Thermally Altered Stone Feature Form and Function:

Attribute Analysis at the Hickory Bluff Site

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Thermally Altered Stone Feature Form and Function: Attribute Analysis at the Hickory Bluff Site, Dover, Delaware

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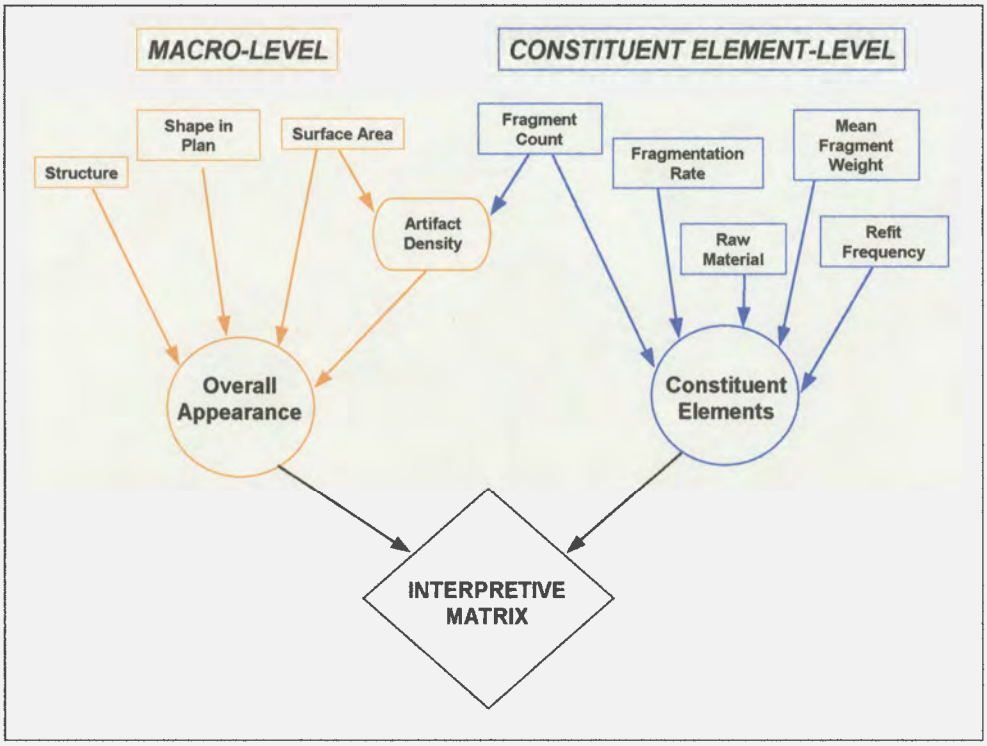
Presented at the 2005 Middle Atlantic Archaeological Conference, Rehoboth, De.

We are all well aware of the generally universal nature of thermally altered stone as it occurs on prehistoric archaeological sites in the region. Thermally altered stone or fire-cracked rock, is a common artifact type, so much so that it is often acknowledged as present on a site and then is essentially ignored, largely because it is difficult to deal with, hard to interpret, and, frankly, kind of boring.

Like many sites in the Mid-Atlantic, the Hickory Bluff site contained a large volume of thermally altered stone (over 26,000 fragments), much of it clustered in features.

For those of you who may not have heard of Hickory Bluff, the site was investigated as part of the SR 1-Puncheon Run Connector, a road and bridge construction project on the south edge of Dover, Delaware. The excavations recovered over 76,000 prehistoric artifacts and documented 150 prehistoric features. The occupations at Hickory Bluff spanned a 4,000 year sequence of the Late Archaic through Middle Woodland periods. In the regional Delmarva chronology, subperiods represented included Barker's Landing Complex, Delmarva Adena Complex, and the Carey Complex.

As part of the general site analysis and interpretation at the site, thermally altered stone was subjected to detailed attribute analyses. The primary objective of the study was to arrive at functional interpretations for the various thermally altered stone features documented at the site.



We approached this task by looking at the features on two levels – as whole or complete entities, but also as made up of individual, constituent parts. On the macro level we examined the overall characteristics of the features, comparing things like size and shape. On the more detailed level we looked at the separate elements that comprised each of the features, examining specific physical characteristics of the individual stones or fragments, asking questions about such things as size, weight, fragmentation rate, and raw material. By studying this collective information, we hoped to determine patterns leading to explanations of how the features had been used

To provide data for comparisons and for functional interpretation, several attributes were recorded for each feature. These included the overall shape of the feature, its horizontal area, and any obvious internal structure – was there an associated pit, were the stones layered or multi-tiered?

We also recorded the total number of stones or fragments in the feature, the mean fragment weight, artifact density (by count), fracture percentage, and lithic material frequency. And finally, an extensive refit study was conducted.

Each of the individual attributes recorded has potential implications for the origin and function of the feature in which it occurs, and we'll go over some of these attributes briefly.

• ***Mean Fragment Weight***

Mean fragment weight provides a general characterization of the sizes of the stone fragments within the features. Like any statistic that describes central tendency, it is wise to be aware of small samples that may be biased by non-representative elements – for example, one or two large fragments could artificially drive up the mean weight of a small group of small fragments.

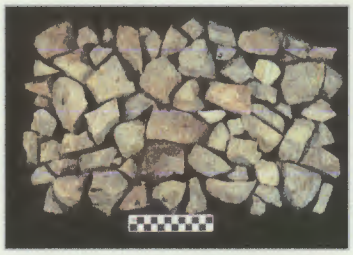
- ***Mean Fragment Weight***
- ***Density***

The density of stones in each feature was also determined. This statistic was calculated by dividing the total count of fragments contained in the feature by the horizontal area of the feature. Artifact density is a means of quantifying the relative degree of clustering of the stones, where a high figure would indicate tight clustering, a lower figure a more scattered distribution. The density figure can provide information about feature formation and post-depositional activity. Moreover, it can provide data for use in comparison against the general artifact distribution across the excavation block as another measure of how distinct the feature clustering might be.

- ***Mean Fragment Weight***
- ***Density***
- ***Fracture Frequency***

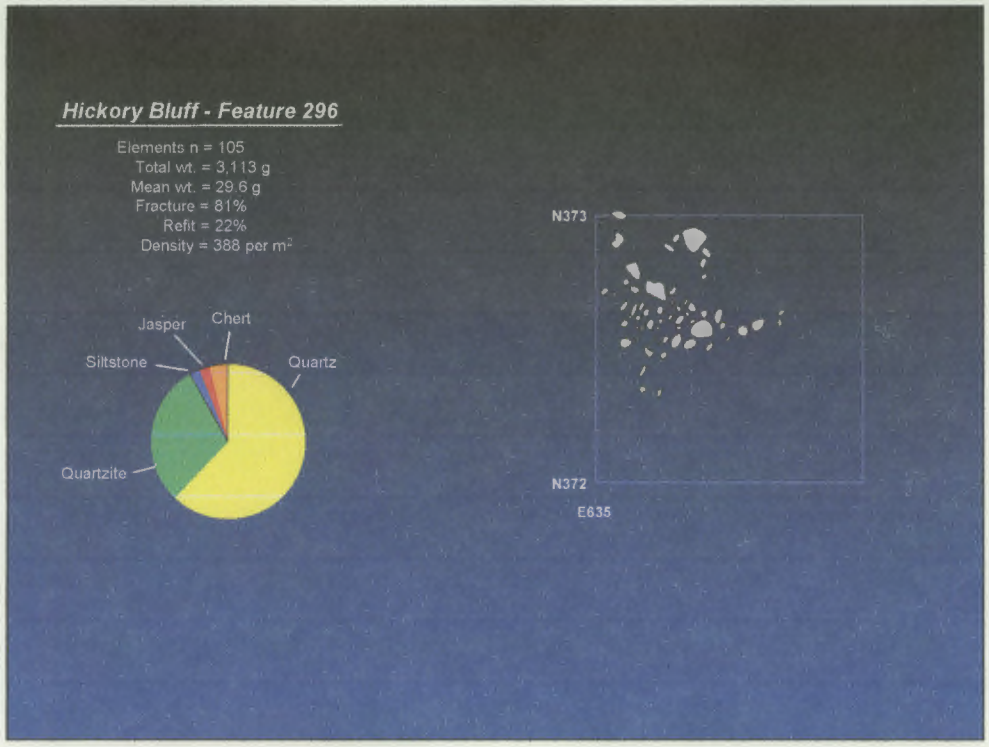
Fracture frequency consists of the percentage of fragmented *versus* whole or non-fragmented stones in each feature. This figure can provide direct information related to feature function and formation. For example, high fracture frequencies imply few whole cobbles, suggesting that the stone was heated repeatedly, or kept at a high temperature for a long period of time, or was heated and rapidly cooled. Each of these has further implications for feature function.

- ***Mean Fragment Weight***
- ***Density***
- ***Fracture Frequency***
- ***Refit Frequency***

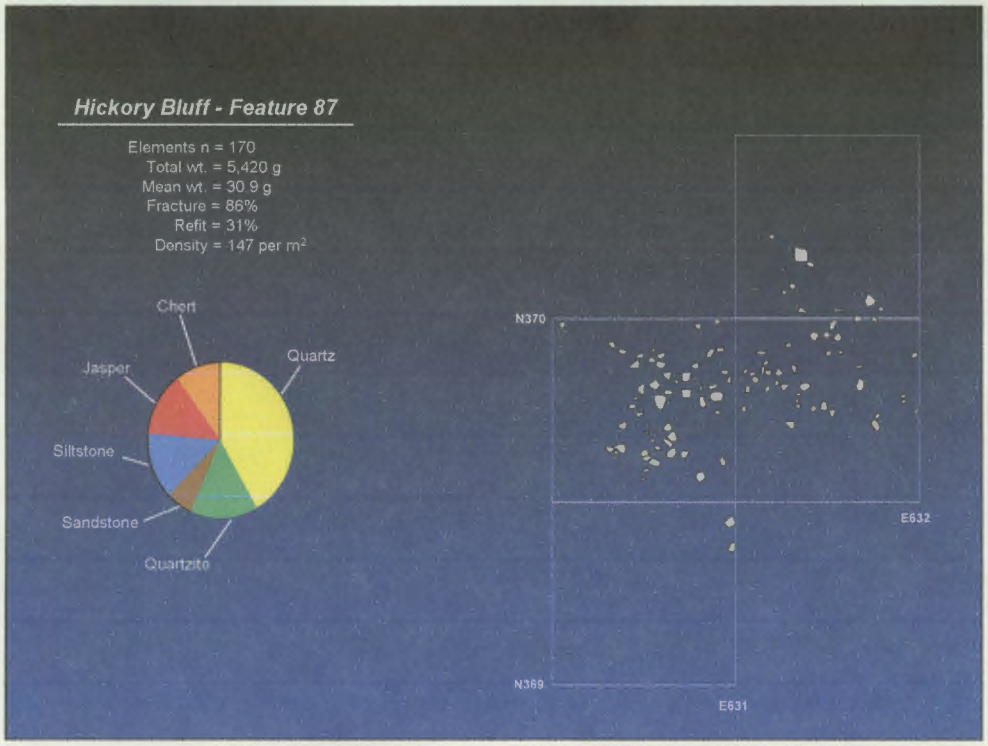


Finally, the frequency with which the fragments can be refitted may supply additional information about formation processes and depositional context. For example, the presence of many refits suggests that the stone was fractured in place and has not been disturbed greatly since deposition.

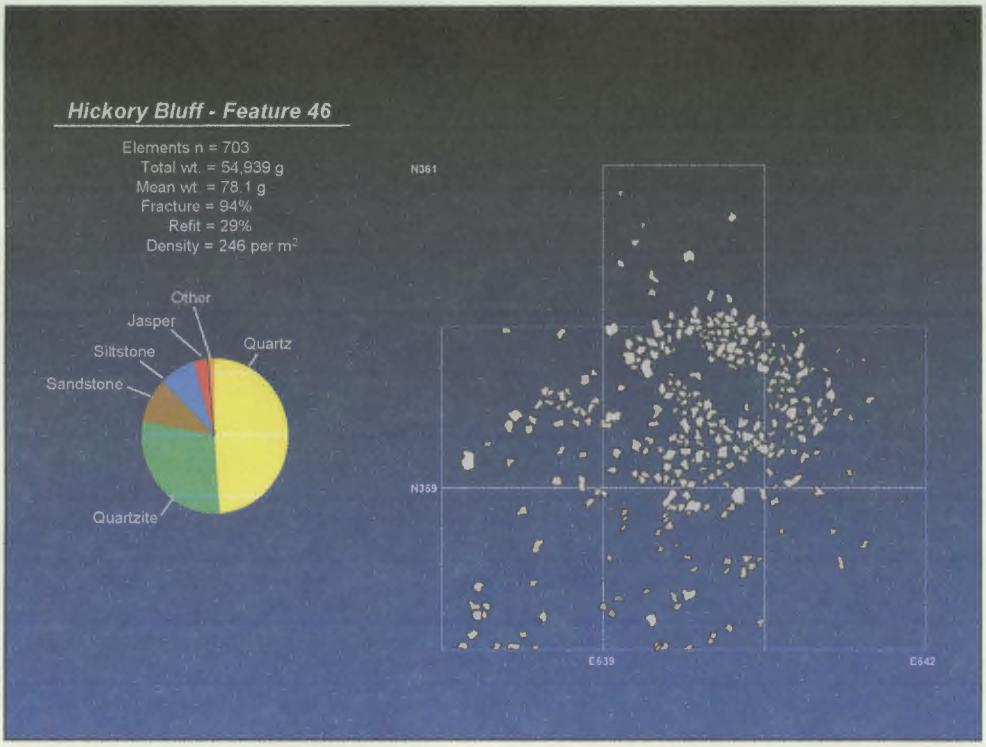
A total of 34 thermally altered stone features were documented at Hickory Bluff. On closer examination, 19 were too scattered to be included in this study– their occurrences as individual or separate cultural features could not be confidently demonstrated. These features may have been the result of several episodes of site use that had been dispersed and intermixed. The remaining 15 features were subjected to the detailed attribute analyses. These features fell into five groups on the basis of the recorded attributes.



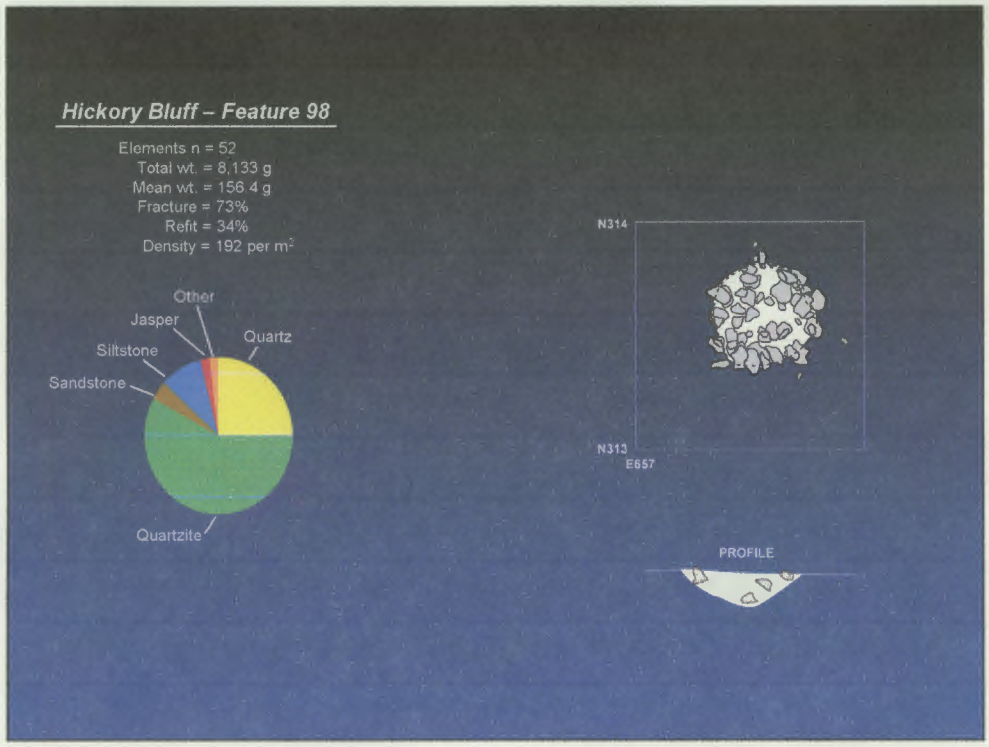
The first group consisted of high density clusters containing on average 2 to 3 kilograms of fractured stone. The range of lithic materials was generally restricted to relatively even proportions of quartz and quartzite. The fragments were small, fracture frequency was high and few refits were present. This group of features seemed to represent the primary or comparatively undisturbed remains of hearths or other fire-related activities.



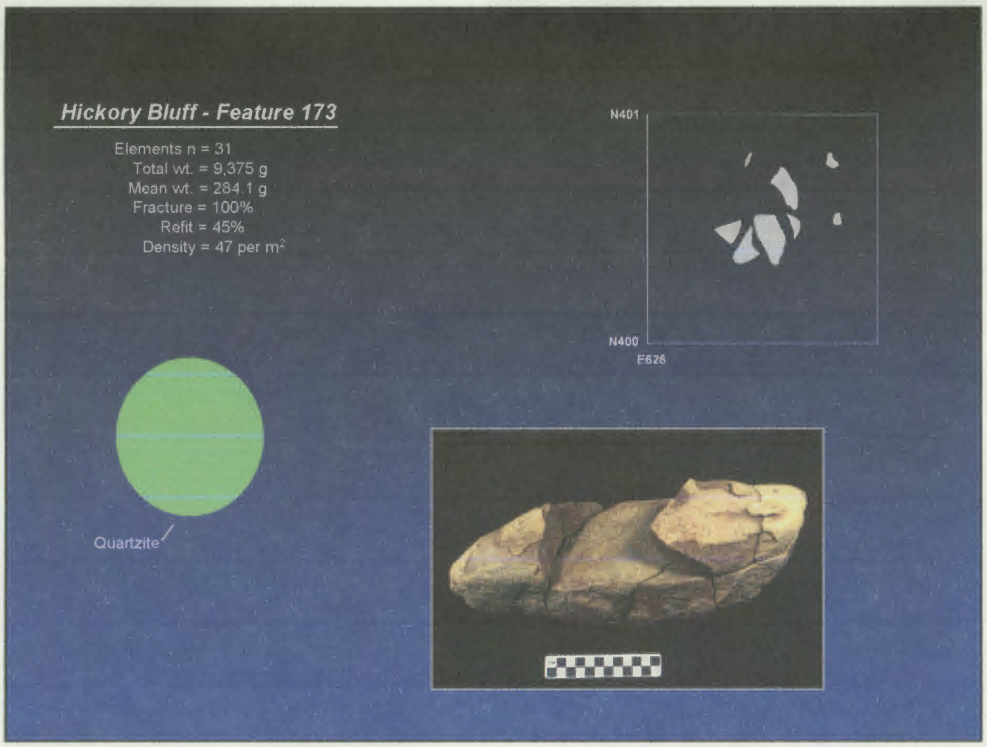
The second group, represented by this image, consisted of large area, low density distributions composed of small fragments from a wide range of materials. Fracture frequency was lower than in the preceding group (meaning there were more complete or unfractured cobbles or pebbles present), and the frequency of refits was very low. The features appeared to represent the widespread redeposition of recycled stone or features that had been extensively disturbed.



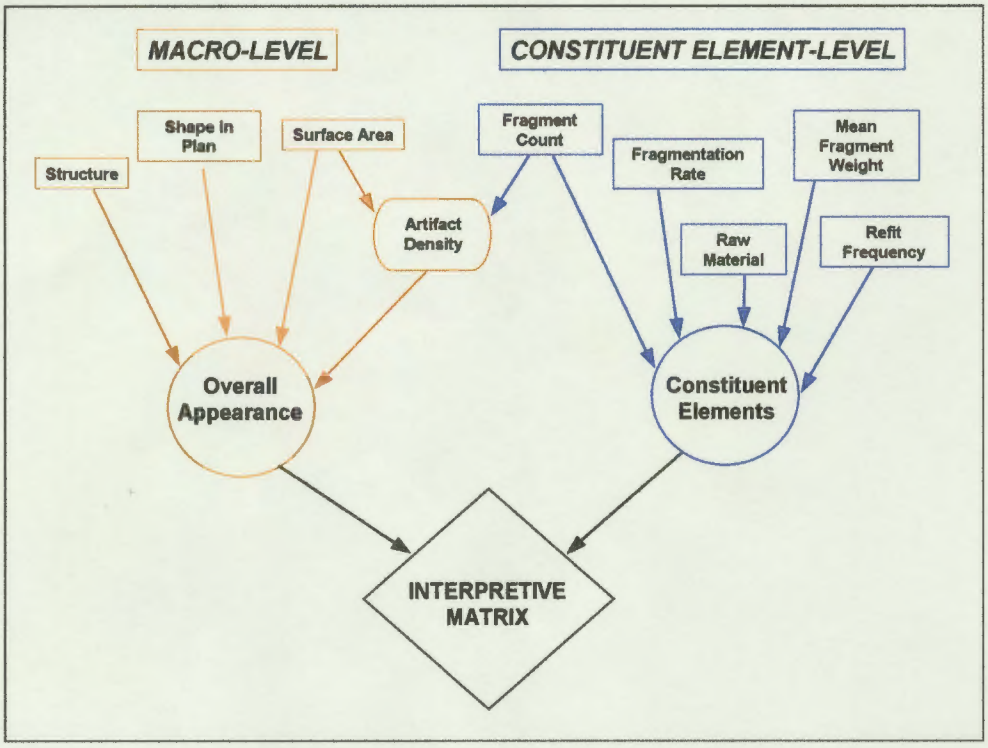
The third group was represented by a single feature composed of a large and dense cluster of stone (with a total weight of more than 54 kilograms). While no excavated pit was noted in association with the stone, the fragments were arranged in several irregular tiers or layers. The fragments were small, fracture percentage was high, and few refits were observed. Based on the density and configuration of the stone fragments, the feature may have been a large hearth or roasting platform. Given the sizes of the fragments and a low occurrence of refits, the feature may also have been a relatively undisturbed deposit of discarded stone.



The fourth group was also represented by a single example, an assortment of relatively large fragments contained in a pit. The fragments were dominated by one material type, quartzite. Fracture percentage was low in comparison to other feature groups, but again, few refits were noted. The feature may have served as a form of earth oven in which large pieces of a specific material were selected for use. Given the low occurrence of refits, the fragments may have consisted of reused stone that was heated elsewhere with only the large examples selected for eventual use.



This last group consisted of yet another single feature, a tightly clustered group of large fragments of quartzite, many of which refit to form a single small boulder. Two facets of the reconstructed boulder were heavily worn and the item appeared to have been extensively used as a platform for hammering or grinding prior to being heated. The tabular stone may have been used for indirect cooking or as a roasting platform.



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For example, a feature exhibiting tight clustering, along with small highly fractured fragments and many refits, suggests that the stone had been extensively heated and was relatively undisturbed.

By contrast, large area features with low artifact densities, small fragments, and low refit frequencies may represent features containing extensively heated stone that was then redeposited…

…or disturbed by some post depositional process.

Thermally Altered Stone Feature Matrix

general implications

	high % complete	low % complete
many refits	• primary context, little disturbance • high temperatures or • possible reuse of feature w/o removal of cobbles	• primary context, little disturbance • recycled stone • high temperatures or • heavily scavenged
few refits	• single use • low temperatures or • mixed primary context, little disturbance, w/ whole and recycled cobble fragments	• discard area—secondary context or • recycled stone • low temperatures or • heavily scavenged

These analyses led us to begin constructing matrices of attributes and functional interpretations. These arrays are not intended to imply precise correlations—we are not looking to pigeonholes these features. But the tables do suggest the general range of interpretive scenarios that might be implied by certain combinations of feature attributes.

Thermally Altered Stone Feature Matrix

functional hypotheses

	high % complete	low % complete
many refits	• cooking—steaming • sweat lodge • repeated use	• use of recycled stone • scavenging • high temperatures or • heavily scavenged
few refits	• cooking—roasting • general heating	• discard area—secondary context • primary context using recycled stone/low temperatures • scavenging

Yet, this sort of cross-tabulation also indicates the potential complexities involved in interpreting features on this basis. For example, high fracture rates and low refit frequencies could imply either that the fractured stones had been removed from their original use location or that pieces had been removed from the cluster during episodes of scavenging, with the larger fragments used elsewhere.

It is, of course, necessary to examine other factors in order to assess the validity of the interpretations--- such as ethnobotanical evidence, temporal depth, and the spatial relationships among thermally altered stone features and other artifact clusters.

And perhaps most importantly, the information needs to be collected in the first place (preferably by very happy people)–thermally altered stone needs to be cataloged at a sufficient level of detail to allow this sort of analysis to be conducted. It takes a little time, but can be rewarding in terms of site interpretation.