Journal of Archaeological Science 40 (2013) 3117–3128

Contents lists available at SciVerse ScienceDirect

Journal of Archaeological Science

journal homepage: http://www.elsevier.com/locate/jas

Statistical means for identifying hunter–gatherer residential features in a lithic landscape

Christopher Morgan [a,*], Molly Boeka Cannon [b], Benjamin Fowler [b]

[a] Department of Anthropology, University of Nevada, Reno,1664 N. Virginia St., Reno, NV 89557-0096, USA
[b] Anthropology Program, Utah State University, 0730 Old Main Hill, Logan, UT 84322-0730, USA

ARTICLE INFO

Article history:
Received 12 January 2013
Received in revised form
20 March 2013
Accepted 8 April 2013

Keywords:
Stone circle
Rock ring
Spatial statistics
Group size
Residential mobility
Site structure
Site formation

ABSTRACT

Techniques are described for extracting circular rock features from landscapes dominated by clasts of the same type from which cultural features are composed, using as a test case a large stone circle residential site in western Wyoming, USA. Methods consist of point plotting all relevantly-sized culturally and naturally-deposited clasts in the field and identifying potential cultural features using point density analyses tools in ArcGIS. Potential rings are either accepted or rejected as cultural features by comparing clast frequency, density and distribution in internal, feature-ring, and external spatial buffers to ethnoarchaeological data recording stone circle size and morphology and to similar data generated from a control sample of off-site, naturally-occurring clasts. The results of the analysis are used to discuss group size, mobility type, and duration of site occupation and to explore problems of assessing such at surface archaeological sites resulting from palimpsest-type site formation processes.

1. Introduction

Circular rock features are common to many types of archaeological sites, especially those associated with hunter–gatherer groups, but their objective identification is often confounded by faint outlines, poor preservation, palimpsest-like site formation processes, post-depositional disturbances, and difficulty of discernment in landscapes dominated by naturally-occurring clasts (Scheiber and Finley, 2010a; Seymour, 2009). Because of this, and the fact that hunter–gatherers nearly always make structures at residential sites (*sensu* Binford, 1980, 1990), this study seeks to answer modest yet nonetheless critical empirical questions about residential feature identification using straightforward morphological analyses and geostatistical methods. These types of questions are often overlooked and their answers often rely on intuition in hunter–gatherer archaeology: what comprises rock-ringed residential features and how can such features be objectively discerned from the natural distribution of rocks often found on the surface of archaeological sites? The subject is important not only to basic methods of site recording and mapping (Hester et al., 2008), but also toward more fundamental questions related to determining group size, group composition, and intensity of site occupation and re-occupation over time (Diehl, 1992; Moore, 1998; Smith, 2003). These empirical determinations are of course essential to answering larger questions concerning degrees of mobility and population size (Binford, 1990; Bocquet-Appel et al., 2005; Casteel, 1979; Kelly, 1992; Schreiber and Kintigh, 1996; Zorn, 1994) which are in turn critical to understanding the fundamental human ecology of groups who built and used such features (e.g., Bettinger, 1977; Grayson and Cannon, 1999; Hardesty, 1983; Winterhalder et al., 1988).

This research focuses on spatial data collected from 48TE479, a stone circle (oftentimes referred to in the vernacular as "tipi rings", though the superstructures associated with such features were likely of considerable variation) site in the Gros Ventre River valley in western Wyoming, USA; it is thus perhaps most applicable to analyses focusing on North America's Great Plains, where such surface features are relatively common (Frison, 1983; Kehoe, 1960; Kornfeld et al., 2010). Such features are structurally simple, consisting typically of little more that 1–3 courses of locally-available cobbles and small boulders arranged in a circular manner, with diameters ranging anywhere from about 2.5 to 8 m (Mobley, 1983). They almost never contain subsurface features or deposits (Kehoe, 1983). Similar features are found throughout western North America, where clastic site surfaces are common and where

* Corresponding author. Tel.: +1 775 682 8992; fax: +1 775 327 2226.
E-mail addresses: ctmorgan@unr.edu (C. Morgan), molly.cannon@usu.edu (M.B. Cannon), b.fowler@aggiemail.usu.edu (B. Fowler).

0305-4403/$ – see front matter
http://dx.doi.org/10.1016/j.jas.2013.04.009

residential features are often difficult to objectively identify within such landscapes. For instance, rock rings associated with residential (per Binford, 1980) group aggregations and storage are common in the piñon ecozones (Bettinger, 1989), valley floors (Eerkens, 2008), and alpine elevations (Bettinger, 1991, 2008; Thomas, 1982) of the Great Basin. Similar features are found in the higher elevations of Wyoming's mountain ranges (Morgan et al., 2012a; Scheiber and Finley, 2010b) and in California's Sierra Nevada (Morgan, 2008, 2012). In fact, due to their simple construction and association with many types of human activities, the methods described in this paper might be applied to any of those situations where humans made and used rock rings, whether it be Neolithic Europe (Blot, 1991; Eogan, 1964), Sub-Saharan Africa (Anquandah, 1986; Soper, 1977), prehistoric Japan (Komai, 1961), or the deserts of Australia (Mathews, 1895; O'Connell, 1987), but its principal focus is on the circular or semicircular structures most often made and used by mobile hunter–gatherer groups (Binford, 1990; Diehl, 1992; Whiting and Ayers, 1968).

Despite their widespread distribution, surprisingly little previous research has been specifically conducted on the problem of identifying and documenting stone circles and other rock rings, particularly in the last decade or so, a situation Scheiber and Finley (2010a) link to the proliferation of management-oriented archaeology into those regions where rock rings are most common, but a phenomenon also likely linked to the paucity of artifacts and subsurface deposits, and hence the perceived research value, typically associated with such sites, at least on the Great Plains (Kehoe, 1983). Historically, most metric research on Great Plains stone circles has focused on basic description, middle-range type questions regarding feature function, and intrasite spatial analysis (Davis, 1983a; Kehoe, 1983). For instance, Smith (1974) and Aaberg (1975) provide basic recording instructions for Great Plains stone circles, emphasizing the benefits of point-plotting the individual rocks comprising such features. Hoffman (1953), Kehoe (1958) and Malouf (1961) use empirical observation and ethnographic analogy to equate stone circle sites with short-term residential groupings of Plains populations. Among the first to systematically address function and the metric morphology of stone circles was Kehoe (1960), who suggested smaller rings may pre-date the acquisition of the horse by Blackfoot groups, a hypotheses later questioned by Larson (1979). Partly in an effort to address this hypothesis, Mobley (1983) used non-parametric statistics to argue that there are indeed three significant stone circle diameter classes in New Mexico, but is equivocal about whether these classes have temporal or functional significance (see also Larson, 1981; Quigg, 1981; Roll, 1981; Wilson, 1983). In a similar vein, Davis (1983b) uses multivariate analyses of internal and external diameters, number of rocks, distance to nearest adjoining stone circle, rock density and feature shape for stone circles in Wyoming in an attempt to link circle morphology with ethnohistoric function. Like Mobley, he is equivocal about his findings and suggests that stone circles, regardless of size or morphology, cannot be excluded as possible tipi rings (see also Finnigan, 1980). Corroborating an earlier observation by Frison (1967), Finnigan (1981) measured rock densities in different directional segments of stone circles in Alberta and found that densities are greater on the windward side of such features, indicating their function as weights holding down the skins of tipis or tents. Moving beyond the analysis of stone circles themselves, others have performed intrasite spatial analysis of artifact scatters, living floors, and refuse deposits, assessing their spatial association with stone circles in attempts to elucidate different activity areas (Reher, 1983; Smith et al., 1995) and the symbolic use of space (Oetelaar, 2000). In a return to the basics of site mapping in the digital age, Scheiber and Finley (2010a) have used high-precision, differently-correctable GPS, remote sensing and radiocarbon dating to record spatially-based attribute data for individual features and the rocks comprising these features in the Bighorn Canyon area of Montana and Wyoming, linking these features to both the Late Plains Archaic (ca. 500 BC) and arguably the migration of the Crow into the region in the Late Prehistoric (after AD 700).

Similar research patterns pertain outside the Great Plains. In terms of function, for instance, Bettinger (1989) used rock ring diameter and artifact associations correlated with ethnographic information to identify ring function in Owens Valley, in eastern California. He argues smaller diameter rings are storage features and larger ones with milling equipment and heterogenous artifact association are domiciles; other possible functions include sweat lodges and menstrual huts. In a similar vein, Baker (2003) compared the morphology of rock rings in western Colorado to ethnohistoric records to argue that the features he identified there likely represent Ute menstrual huts. Seymour (2009) used similar ethnoarchaeological methods to identify faint Apache wickiup footprints in Sonora, Mexico (see also Donaldson and Welch, 1991). One of the most direct (yet also perhaps unnecessarily complex) attempts to quantitatively assess rock ring morphology as an indicator of function comes from outside the realm of hunter–gatherer archaeology: in Great Britain, Patrick and Wallace (1982) used Fourier analysis to assess degrees of circularity of stone circle sites arguably linked to archaeoastronomical observation.

Moving beyond simple morphological-functional studies, Simms (1989) used ethnoarchaeology and intrasite spatial analyses to elucidate mobility type and duration of occupation at a Shoshonean wickiup site in Eastern Nevada. Bettinger (1975) took these types of analyses one step further by estimating population size from rock ring surface area in eastern California. Counterintuitively, some of the more recent and quantitative approaches toward residential feature identification consist of those focusing on geostatistical analysis of artifact distributions in the absence of direct evidence for residential feature construction (Stiger, 2006; Surovell and Waguespack, 2007) or those employing remote sensing techniques (Finley and Scheiber, 2007; Morgan et al., 2012b). There has consequently been a fair amount of description and attempts at determining rock ring function, mainly by employing ethnoarchaeological techniques, but very little focus on objectively identifying features from surface data, suggesting intuition trumps metric analysis in many site recording and reporting situations. Many who have stood around what appears to be a faint rock circle or a cluster of cobbles with their colleagues, shrugging their shoulders as to whether or not they had a feature on their hands likely know this is often the case.

Within this context, the goal of this paper is to provide simple quantitative and statistical means of objectively and confidently identifying circular surface residential features in any variety of geomorphic contexts using methods that should be transparent and easily replicable to those with a working grasp of basic mapping techniques, simple spatial statistics and access to industry-standard GIS software. It uses as a test case a large stone circle site along the Gros Ventre River in Western Wyoming, where clasts eroding out of a Pleistocene fluvial terrace have hindered past attempts to determine the actual number of residential features at the site. Though methodologically oriented, it concludes with a brief consideration of the contributions of objective feature identification toward interpreting group size and composition, duration of occupation, degrees of residential mobility and the constraints of ascertaining such from surficial archaeological deposits.

2. Site description

The focus of this study is site 48TE479, originally recorded in 1971 (Love, 1971). It was then described as a site containing at least