XXVI VALCAMONICA SYMPOSIUM 2015

Capo di Ponte (Bs) ITALY
September 9 to 12, 2015

PROSPECTS FOR THE PREHISTORIC ART RESEARCH
50 years since the founding of Centro Camuno

PROSPETTIVE SULLA RICERCA DELL'ARTE PREISTORICA
a 50 anni dalla fondazione del Centro Camuno

Centro Camuno
di Studi Preistorici

Proceedings

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Proceedings of the XXVI Valcamonica Symposium , September 9 to 12, 2015
Atti del XXVI Valcamonica Symposium , 9 - 12 Settembre 2015

I Edizione multilingua, Edizioni del Centro (Capo di Ponte)
ISBN 9788886621465

Edited by / A cura di: Federico Troletti (CCSP / University of Trento, Italy)
Editing / Redazione: Federico Troletti, Valeria Damioli
Tranlated / Traduzioni: William J. Costello, Valeria Damioli, Ludwig Jaffe, Federico Troletti
Layout and Graphic Design / Impaginazione e grafica: Valeria Damioli

Printed in September 2015 by Press Up s.r.l.
Finito di stampare in Settembre 2015, presso Press Up s.r.l.

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Under the auspices and the partecipation of / *Con il patrocinio e la partecipazione di*

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Riserva Naturale incisioni rupestri di Ceto, Cimbergo, Paspardo

With the support of / *Con il sostegno di*

Banca Valle Camonica (Gruppo UBI Banca)
SIAS Segnaletica Stradale s.p.a., Esine

The socio-spatial context of rock-art in the Purgatoire River Valley: an exploratory analysis

Ralph J. Hartley * and Anne M. Wolley Vawser **

Summary

The semi-arid landscape of southeast Colorado (U.S.) is characterized by tablelands, mesas and several canyon systems that drain to the Purgatoire River. The prehistoric use of numerous small bedrock overhangs adjacent to this river provided shelter for highly mobile hunters and gatherers. Archaeological investigations in this region have documented diverse prehistoric activities since the Early Archaic (ca. 8000 BP). Variable rock-art and grinding or milling activities are revealed at or in proximity to the rock-shelters. This paper promotes the utility of exploratory analyses of a spatially complex array of rock-shelters, rock-art, and grinding and milling surfaces that likely reflect the periodic short-term use of this locale for centuries. These analyses extend the descriptive knowledge-domain underlying interpretive models of prehistoric activities while embracing the ambiguity inherent to the role of rock-art in the context of socio-spatial relationships observed in the archaeological record.

Riassunto

Il paesaggio semi-arido del sud-est del Colorado (USA) è caratterizzato da pianori, altipiani e diversi sistemi di canyon che confluiscono nel fiume Purgatoire. La frequentazione preistorica di numerosi piccoli ripari sottoroccia adiacenti a questo fiume attesta la presenza di cacciatori e raccoglitori nomadi. Le ricerche archeologiche in questa regione hanno documentato una frequentazione preistorica in età arcaica (ca. 6.000 a.C.). Si sono rilevate attività di intervento sul territorio e esempi di arte rupetre in corrispondenza o in prossimità dei ripari sottoroccia. Questo articolo sottolinea l'utilità di analisi esplorative che tengano conto della presenza di ripari, dell'arte rupestre e delle superfici di rettifica e fresatura che probabilmente riflettono l'uso periodico di breve termine di questi luoghi per secoli.

Introduction

The marking of a place is, not unlike that of non-human-behavior, oriented cognitively toward communicating information. We, unlike many species however, depend primarily on a visual mode for discriminating information. Our psychological capacity for accumulating what can often be energetically expensive symbolic information enhances social learning, interaction, and locally adaptive behavior (cf. Parker 1987; Boyd, Richerson and Henrich 2011). The communicative dynamics underlying the creation and display of petroglyphs and pictographs on a landscape dense with a "taphonomic palimsest" of remains of variable human activities continues to be a challenging focus of research in anthropological archaeology. Where rock-art and the remains of domestic activities are positioned relative to rock-shelters used by prehistoric, highly mobile hunters and gatherers along the Purgatoire River in southwest Colorado is a focus of this paper. Pursuing the communicative role of rock-art in the context of spatial relationships observed in the archaeological record is, we believe, worthy of exploratory analyses that have the potential to inform models of activity in this locale.

The Purgatoire River flows northeast to the Arkansas River through an area known as the Picket Wire Canyonlands, a component of the Comanche National Grasslands managed by the U.S. Forest Service. This area is bounded on the northwest by a large tract of land owned by the U.S. Army for the purpose of military training exercises (Pinon Canyon Maneuver Site (PCMS). This semi-arid landscape is characterized by tablelands, mesas and several canyon systems that drain southeast to the Purgatoire River (Fig. 1). Four adjacent locations with numerous rock-shelters known to have been used prehistorically by Native Americans are examined in this study (5LA1023, 5838, 5841, and 5844; Reed, Horn 1995).

Rock-shelters and alcoves are often differentiated from "caves" in North American archaeological literature but less so in ethnographic and ethnohistoric accounts. Characteristics of a rock-shelter in the semi-arid south central U.S. is best defined by Collins (1991, p. 158) as where bedrock overhangs and the area beneath is "within reach of daylight and ambient temperature and moisture". Sheltered spaces formed by large boulders along the western portion of the Purgatoire River valley have the potential to offer such characteristics (Fig. 2).

Ethnographically documented use of rock-shelters and archaeological investigations of prehistoric rock-shelter sites often reveal that various human activities took place outside the sheltered floor area on adjacent talus slopes or terraces. Ethnographic and ethnohistoric accounts suggest that the occupants of these shelters

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for more than one night were usually, but not always, kin-based groups (i.e., either nuclear or extended families). These mobile kin-based groups, inhabiting a wide range of environments, are known to have carried out a number of different domestic activities within and around rock-shelters. The duration of occupation, from a few nights to several months, was conditioned by variable subsistence needs and opportunities. The degree to which sheltered spaces were enhanced or modified with, for example, brush or portable rock, rests for the most part on the subsistence strategy and length of stay at such places (Seligmann, Seligmann 1911; Evans 1937; Gardner 1972; Lim 1985; Veth 1993; Binford 1996; Galanidou 2000).

The four site localities examined here are assumed to have been a magnet for a number of short-term activities by kin-based foraging groups. Data for this study is based on ground surface observations. Exploratory analyses are pursued in one dimension since the data are available in presence/absence format only. The direct behavioral context and/or simultaneous use of features or artifacts cannot be assessed reliably at this time. We also acknowledge that the presence or the absence of observations used as units of analyses can be the result of depositional and erosional activity. Failure to observe remains like portable groundstone does not necessarily indicate that milling did not occur within the site (e.g., Veth 1993, p.78). Simply stated, we do not know the formational history of the cultural remains at this locale. The development of methods to determine high temporal resolution for the observations used here is highly unlikely, and with rock-art, stylistic motif categorization is considered inherently subjective (Reed, Horn 1995, p. 121; Wandsnider 1996; Scheinsohn *et al.* 2015). Nevertheless, current regional classificatory assessments of rock-art suggest the much of the petroglyph marking in the study area is morphologically similar to that created during the Middle (5000-3000 B.P.) and Late Archaic (3000-1850 B.P.). Most marking is considered non-representational (i.e. abstract) while some apparent zoomorphic quadruped imagery is in evidence (Reed, Horn 1995; Loendorf 2008) (Fig. 3).

Research Orientation

We approach this study as an exercise in exploratory spatial analysis using categorical data and visualization. As a pre-modeling effort it makes no claims toward formal inferential goals, but rather attempts to generate questions that may be pursued with intent of constructing empirical models that illustrate the complexity of relationships in the human use of places through time (Carr 1991; Fotheringham *et al.* 2000, pp. 185-188; Goodchild, Janelle 2004, p. 7). For constructing a model of the past is, as Binford (2001, p. 482) emphasized, vastly different and more difficult than searching for an explanation of variability in the archaeological record.

We address the ambiguity inherent to surface observations by constructing variables that are the result of minimizing assumptions about correctly identifying the material residue of prehistoric activity. With data from sites on the Pinon Canyon Maneuver Site (PCMS) as referential background, we examine archeological surface observations in Picket Wire Canyonlands to identify potential spatial relationships between rock-art "panels", plant-grinding activities, and rock-shelters. The presence of grinding or milling activities is assumed here to be a rough index of the domestic investment in the site (cf. Lynch 2014).

The PCMS has undergone extensive inventory over the last three decades making it an excellent, variable landscape within which to compare the four site localities examined here. Although several thousand pre- and proto- historic Native American sites have been documented within the PCMS boundaries 171 possess nominal and/or categorical data resulting from field observations with at least one of the following variables:

- Rock-shelters that show evidence of prehistoric occupation or use that have not been modified with architecture, such as stacked rock - ROCKSHEL.
- Rock-shelters that show evidence of prehistoric occupation or use and exhibit the remains of architectural modification - ROCKWARC.
- Artifactual remains that show evidence of grinding or milling activity, such as metates, manos, bedrock metates or other grinding surfaces - GROUNDSTONE (Fig. 3).
- Petroglyphs and/or pictographs - ROCKART (Fig. 3).
- Rock aligned or stacked so as to be or contribute to a structural form - ARCHITECTURE.

We asked one fundamental question of the PCMS data set: To what extent is the presence of prehistoric grinding or milling activity, rock-art, and architectural remains spatially associated with the human use of a rockshelter? Analysis suggests that rockshelters, both modified and unmodified, show a weak association with evidence of grinding activities (Table 1). The presence of rock art is much less associated with modified rockshelters and devoid of any demonstrable association with unmodified rockshelters. Log-linear analysis (binary logit) indicates however that the presence of grinding activities is the best predictor of rockshelter occupation (Table 2). That is, controlling for rock art, the probability of groundstone being present at an unmodified rockshelter is 16.5 times greater than evidence of these remains being absent. Similarly, at modified rockshelters, the probability of groundstone being present at the site is 5.75 times greater than its presence not being observed.

With some measure of association established for the presence of remains at rockshelter sites in the PCMS we examined the content of the four site localities along the Purgatoire River. Three fundamental questions were asked of observations made at these places:

- To what extent are rock art, grinding and milling materials, and structural features spatially associated with rockshelters?

- To what extent do these remains co-occur in proximity to rockshelters?
- How are these observed remains positioned relative to rockshelters?

The spatial extent of these site localities, as determined by initial documentation of the cultural features and remains, was apportioned into spaces, such that each rock-shelter functioned as the centroid by which tessellation procedures forming polygons were constructed to establish a "proximal solution" to the site spatial morphology[1]. With this procedure every location of rock art, grinding and milling material, and architectural or structural feature is designated as nearer to a given rockshelter than any other rockshelter. Each polygon, as a unit of analysis, is then conceptualized as a space oriented to a particular rockshelter. For the purpose of these analyses we consider these spatial units to be similar in utility to the spatial "primitive structural elements" conceptualized by Wandsnider (1996). Differences include, however, that they are not uniformly distributed in space and that the fundamental assumption being explored here is that the spatial unit is defined by domestic activities associated with use of the rock-shelters[2] .

Results

A total of 47 spatial units (polygons) stemming from rockshelter locations was derived from the four site localities examined (Figg. 4, 5 and 6). Of these, approximately half contain evidence of grinding or milling activity or rock art (Table 3). Reed and Horn (1995, pp. 111,141) noted a roughly similar occurrence of grinding activity at "modified rockshelters" among all sites recorded in Picket Wire Canyonlands, but far less than the nearly 75% of rockshelter sites in the PCMS sample. The presence of rock art, however, is much greater in the spatial units partitioned here than that of sites defined in the extensive inventory (about 27%) of Picket Wire Canyonlands. Notable is the comparable infrequent rock-art recorded at rock-shelter sites in the PCMS sample.

Our interest in exploring associations between rockshelters, grinding or milling evidence, and the presence of rock art required assessing the co-occurrence of rock art and grinding evidence in each spatial unit. Nearly 75% of all spatial units at these four site localities do not reveal the presence of rock art and surface indication of grinding or milling activity together (Table 4). However, the co-occurrence of these remains in Picket Wire Canyonlands is far greater than that indicated by the PCMS sample, where at more than 97% of the rockshelter sites evidence of grinding or milling and rock art are *not* found together[3]. The positioning of rock art, grinding or milling activities, and structural features relative to rockshelters indicates a somewhat consistent mean maximum distance for all but site 5LA5838 (Table 5). Polygon #4 of that site skews the mean range of distance of features from rockshelters.

Discussion

The search for patterns in the human use of space is fraught with problems, both conceptual and real. The confounding effect of historical phenomena, manifested in the accumulation of material residue of behavior, is acknowledged when tempted with constructing conclusive inductive inference about any process derived from spatial patterning generated by empirical observations. Although sometimes spatially associated with artifactual remains, rock-art may be non-contemporaneous with all or some of these remains (cfr. Wright 2014, pp. 127-135). Even where time can be controlled, however, such inferences should be considered conjectural (Taylor 1977, p. 149). Rock-art as a component of the archaeological record is often the result of an accumulation of episodes of activity and the translation of information about those activities into data rarely informs us about factors that conditioned behavior (Binford 1987, p. 450). It's these fundamental factors that influence human decision making on a landscape that we see manifested in the archaeological record, including the creation and placement of rock-art (Bird, Codding 2008, p. 404). So then how do analyses of static point locations at the scale examined here contribute to the pursuit of understanding the processes that generated activities at these locations? Information transfer among individuals or social groups and relations between them and the bio-physical environment are often reflected in observations that can be defined spatially (e.g. White 2013). The characteristics in any patterning in one plane can help frame questions that are oriented toward investigating the behavior underlying archaeological observations. These analyses pursue a recognition of spatial patterning from which variation in cultural remains stemming from the use-history of a place can influence inference, derived for the most part, inductively (cfr. Binford 1987, pp. 465-466). These exploratory analyses are aimed at extending the descriptive knowledge domain that underlie

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1 This procedure uses an algorithm of Voronoi tessellation that divides a plane into polygons, in this study one for each rock-shelter. A mosaic of tiles imposed over the area of interest is formed, commonly known as Dirichlet tiles, Thiessen or Voronoi polygons (see Upton and Fingleton 1985, pp. 96-104; Haining 1990, pp. 20, 101-110; Halls *et al.* 2001).

2 We acknowledge that the geometric nature of these spatial units, in all likelihood, is not reflective of the "real" use of space. Also, we are aware that clusters of small rockshelters may have been used contemporaneously by non-kin related families forming "camps" (e.g. Gregg 1980, p. 130; cfr. Binford 1991a, 1991b; Gould,Yellen 1991; Whitelaw 1991). Aggregation of families relying on the protection offered by rockshelters may be reflected in the spatial structure of remains at a scale differing from that explored here. The purpose of the methodology used in this paper is one of assessing spatial efficiency, all other variables held constant.

3 Since this field work was conducted (2001) several rock shelter sites have been investigated in the PCMS. For example, investigations at thirteen sites with nineteen rock-shelters in the Pinon Canyon Maneuver Site by New Mexico State University reveal a co-occurrence of rock art and evidence of grinding or milling at 38% of these sites (Owens, Loendorf 2005). Available descriptions preclude any attempt to differentiate observations at all nineteen shelters however.

reconstructive models of prehistoric activities, making no pretense of understanding the behavioral dynamics reflected in the palimpsest of material residue (cfr. KOHLER 2000; MCGLADE 2003).

Although difficult to delineate, some variance in morphology of the rock-art in the Purgatoire Valley is assigned to different groups and time periods (LOENDORF 1989, 2008; LOENDORF, KUEHN 1991; REED, HORN 1995; ZIER, KALASZ 1999; WINTCHER 2004, 2005). It can be argued also that this riverine landscape varies from the adjacent tablelands, not only topographically, but arguably in "place-use" and "place-occupation" history (WANDSNIDER 1998).

Does the extent or duration of occupation in the study area account for the higher density of rock-art relative to the tablelands to the north? What accounts for the greater frequency of rock-art and grinding or milling remains in proximity to rockshelters in Picket Wire relative to rockshelter sites on the PCMS?

In the twelve polygons where rock-art and evidence of grinding or milling are observed to co-exist visual assessment suggests that rock-art is often positioned somewhere near the boundaries of the spatial unit, irrespective of other rock art locations within the space. Where these spatial units are examined as a whole and including the most extreme distribution in polygon #4 at 5LA5838, rock-art lies at a median maximum distance from rock-shelters (15m) that is greater than that of grinding or milling evidence (11.50m). Does an extended stay and investment in a place foster proprietary behavior manifested in rock-art symbols and their location? Does the distribution of rock-art panels in the vicinity of a rock-shelter vary with respect to the remains of activities in this space? Does the content of rock art panels vary relative to their positioning in this space?

Procedures by which to minimize the "noise" that is inherent to patterning in the archeological record at these localities is, we believe, to be found in investigations of spatial variation at scales that are smaller than what is often deemed an archeological site. Patterning or the absence of spatial association at various scales may solicit new questions about the dynamics that produced the observations, but that in itself is of value (BINFORD 1992, pp. 51-52)[4]. Visualization of multivariate spatial data, while fostering assumptions and interpretations, requires quantitative methods by which to reliably assess social learning and information exchange (FOTHERINGHAM 1997, 1999). It is exploring the dynamics of such interaction that underlies much of social science, but as anthropologist John Hartung so aptly reminds us with regard to interpreting such relationships, "in science we are wrong until you prove you might not be" (ALCOCK 1989, p. 13).

	n (%)	χ^2	Cramer's V	Russel/Rao[5]
ROCKSHEL				
GROUNDSTONE	11 (78.6)	2.62	.124	.064
ROCKART	1 (7.1)	.108	.025	.006
ARCHITECTURE	-	-	-	-
ROCKWARC				
GROUNDSTONE	17 (73.9)	8.77	.226	.099
ROCKART	5 (21.7)	14.47	.291	.029
ARCHITECTURE	4 (17.4)	.248	.038	.023

Table 1 - Associations with unmodified and modified rockshelters.

	Coefficient	T-ratio	p	Odds Ratio
ROCKSHEL				
GROUNDSTONE	2.80	5.44	0	16.5
ROCKART	25.78	.022	.987	-
GROUNDSTONE AND ARCHITECTURE	12.819	.015	.988	-
ROCKWARC				
GROUNDSTONE	1.749	5.322	0	5.75
ROCKART	-0.784	-0.499	0.618	.457
GROUNDSTONE AND ARCHITECTURE	-1.499	-1.36	0.174	.223

Table 2 - Logit analysis of rock art and groundstone at PCMS rockshelters.

4 Hispanic ranching and settlement in the study are during the 19th century may contribute to any "noise" in presumed patterning of activities by indigenous groups (REED, HORN 1995, pp. 122-139; CHURCH 2002). Cultural remains at site 5LA5844 are especially vulnerable to being a locale where rock-shelters, bedrock metates, groundstone, and rock-art were used or altered.

5 This similarity measure as a coefficient of resemblance indicates the properties of sites exhibiting this characteristic at modified and unmodified rockshelters. Similarity scores offer some indication of association, whereas Cramer's V offers a measure (0-1) of the proportion of maximum variation due to interaction between the variables. This level of analysis minimizes assumptions inherent in the data (see SNEATH, SOKAL 1973, pp. 129-137; SPAULDING 1982; LIEBETRAU 1983).

Site	Polygons	Rock Art	Grinding/Milling	Architecture
5LA1023	14	6 (43%)	2 (14%)	6 (43%)
5LA5838	4	1 (25%)	4 (100%)	3 (75%)
5LA5841	21	10 (48%)	9 (43%)	11 (52%)
5LA5844	8	7 (88%)	6 (75%)	0
Total	47	24 (51%)	21 (45%)	20 (43%)

Table 3 - Content of spatial units (polygons).

Site	Rock Art and Groundstone	Rock Art and Architecture	Groundstone and Architecture
5LA1023	1 (7%)	4 (29%)	1 (7%)
5LA5838	1 (25%)	1 (25%)	1 (25%)
5LA5841	5 (24%)	5 (24%)	6 (29%)
5LA5844	5 (63%)	0	0
Total	12 (26%)	10 (21%)	8 (17%)

Table 4 - Co-occurrence of variables in spatial units (polygons).

Site		Rock Art	Grinding/milling	Architecture
5LA1023	mean	11.67	10.0	5.50
	sd	11.50	2.83	6.90
5LA5838 *	mean	62	19.0	33.67
	sd	-	32.90	28.30
5LA5841	mean	16.50	9.33	7.55
	sd	13.34	7.59	8.86
5LA5844	mean	15.86	13.33	0
	sd	11.91	8.90	

Table 5. Distance (meters) from rockshelters.
* Measures include maximum distance within the geometric boundaries of polygon number 4.

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Fig. 1 - Archeological Site locations in the Picket Wire Canyonlands, Purgatoire River, Comanche National Grasslands


Fig. 2 - Example of one of the many rockshelters found at sites along the river (Site 5LA5841) and a view of the Purgatoire River valley from the rockshelter.


Fig. 3 - Example of the many bedrock grinding surfaces documented (Site 5LA5844) and example of rock art in a small sheltered area with a nearby grinding surface (lower left of photo) (Site 5LA5841).

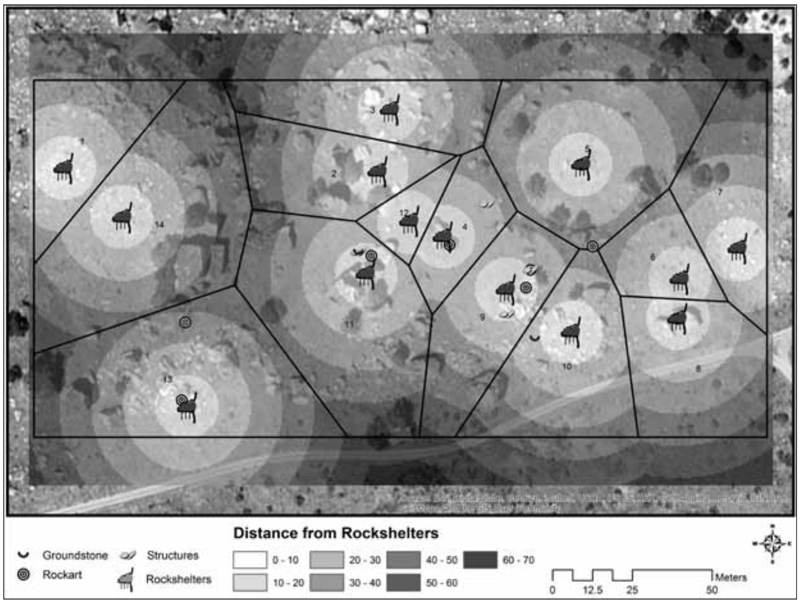

Fig. 4 - Thiessen polygons for rockshelters and the locations of associated features at site 5LA1023.

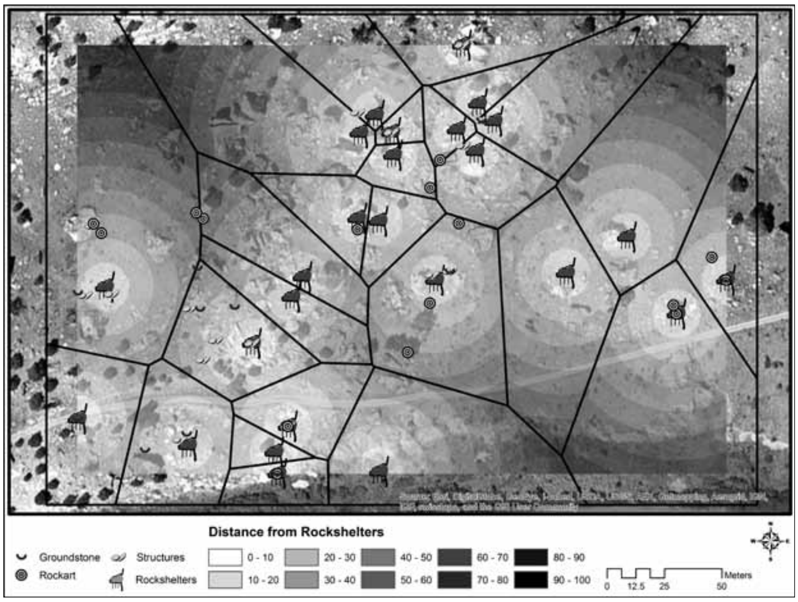

Fig. 5 - Thiessen polygons for rockshelters and the location of associated features at site 5LA5841.

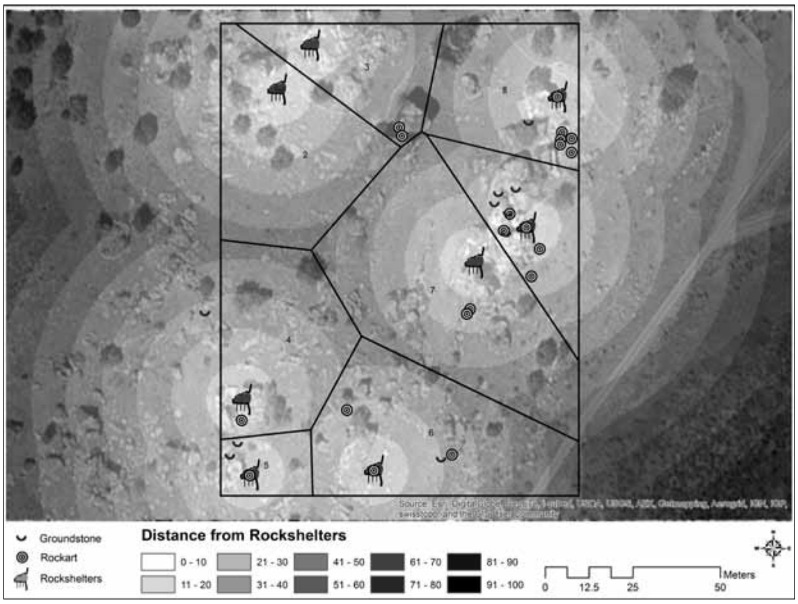

Fig. 6 - Thiessen polygons for rockshelters and the location of associated features at site 5LA5844.