A Statistical Analysis of Two Rock-Art Sites in Northwest Kenya

B. Mark Lynch; R. Donahue

Journal of Field Archaeology, Vol. 7, No. 1. (Spring, 1980), pp. 75-85.

Stable URL:
http://links.jstor.org/sici?sici=0093-4690%28198021%297%3A1%3C75%3AASAOTR%3E2.0.CO%3B2-T

Journal of Field Archaeology is currently published by Boston University.

A Statistical Analysis of Two Rock-Art Sites in Northwest Kenya

B. Mark Lynch
Southern Illinois University
Carbondale, Illinois

R. Donahue
Michigan State University
East Lansing, Michigan

The two Namoratunga cemetery and rock-art sites in NW Kenya were occupied by pastoralists by 335 B.C. The rock art consists of over 1000 occurrences of geometric art. Today many of these same geometric designs are used as lineage markers among related East African pastoralists. Using a variety of statistical techniques the art was analyzed for both inter- and intra-site variability. It was found that within the largest cemetery of 162 graves, graves sharing the same design tend to occur in the same area of the cemetery. It appears that different kin groups had their own burial areas in the cemetery. In addition, the two sites, separated by 1 km., differed in the designs they contained. The latter circumstance also seems to indicate that different kin groups were represented at the two sites.

Introduction

Africa contains vast quantities of rock art, some examples of which are as old as 27,000 years,[1] while other examples are as recent as late prehistoric and even historical times. Interpretations of African prehistoric art have largely been descriptive in nature and mainly concerned with problems of chronology and general ethnographic analogies. As far as we are aware there have been few interpretations based on systematic quantitative analysis of significant rock-art centers. In East Africa, in particular, analytical studies have been of a limited nature, especially for the geometric art that has been reported for a large number of sites in Uganda, Kenya, and Tanzania.[2]

The following analysis deals with the Namoratunga cemetery and rock-art sites of NW Kenya (FIG. 1). A radiocarbon sample dating human bone from one of the Namoratunga burials yielded a date of 335 B.C. The fact that the people who were responsible for these sites were at least partially pastoralists is attested to by the large numbers of domestic cow and sheep/goat tooth fragments found in the Namoratunga graves. As such the Namoratunga sites are extremely important in understanding the nature of pastoralism in East Africa. Based on present evidence it seems likely that pastoralists first entered East Africa at least by the 2nd millennium B.C., probably from the western Ethiopian Highlands and the adjacent portion of the Sudan.[3] Minimum dates based on C-14 analysis for the expansion of these early pastoral societies into East Africa are 1445 B.C. at Lukenya Hill, 1050 B.C. in the Serengeti, and 750 B.C. in the Fort Ternan area. All of these areas are considerably south of the Lake Turkana area, clearly indicating that pastoralists were in the area of the Namoratunga sites by at least the 2nd millennium B.C. By 335 B.C. pastoral societies in East Africa were already well differentiated with specialized economic and ecological adaptations. In the Lake Turkana area, for example, both Cushitic and Nilotic communities were present with competition between these groups prob-

1. E. W. Wendt, "'Art Mobilier' from the Apollo II Cave, Southwest Africa, Africa's Oldest Dated Works of Art," *South African Archaeological Bulletin* 31 (1976) 5-11.

2. R. M. Gramly, "Meat Feasting Sites and Cattle Brands: Patterns of Rock Shelter Utilization," *Azania* 10 (1975) 107-122; O. Odak, "Report on the Prehistoric Art Project of the National Museum of Kenya," *Nyame Akuma* 9 (1976) 6-10.

3. C. Ehret, *Southern Nilotic History: Linguistic Approaches to the Study of the Past* (Evansville: Northwestern University Press 1971) 35.

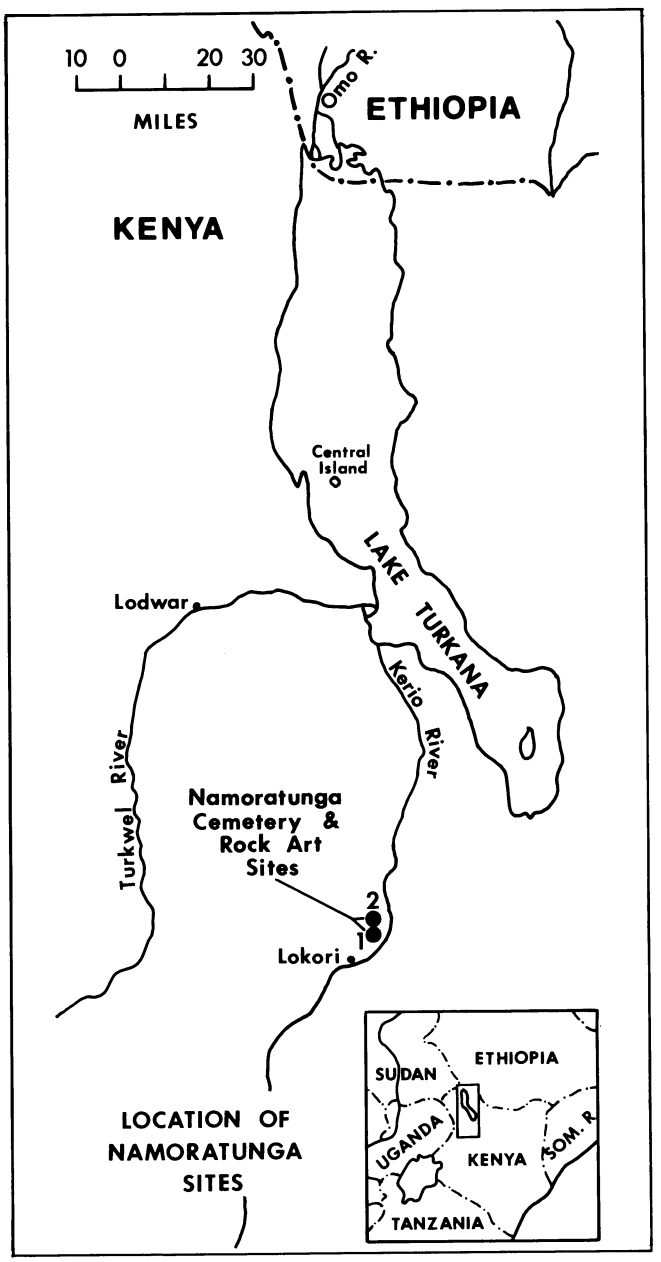


Figure 1. Map showing distribution of Namoratunga sites in NW Kenya.

ably being quite high.[4] The Namoratunga sites on the basis of similar grave construction and mortuary routine, are closely related to sites of present day Eastern Cushitic-speaking peoples.[5]

4. D. W. Phillipson, *The Later Prehistory of Eastern and Southern Africa* (London: Heinemann Books Ltd. 1977) 70-85; C. Ehret, *Ethiopians and East Africans: the Problem of Contacts* (Nairobi: East African Publishing House 1974) 39-59.

5. B. M. Lynch, "The Namoratunga Cemetery and Rock Art Sites of N.W. Kenya: a Study of Pastoralist Social Organization," unpublished Ph.D. dissertation (Michigan State University 1978) 222-223.

The Namoratunga sites provide a unique set of circumstances not found at other rock-art sites in East Africa. In addition to providing a very large sample of rock art, over 1,000 examples, the sites mark one of the few instances where the meaning of these geometric forms can be inferred. These sites also represent one of the only instances where the art can be linked to an excavated pastoralist cemetery.

Each of the two Namoratunga sites consists of a cemetery and an associated rock-art center. These sites, which occur in relative isolation, are located on two small volcanic outcrops (FIG. 2) separated by ca. 1 km. and are west of the Kerio River, one of the main tributaries of Lake Turkana.

Analysis

All of the art at the two sites occurs in the form of petroglyphs and was found on the smooth rock faces of the volcanic outcrops as well as on many of the large standing stone slabs that formed the periphery of the graves in the two cemeteries (FIG. 3). A total of 173 graves were recorded for the two sites, 162 at one and 11 at the other. Thirty-eight of these had decorated slabs, some with as many as 11 petroglyphs. In all, more than 1,000 different engravings were found at these two sites representing 142 distinct geometric designs (TABLE 1). The designs consisted largely of circle, spiral and line motifs; four examples of naturalistic art, however, did occur: two giraffe figures and two figures which resembled single-hump camels.

The petroglyphs were formed by taking a hard, pointed rock and pecking through the relatively soft exterior "skin" of the basalt slabs to the lighter colored interior. This art ranged from examples that were well patinated and with desert polish, i.e., gloss produced by wind and sand, to instances where the art looked very "fresh". Because of this wide range in the relative amounts of weathering, we have assigned the art to three broad categories. These groupings provide a relative chronology for the art. The first group consists of all examples that appeared to be "fresh". These designs were much lighter in color than the weathered rock surface they were pecked through and were not patinated (FIG. 4). The second category contained rock art that displayed some patination. This category was darker in color than Category 1 but still lighter than the parent rock surface. This group exhibited no desert polish (FIG. 5). The third category of art was heavily patinated and had desert polish (FIG. 6). In fact, many of the designs in Category 3 were nearly obscured. These examples, for all intents and purposes, displayed the same color, patination, and desert polish as the original rock

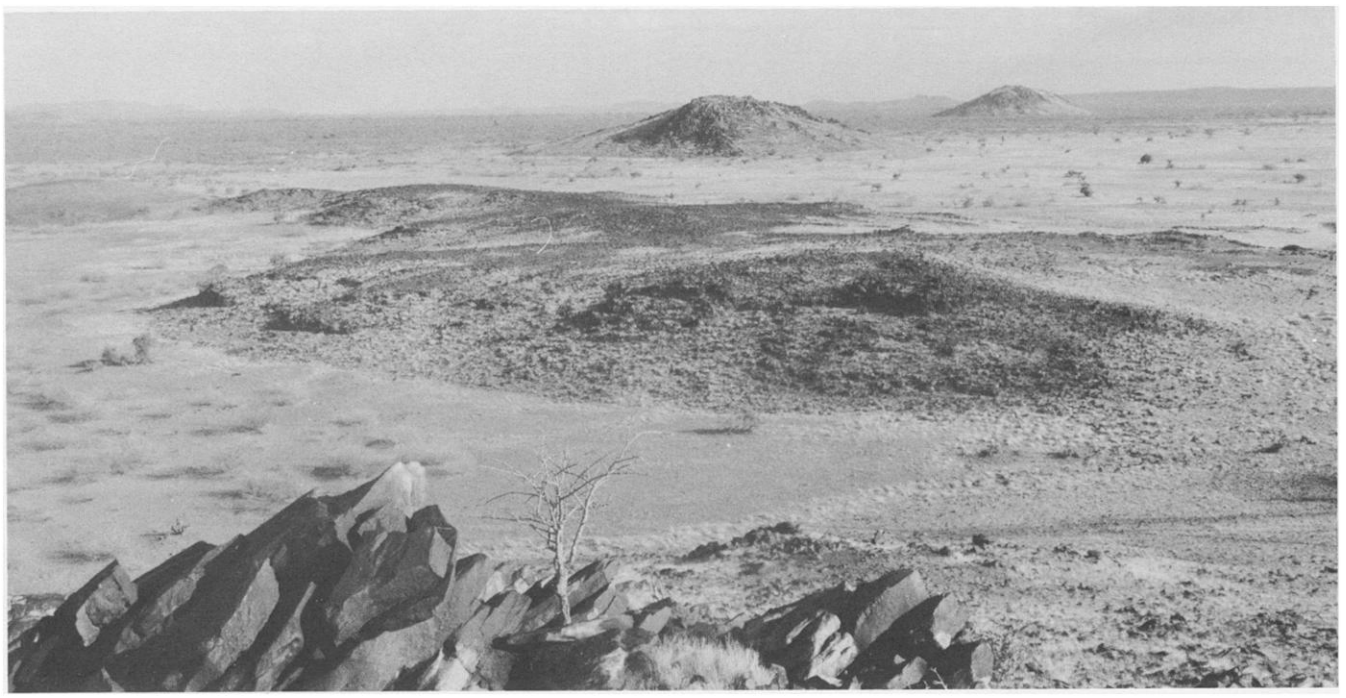


Figure 2. View of volcanic outcrop containing Namoratunga 1 Cemetery.

Figure 3. Stone grave at Namoratunga 1 Cemetery.

Table 1. Key to designs.

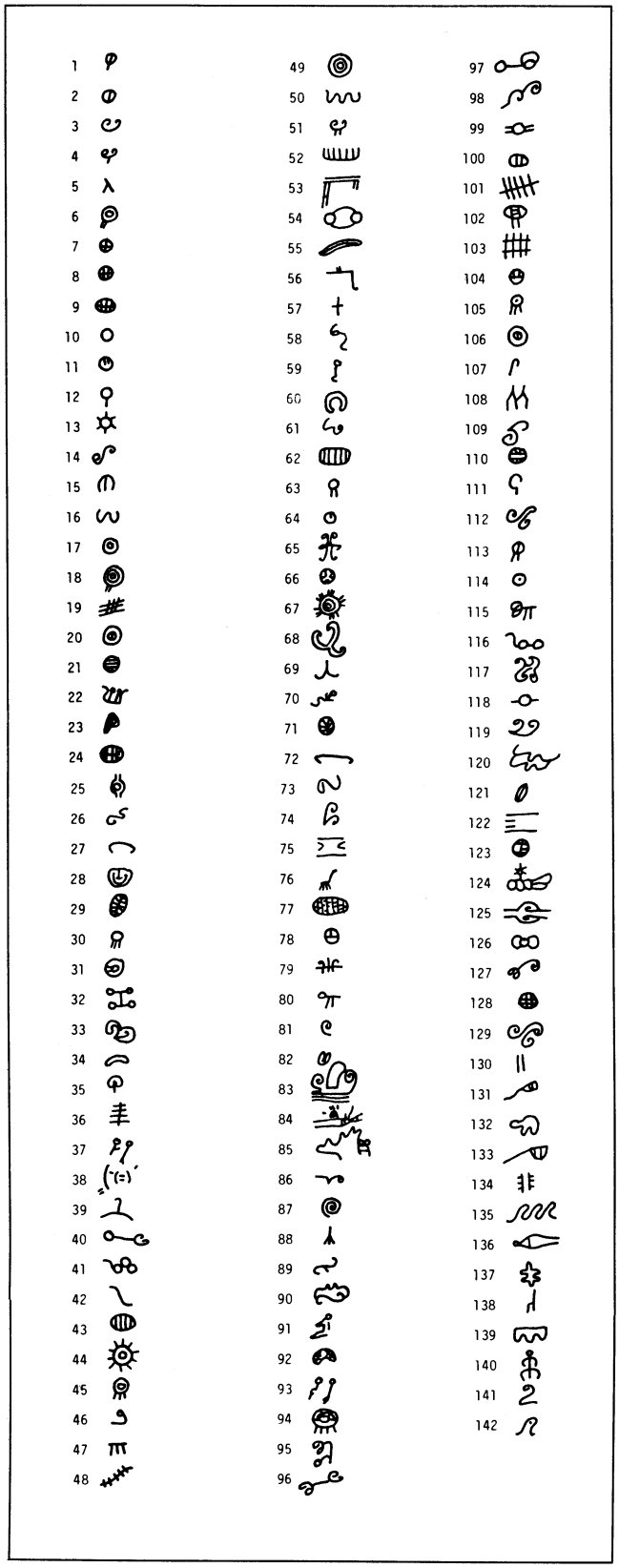


Figure 4. Example of rock art displaying almost no patination.

Figure 5. Example of rock art displaying moderate patination.

Figure 6. Example of rock art displaying heavy patination.

surfaces through which they were engraved (FIGS. 5-6).

The differences among the three categories is subjective, since only one individual categorized the art (BML); it is felt, however, that the groups are at least internally consistent and, as such, are of value. Viewing these groups chronologically, Category 1 would be the youngest with Category 3 the oldest. The possibility that these three different categories reflect the fact that certain engraved rock surfaces were simply more exposed to the elements than other surfaces is not likely. In many cases all three stages of weathering were found on the same rock surface. In addition, well patinated engravings were often found in areas protected from the wind whereas "fresher" engravings could be found on more exposed surfaces. There was no correlation between weathering and an engraving's height above ground.

Despite the fact that many of the engravings looked quite fresh, the Turkana, a nomadic herding people who now inhabit the area, claim that they were not responsible for the art. Tribal elders said that the art and the accompanying cemeteries predate their arrival in the area. The Turkana probably entered the area around 1600 A.C.[6] Indeed, the Turkana mortuary routine bears no resemblance to that found at the Namoratunga sites. Interestingly, despite the fact that the art and graves are clearly unrelated to the Turkana, they were able to recognize 99 out of 142 different geometric designs at the Namoratunga sites. These designs were used by the Turkana as marks of ownership and were branded on their livestock. A male inherited his brand symbol from his father, hence these symbols serve to delineate Turkana patrilineages.[7] The Pokot, Samburu, and Masai,[8] also East African herding peoples, used these brand symbols in much the same way.[9]

The designs at the Namoratunga sites may have been used in the same way to delineate kin groups. As mentioned previously, 38 of the graves were decorated. Males, females, and children were interred at the two sites; only males, however, were interred in decorated graves. Approximately 25% of all of the decorated graves were randomly selected for excavation.[10] Eight of the nine graves excavated contained males; one skeleton could not be definitely sexed because of poor preservation. Hence, much like the Turkana, the Namoratunga designs appear to be associated only with males.

If it is assumed that the designs were used in much the same way at the Namoratunga sites and on Turkana livestock, it becomes possible to use the art as a key to interpreting the social organization reflected by the Namoratunga sites. First, in the cemetery areas themselves a pattern appears when the distribution of decorated graves is examined. Graves sharing similar designs tend to occur in the same area of the cemetery. Although this pattern could not be measured statistically, 19 of 21 different design motifs found on the graves in the larger cemetery occurred in localized areas. There was no correlation between grave size and the design(s) on the associated stone slabs. Given present day uses of these designs one might hypothesize individual kin groups' having their own burial precinct within the cemetery. Unfortunately, because of poor skeletal preservation it was impossible to test this proposition using osteological data, either metric or non-metric.

But even more compelling patterns emerge when the two sites are compared. Geographical constraints do not account for the disparity in the numbers of graves (162 and 11) at the two sites, since either of the two volcanic outcrops, which are quite near each other, could easily have accommodated all 173 graves. The distribution thus appears to be culturally determined. If different subgroups within the larger social unit used the two cemetery areas one might hypothesize that the two sites would differ in the designs they contain. The designs might thus be used as a rough measure of social distance: the greater the difference in the designs at the two sites, the greater the social distance between the people responsible for the two sites.

The first stage in the analysis was to determine if the two sites differed significantly in the designs they contained. To facilitate this a model was formulated to calculate the probability of all of each design occurring at one site only. The Independent Binomial Probability Distribution was used. It can most simply be expressed by the formula

$$P = .5^{n-1}$$

where P = probability of success
n = number of trials or sample size

So, for example, for Design 1, which occurred 3 times at Site 1 and 3 times at Site 2 in the heavily weathered

6. G. Were and D. Wilson, *East Africa Through a Thousand Years* (Nairobi: Evans Brothers 1972) 67.

7. P. H. Gulliver, *The Family Herds* (London: Routledge and Kegan Paul Ltd. 1955) 76-106.

8. M. Merker, *Die Masai* (Berlin: Dietrich Reimer 1910) 167.

9. B. M. Lynch and L. H. Robbins, "Animal Brands and the Interpretation of Rock Art in East Africa," *CurAnth* 18 (1977) 538-539.

10. Excavations were conducted for one year (1975-1976) by B. M. Lynch and L. H. Robbins to study the later prehistory of the West Lake Turkana Basin. The project was sponsored by Michigan State University with funding from the National Science Foundation. A complete report on the excavations is in press (Michigan State University Museum Anthropological Series).

category, we would have $.5^{n-1}$ or $.5^{6-1} = .0125$. This procedure is followed for each different kind of design in each of the three weathering categories. These probabilities are in turn summed for each category of weathering and divided by the number of designs. This procedure gives the average or expected probability of finding all of each design at only one site. The final formula is:

$$P = \frac{\Sigma\, 0.5^{n-1}}{I}$$

Where I = the total number of designs observed in each weathering category.

Probabilities for finding all of each design at one site are as follows.

Heavily weathered: 42.45034814/72 = .590
Moderately weathered: 39.40930224/62 = .636
Lightly weathered: 21.18543457/32 = .662
Total (all designs): 74.7684491/113 = .662

The χ^2 technique was used to test if the expected differed significantly from the actual counts of designs at the two sites (TABLE 2).

In the Heavily Weathered category 72 of the 142 different kinds of geometric designs were represented. Twenty-seven of these 72 occurred at both sites while 45 occurred at only one of the two sites. For the Heavily Weathered category, the difference between the two sites was not found to be significant at the .05 level.

For the Moderately Weathered category, the null hypothesis of "no difference" is rejected. The two sites are significantly different in the designs they contain. As was the case for the Moderately Weathered examples, the null hypothesis of "no difference between the two sites" is rejected for the Lightly Weathered category. The two sites differ significantly (.05 level).

When all the designs are examined, however, regardless of weathering category, the two sites are not found to differ significantly (TABLE 3).

Through time the two sites become increasingly differentiated in terms of their designs. Given the initial assumption that differences in rock art indicate social differences, it would appear that initially the two sites were quite similar in the social groups they represented. Through time, however, this social distance increased. Hence, the initial hypothesis that the difference between the two sites is culturally determined appears to be validated with different kin groups within the larger social unit utilizing the two cemeteries for the Moderate and Light Weathering categories.

The two sites were next compared to see if there were differences in the relative frequencies of the designs that the sites had in common. To facilitate this the relative chronology for the art described previously was once again utilized. For each of the three categories of weathering, termed Heavy, Moderate and Light, a Pearson Product-Moment Correlation[11] was performed between the two sites; e.g., Heavily weathered examples at Site 1 were compared with Heavily weathered examples from Site 2, as were Moderately and Lightly weathered examples (see Tables 4-5). Because of the

Table 2. Results of Chi-square analysis of expected and actual design frequencies in three categories at both sites.

	Heavily Weathered one site only	both sites	N
observed count	45	27	72
expected count	N (.590) 42.48	N (1−.590) 29.52	
χ^2 = .3646			
df = 1 at .05 = 3.841			
	Moderately Weathered one site only	both sites	N
observed count	49	13	62
expected count	N (.636) 39.432	N (1−.636) 22.568	
df = 1 at .05 = 3.841	χ^2 = 6.378		
	Lightly Weathered one site only	both sites	N
observed count	27	5	32
expected count	N (.662) 21.184	N (1−.662) 10.816	
df = 1 at .05 = 3.841	χ^2 = 4.72		

Table 3. Results of Chi-square analysis of total design frequencies (expected and actual) at both sites.

	one site only	both sites	N
observed count	81	32	113
expected count	N (.662) 74.806	N (1−.662) 38.194	
df = 1 at .05 = 3.841	χ^2 = 1.517		

11. J. Freund, *Modern Elementary Statistics* (Edgewood Cliffs, N.J.: Prentice-Hall 1967) 335.

Table 4. Distribution of designs and weathering categories at Site 1, excluding those found on individual graves.

	West				South				East				North			
Design #	Total	H	M	L	Total	H	M	L	Total	H	M	L	Total	H	M	L
10	9	1	2	6	1	0	0	1	22	15	5	2	4	0	3	1
63	0	0	0	0	2	0	0	2	3	3	0	0	0	0	0	0
2	1	0	1	0	1	0	1	0	3	3	0	0	2	1	1	0
20	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
17	2	0	1	1	1	0	0	1	7	3	0	4	1	1	0	0
87	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	0
14	0	0	0	0	1	0	0	1	20	19	0	1	0	0	0	0
11	0	0	0	0	0	0	0	0	6	6	0	0	1	1	0	0
3	1	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0
9	0	0	0	0	0	0	0	0	3	1	2	0	2	0	1	1
21	0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	0
78	2	0	2	0	0	0	0	0	3	3	0	0	1	0	1	0
83	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	0
114	1	0	0	1	0	0	0	0	3	2	1	0	0	0	0	0
4	10	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
48	11	1	5	5	0	0	0	0	2	2	0	0	0	0	0	0
22	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
1	2	1	0	1	0	0	0	0	2	2	0	0	0	0	0	0
15	1	0	0	1	0	0	0	0	1	1	0	0	0	0	0	0
36	10	1	4	5	0	0	0	0	0	0	0	0	0	0	0	0
23	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
7	1	0	1	0	0	0	0	0	2	1	1	0	0	0	0	0
102	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
50	1	1	0	0	0	0	0	0	4	4	0	0	0	0	0	0
43	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0
57	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
53	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
38	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
84	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
62	1	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
8	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0
49	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
79	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	10	6	4	0	0	0	0	0
47	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
34	0	0	0	0	0	0	0	0	9	8	1	0	0	0	0	0
35	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
80	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
37	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
30	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
82	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
42	0	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0
59	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
81	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
5	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
18	0	0	0	0	0	0	0	0	1	0	0	1	0	0	0	0
64	0	0	0	0	0	0	0	0	4	4	0	0	0	0	0	0
99	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
60	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0
58	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0
19	0	0	0	0	0	0	0	0	1	1	0	0	0	0	0	0

Table 5. Distribution of designs and weathering categories at Site 2, excluding those found on individual graves.

	West				South				Northeast			
Design #	Total	H	M	L	Total	H	M	L	Total	H	M	L
17	1	1	0	0	9	4	5	0	16	8	3	2
7	2	2	0	0	3	1	1	1	13	5	5	3
10	1	0	1	0	9	2	3	4	105	59	46	0
114	1	0	1	0	5	4	0	2	9	2	5	2
3	0	0	0	0	5	5	4	2	73	61	22	0
49	0	0	0	0	5	3	1	1	4	2	2	0
99	0	0	0	0	1	1	0	0	0	0	0	0
42	0	0	0	0	2	1	1	0	12	6	6	0
2	0	0	0	0	9	6	2	1	35	10	22	3
8	0	0	0	0	2	1	0	1	8	1	4	3
9	0	0	0	0	2	1	0	1	2	0	2	0
47	0	0	0	0	1	0	0	1	0	0	0	0
72	0	0	0	0	1	0	0	1	4	1	2	1
87	0	0	0	0	2	0	2	0	11	1	10	0
43	0	0	0	0	2	1	0	1	5	1	4	0
81	0	0	0	0	3	0	2	1	0	0	0	0
14	0	0	0	0	7	1	5	1	3	0	3	0
19	0	0	0	0	2	0	2	0	1	1	0	0
119	0	0	0	0	1	0	0	1	0	0	0	0
16	0	0	0	0	2	2	0	0	2	1	1	0
73	0	0	0	0	1	0	1	0	0	0	0	0
15	0	0	0	0	7	3	3	1	3	1	1	1
120	0	0	0	0	1	0	1	0	0	0	0	0
64	0	0	0	0	2	0	2	0	3	1	2	0
121	0	0	0	0	2	0	2	0	0	0	0	0
74	0	0	0	0	1	0	1	0	0	0	0	0
129	0	0	0	0	1	0	1	0	0	0	0	0
88	0	0	0	0	0	0	0	0	1	1	0	0
52	0	0	0	0	0	0	0	0	1	1	0	0
26	0	0	0	0	0	0	0	0	1	1	0	0
11	0	0	0	0	0	0	0	0	1	0	1	0
28	0	0	0	0	0	0	0	0	4	1	3	0
108	0	0	0	0	0	0	0	0	1	0	1	0
31	0	0	0	0	0	0	0	0	1	0	1	0
29	0	0	0	0	0	0	0	0	1	0	1	0
33	0	0	0	0	0	0	0	0	1	0	1	0
74	0	0	0	0	0	0	0	0	1	0	1	0
89	0	0	0	0	0	0	0	0	1	0	1	0
65	0	0	0	0	0	0	0	0	1	0	1	0
69	0	0	0	0	0	0	0	0	2	0	2	0
55	0	0	0	0	0	0	0	0	1	0	1	0
91	0	0	0	0	0	0	0	0	1	0	1	0
66	0	0	0	0	0	0	0	0	1	0	1	0
110	0	0	0	0	0	0	0	0	1	1	0	0
84	0	0	0	0	0	0	0	0	1	1	0	0
93	0	0	0	0	0	0	0	0	1	0	1	0
18	0	0	0	0	0	0	0	0	2	0	0	2
95	0	0	0	0	0	0	0	0	1	1	0	0
77	0	0	0	0	0	0	0	0	1	1	0	0
126	0	0	0	0	0	0	0	0	1	0	1	0
100	0	0	0	0	0	0	0	0	9	8	1	0
68	0	0	0	0	0	0	0	0	1	0	1	0
96	0	0	0	0	0	0	0	0	2	0	1	1

Table 5.—*Continued.*

	West				South				Northeast			
Design #	Total	H	M	L	Total	H	M	L	Total	H	M	L
97	0	0	0	0	0	0	0	0	1	0	1	0
30	0	0	0	0	1	1	0	0	0	0	0	0
122	0	0	0	0	1	1	0	0	0	0	0	0
46	0	0	0	0	1	1	0	0	9	5	4	0
123	0	0	0	0	1	1	0	0	0	0	0	0
4	0	0	0	0	3	2	0	1	49	27	22	0
1	0	0	0	0	1	1	0	0	2	2	0	0
67	0	0	0	0	1	1	0	0	1	1	0	0
75	0	0	0	0	1	1	0	0	0	0	0	0
125	0	0	0	0	1	1	0	0	1	0	1	0
44	0	0	0	0	1	1	0	0	0	0	0	0
78	0	0	0	0	1	1	0	0	1	0	1	0
76	0	0	0	0	1	1	0	0	0	0	0	0
27	0	0	0	0	1	1	0	0	0	0	0	0
124	0	0	0	0	1	0	1	0	0	0	0	0
50	0	0	0	0	0	0	0	0	13	6	7	0
63	0	0	0	0	0	0	0	0	13	3	9	1
54	0	0	0	0	0	0	0	0	1	1	0	0
86	0	0	0	0	0	0	0	0	1	1	0	0
56	0	0	0	0	0	0	0	0	1	1	0	0
13	0	0	0	0	0	0	0	0	3	2	0	1
23	0	0	0	0	0	0	0	0	1	0	1	0
85	0	0	0	0	0	0	0	0	1	0	1	0
130	0	0	0	0	0	0	0	0	1	1	0	0
12	0	0	0	0	0	0	0	0	19	11	4	4
48	0	0	0	0	0	0	0	0	1	1	0	0
105	0	0	0	0	0	0	0	0	2	2	0	0
25	0	0	0	0	0	0	0	0	4	1	2	1

close proximity between the two sites (1 km.), it was hypothesized that there would be a high correlation between the two sites through time in terms of the relative frequencies of shared designs at both sites. The resulting correlation coefficients were .800, .605, and .052 for the Heavy, Moderate, and Light categories respectively, with a value of 1 being a perfect correlation between the designs at the two sites. For example, for the Heavy category design 10 (see Table 1) is the most common design at both Site 1 and 2 and occurs at the two sites in the same relative percentage. This correlation also occurs for the Moderate category but does not occur for the Light designs. This circumstance indicates that in terms of the frequency of occurrence of designs there is a progressive weakening in the relationship between the two sites through time.

To test the correlations derived from the Pearson Product-Moment Correlation for the Heavy and Moderate categories the Paired Differences technique for testing the difference in the two means was performed.[12] Both Heavy and Moderate categories showed significant differences (99th percentile level) with Site 2 having consistently larger frequencies of individual designs.

It should be noted, however, that the Pearson Product-Moment Correlations for Sites 1 and 2 disappear for the Heavy and Moderate categories if the five most common designs at the two sites are removed from the analysis (see TABLES 4-5). The five designs — 10, 12, 17, 3, 4 (see TABLE 1) — are among the least elaborate found at the two sites. In addition, Merker noted that all five of these designs were used by the Masai simply as adornment on a favorite animal and did not represent particular lineages.[13] As such the correlations in frequencies between the two sites may not be mean-

12. Ibid. 255.

13. Merker, op. cit. (in note 8) 167.

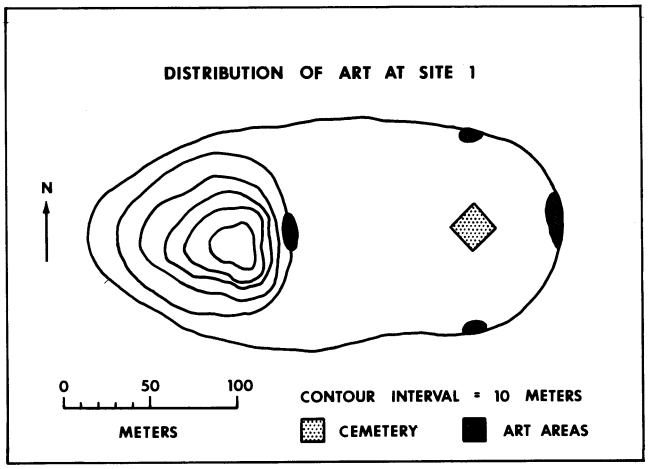
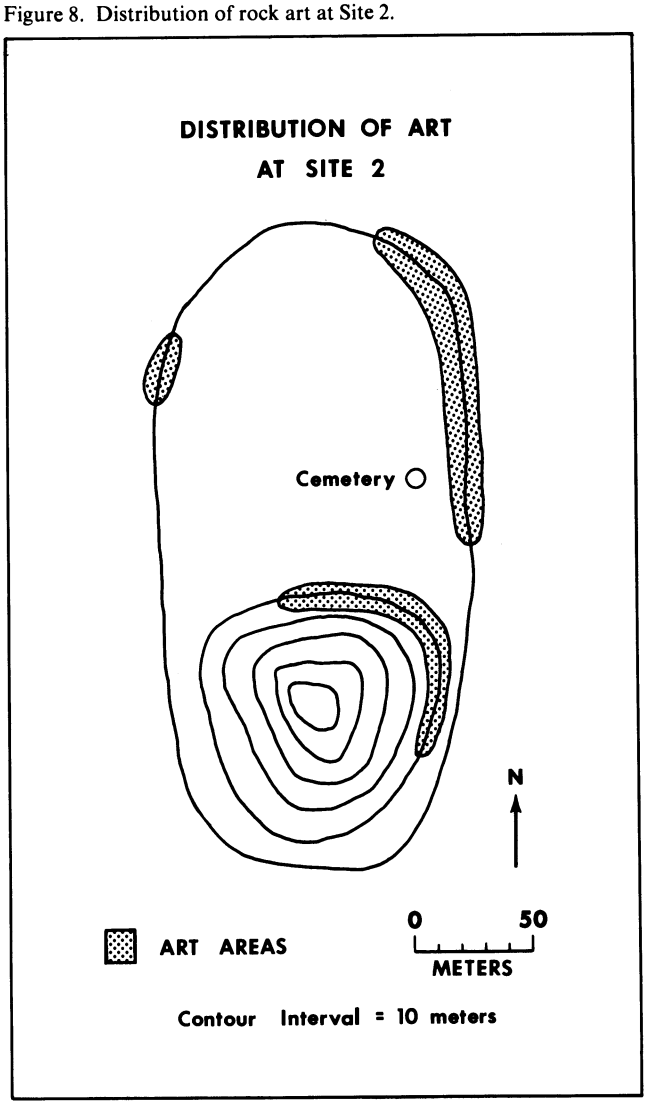


Figure 7. Distribution of rock art at Site 1.

Figure 8. Distribution of rock art at Site 2.



ingful and may simply reflect a certain amount of noise inherent in the use of these designs.

Finally, the two sites were examined for intra-site variability. At Site 1 the art on rock outcrops appeared in four distinct locations, to the north, south, east, and west of the cemetery (FIG. 7 and TABLE 4). No art was found in the intervening spaces despite the fact that suitable smooth rock surfaces were present. This distribution was particularly interesting since the cemetery was aligned with the four cardinal directions. In addition, burials within this cemetery were also oriented toward one of the four cardinal directions, usually with less than a 10-degree error. An individual's burial orientation depended upon his location within the cemetery. For example, an individual in the NE quadrant of the cemetery would be oriented cranially-caudally either N-S or E-W with the skull towards the north or east, respectively. An individual in the SE portion of the site would be oriented either S-N or E-W. This pattern, where burials were oriented away from the center of the site, was found to be significant at the .05 level. The art on the outcrop and the cemetery both appear to be organized in terms of the four cardinal directions.

The four areas with art were compared to see if there were significant differences among the designs in each area. A simple Chi-square test was performed on the data. This indicated that the four areas differed from each other significantly (at 99th percentile) in the designs they contain. Tracing this pattern temporally is more difficult; in many cases the designs remain spatially segregated through time. In other instances, however, a design appears in only one area and only during a single time period. Once again, time here is measured in a relative sense using the broad weathering categories discussed earlier.

At Site 2 two of the 11 graves were decorated each with a different symbol, designs 17 and 12 (see TABLE 1). In addition to these designs, designs also occurred on the outcrop where the cemetery was located. At Site 2 the art on the outcrop occurs in three distinct geographical areas, to the south of the cemetery, to the west, and to the NE (FIG. 8 and TABLE 5). These three areas are separated by areas containing no art even though there were rock surfaces which could have been engraved. Here, unlike Site 1, certain designs were not found to occur only in certain areas of the outcrop. All but five of the designs were found in both the south and NE areas. This lack of patterning may reflect the lack of spatial organization of the Site 2 cemetery. Here, unlike the cemetery at Site 1, the Site 2 cemetery was not spatially organized in any particular manner. The cemetery at Site 2, however, was extremely small (11 graves). The burials at Site 2 were oriented the same as Site 1, in

one of the four cardinal directions, indicating a shared mortuary routine with Site 1.

The art was also examined to determine if any patterns could be found in which designs occurred on individual rock surfaces. A single large rock surface, for example, could contain as many as 17 different designs. To facilitate this 50% of all the engraved rock surfaces at Site 1 were examined. Only Heavily Weathered engravings were utilized. A simple pattern matrix revealed that the art was apparently haphazardly placed on particular rock surfaces. It appears that spatial considerations for the designs are important only in terms of what area of the site the art is located in and not in terms of what particular designs are engraved on the same rock surface.

Conclusion

In summary, both inter- and intra-site variability was found in the art. First, there was a significant difference in the art found at the two sites for two of the three weathering categories. It appears that different subgroups within the larger social unit as represented by these symbols are to be found at the two sites. Through time the art at both sites becomes more divergent, perhaps indicative of increasing social distance between the two sites. Secondly, at least for Site 1, there was intrasite variability. The art on the outcrop itself occurred in four distinct areas and these four areas differed significantly in the art they contained. This pattern parallels the organizational principles of the Site 1 cemetery itself. The cemetery and the burials within it were aligned in the four cardinal directions with a burial's orientation dependent upon that individual's location within the cemetery. Hence, four rough burial precincts exist within the cemetery in terms of burial orientation and location, which conform to the four cardinal directions. The art on the outcrop itself occurred to the north, south, east, and west of this cemetery. One might suggest that each burial precinct has an accompanying art area. At Site 2 similar intrasite variability was not found, probably because of the less organized nature of that site's cemetery.

It is in no way intended, however, that the model presented is the only way of interpreting the patterning found in the Namoratunga rock art. It is only one model that appears to fit the data. It should be noted that designs similar to those found at the Namoratunga sites are used ethnographically in a number of ways that can easily distort any underlying regularities found in the patterning of the art. Among the Masai, to cite but one example, these symbols are used to brand livestock, as added decoration on a favorite animal, and as shield and body decorations to signify membership in age grades and clans.

Clearly the Namoratunga rock-art and cemetery sites provide a unique set of circumstances for the study of pastoral rock art in East Africa. Here, with the aid of ethnographic data, it was possible tentatively to interpret the geometric rock art and to use the rock art to test hypotheses concerning the Namoratunga social organization. It is suggested that different kin groups were represented at the two sites, possibly different patrilineages. Hence, for the Namoratunga sites the art proved to be what was clearly an important key to understanding the Namoratunga mortuary routine. As such, the Namoratunga sites may have far ranging implications not only for the study of rock art but for the study of pastoral society in East Africa.

B. Mark Lynch is an archaeologist for the Center for Archaeological Investigations and an adjunct Assistant Professor with the Department of Anthropology at Southern Illinois University. His major interests are in using mortuary practices and rock art to understand prehistoric culture change in Africa, particularly those associated with the introduction of food production.

R. Donahue is working on his Ph.D. in anthropology at Michigan State University. His primary interests are in the application of statistical techniques to archaeological data.