C) stand today while the smallest (D) was destroyed between 1932 and 1947. Nine months of fieldwork have been completed since 2006. Although we initially focused on investigating the history and use of the mounds, our excavations have shown that the complexity and scale of earthmoving at Feltus far exceeds what is readily visible on the surface. Figure 1 depicts the major earthmoving episodes we have identified.**

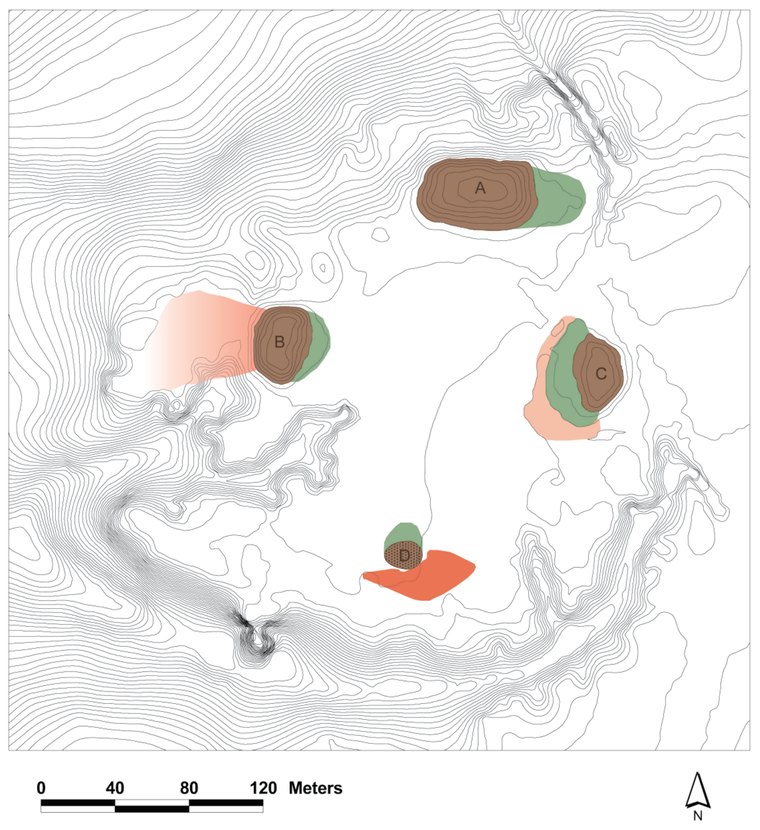
Figure 1: Topographic map (contour interval = 1 m) of Feltus showing major episodes of earthmoving (brown = mounds, green = platforms, red = negative features).

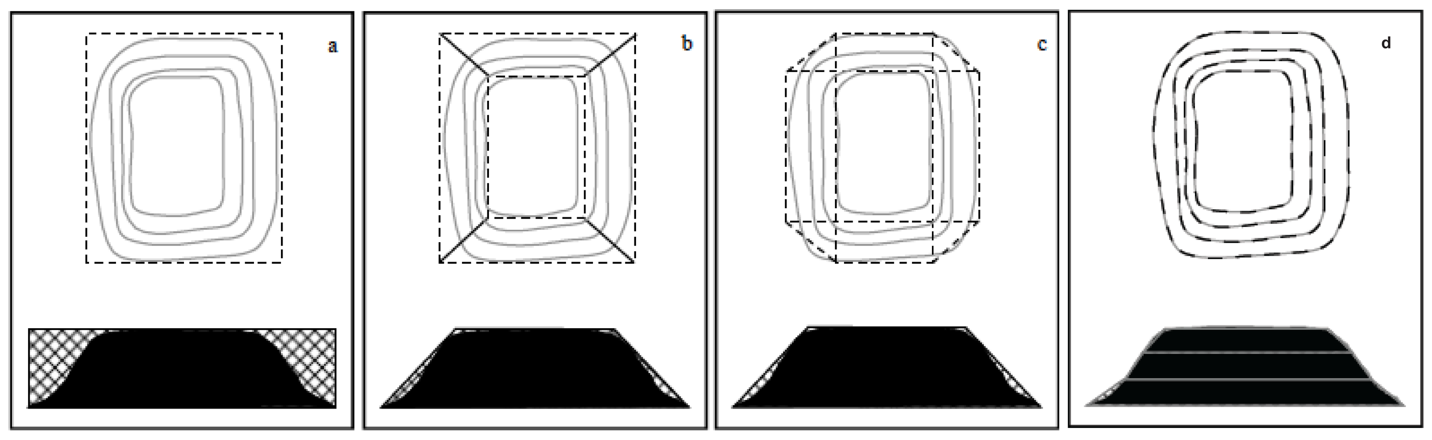
Figure 2: (a-c) Geometric methods of calculating volume, all leading to significant over-estimation; (d) the more accurate contour method of calculating volume (Lacquement 2009:Figures 2.1-2.2).

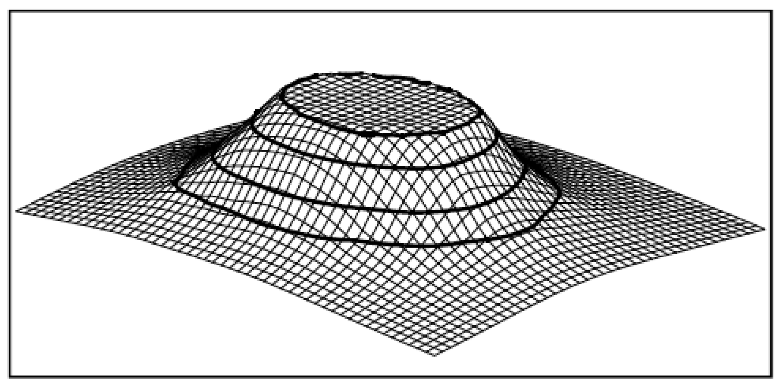
Figure 3: Wireframe map used to demonstrate the highly accurate gridding method of calculating volume (Lacquement 2009:Figure 2.3).

## Methods: Calculating Mound Volume

**Mound volume has been used as an important measure of site size, duration of use, and social complexity (Blitz and Livingood 2004; Erasmus 1965; Muller 1997). Most early attempts at calculating volume relied on geometric formulas (e.g., Treganza and Cook 1948; Jeter 1984) (Fig. 2a-c). Later work showed that such formulas overestimate volume and introduced a method based on detailed contour maps (Shenkel 1986; Sorant and Shenkel 1984) (Fig. 2d). Importantly, the contour method is likely to under- rather than over-estimate mound volume (Sorant and Shenkel 1984:600). Lacquement (2009) used a computer-aided gridding method to create even more accurate volume estimates (Fig. 3). By adding together the volumes of many tiny cells (versus relatively few flat slices), this method allowed features such as ramps and plaforms to be included (Lacquement 2009:34).**

**Using Surfer 9.0, we employed this gridding method to calculate the volumes of Mounds A, B, and C from detailed contour maps constructed from LiDAR data (Fig. 4). Based on an early description (Wailes 1852) and our excavations, we were also able to roughly estimate the volume of Mound D (Table 1).**

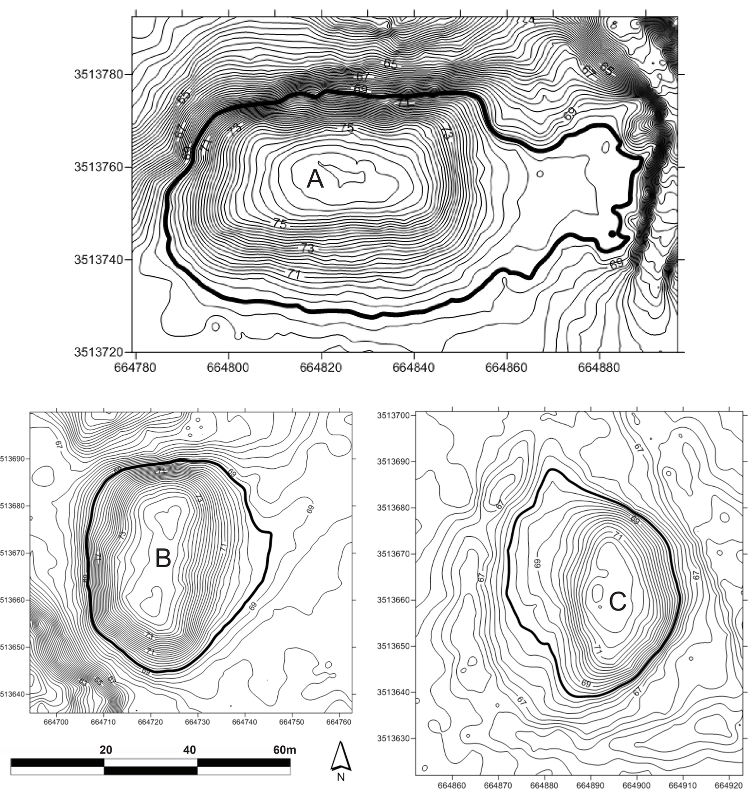
Figure 4: Detailed topographic maps (contour interval = 0.25 m) of each of the extant mounds at Feltus showing the base contour that was used to calculate mound volume.

## Methods: Accounting for Negative Features

**We have also identified three episodes of large-scale digging and earthmoving that resulted in negative features: a ditch surrounding Mound C, an area of land-leveling west of Mound B, and a large, refilled borrow pit south of Mound D (see Fig. 1). The first two are not included in our calculations of total earthmoving at Feltus because the earth taken from these features was probably included in the mounds, and thus is already counted. That said, the borrow pit (Fig. 5) is included because it was not only dug (perhaps during the construction of Mound D), but also refilled at a later date. In this case, coring and excavation data was used to map of the base of the feature and geometric formulas were then used to estimate its volume.**

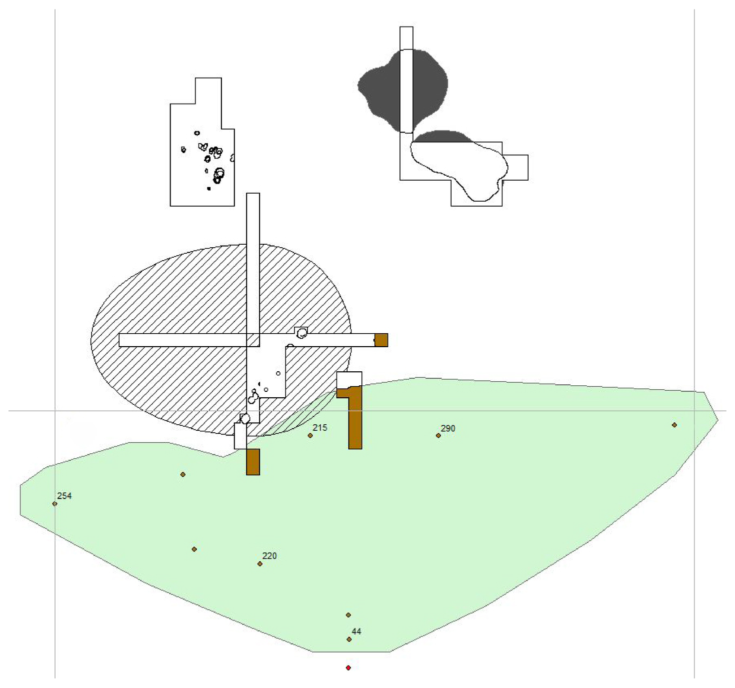
Figure 5: Map of the Mound D area showing coring (green) and excavation (brown) data on the base of the refilled borrow pit feature.

## Results: Earthmoving at Feltus and Beyond

**Excavations at Feltus revealed large amounts of earthmoving in addition to the three primary mounds. Tables 1 and 2 show minimum estimates and the volumes may well be larger. The ease of this estimation technique combined with the data collected during the Mississippi Mound Trail project provides a unique opportunity to compare earthmoving at a variety of Lower Mississippi Valley sites (Table 2). Plaquemine period sites tend to be the largest, but our work at Feltus shows that Coles Creek sites may have significant earth-moving that is not readily apparent. Our recent test excavations at Smith Creek (22Wk526), a Coles Creek site similar in layout to Feltus, show that large areas of the plaza were modified prehistorically (Fig. 6). The area south of Mound B may be a platform much like that adjacent to Mound C at Feltus; hand-augering could not reach the bottom of the deposit. The area west of Mound C was found to be a relatively homogeneous deposit of dark, organic fill (Fig. 7). These deposits must be further explored in order to understand their functions. Moreover, a systematic coring of Smith Creek may reveal additional areas of landscape modification.**

Table 1: Feltus volume estimates

| Site Feature | Volume ($m^3$) |
|---|---|
| Mound A | 9,617 |
| Mound B | 3,644 |
| Mound C | 1,258 |
| Mound D | 1,100 |
| *Subtotal* | *15,619* |
| Borrow Pit | 800 |
| ***TOTAL*** | ***16,419*** |

Table 2: Additional LMV volume estimates

| Period | Site | Mound | Volume ($m^3$) |
|---|---|---|---|
| Plaquemine | Anna (22Ad500) | 3 | 29,518 |
| | | 5 | 3,064 |
| | | 6 | 13,762 |
| Plaquemine | Bates #1 (22Je514) | - | 621 |
| Plaquemine | Lessley (22Wk504) | - | 4,110 |
| Plaquemine | Windsor (22Cb508) | A | 12,847 |
| | | B | 2,079 |
| | | C | 2,741 |
| | | D | 138 |
| Plaquemine | Bayou Pierre (22Cb534) | A | 2,598 |
| Coles Creek | | D | 605 |
| Coles Creek | Smith Creek (22Wk526) | A | 16,388 |
| | | B | 2,250 |
| | | C | 1,366 |
| Marksville | Pumpkin Lake (22Je517) | - | 1,148 |

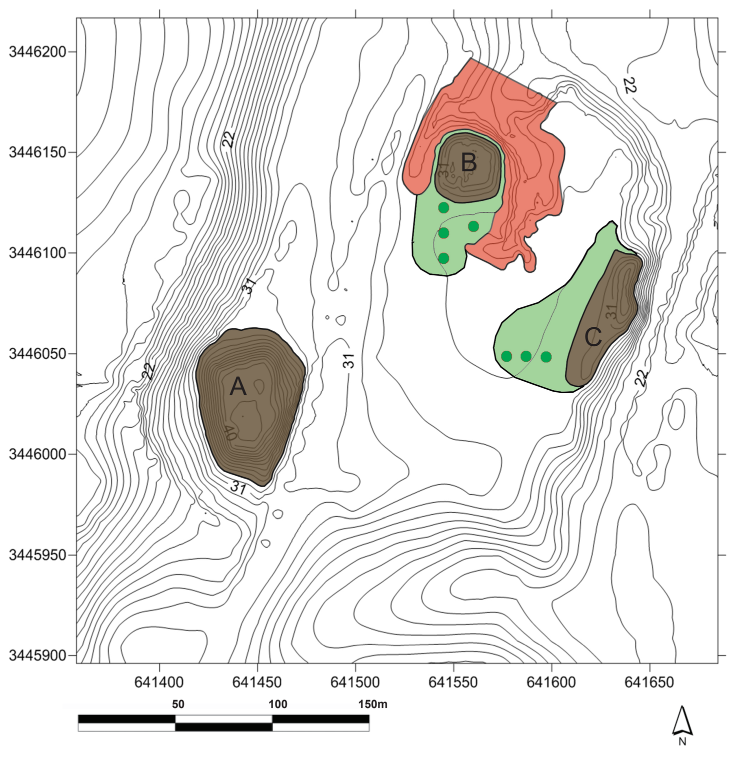
Figure 6: Topographic map (contour interval = 1 m) of Smith Creek showing large episodes of earth moving (brown = mounds, red = ditch, green = additional platforms and/or plaza construction).


Figure 7: Profile of the test unit west of Mound C at Smith Creek showing over 1 m of cultural fill atop the natural ground surface.

## Conclusion: Looking Beyond Mound Volume

**Our results indicate that topographic maps constructed from LiDAR data can quickly provide accurate mound volume estimates using the gridding method. These estimates can provide a starting place from which to discuss site size, duration of use, and labor requirements. That said, our excavations at Feltus and Smith Creek show that focusing only on mounds greatly underestimates the amount of earth being moved at Coles Creek sites, a finding in line with Kidder's (2004) work at Raffman. Excavations, combined with systematic coring or shovel testing (Fig. 8), can effectively be used to determine if additional features should be included.**

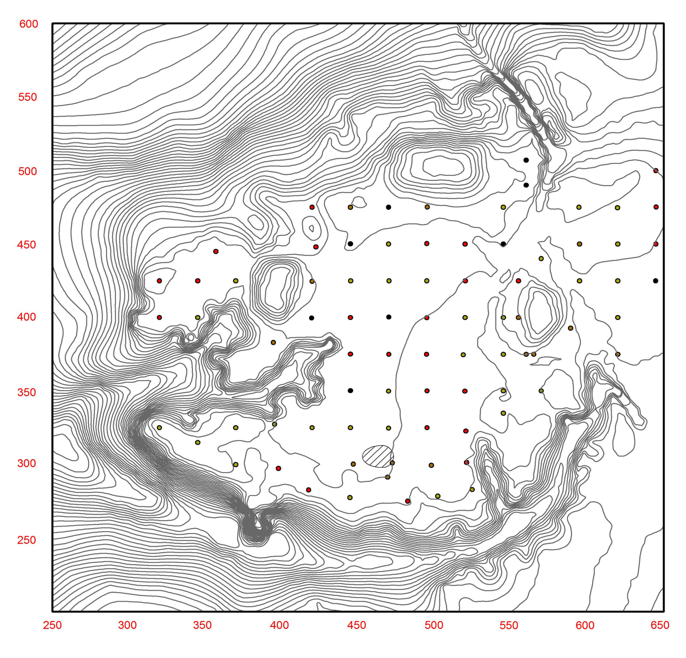
Figure 8: Feltus shovel testing grid showing various levels of landscape modification across the site. Red dots indicate where earth was likely removed prehistorically.

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