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THE BISCUIT HILL STONE CIRCLES: 5WL1298

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ABSTRACT

Stone circles are universal features on the central and northern portions of the High Plains. In Colorado, these features are found singly and clustered in groups numbering into the hundreds. Despite their ubiquity, few of the circles have been reported in the professional literature on the Colorado Plains archaeology. Therefore, the Fort Collins Chapter of the Colorado Archaeological Society undertook an intensive recording project of one of these circle clusters, the Biscuit Hill Site (5WL1298). At least 65 circle features were noted at the Biscuit Hill Site. The circles ranged in size from 4 to 12 m in diameter, and were, in general, larger than circles at other sites on the High Plains. Other than the existence of one nineteenth-century glass bead, no definitive evidence for the age of the Biscuit Hill Site are available.

INTRODUCTION

The round circle of stones we see were put up on the bottom edge of their tents to prevent the winds blowing them down (Fidler 1793, in Johnson 1967:258).

The stone circles near Biscuit Hill are the largest aggregate of well-preserved stone circles yet described in northeast Colorado and the southern reaches of the High Plains (Morris et al. 1983). Survey and study of the site was initiated in 1987 by the Fort Collins Chapter of the Colorado Archaeological Society under the direction of Edward D. Day. The goal of the project was to permanently record this cultural resource, to contribute information about stone circles sites, and to provide a basis for further study

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in the area. The investigation included recording and mapping the stones forming each circle and associated features on the site, constructing a composite map of all the circles and features, and analysis of the observations made.

The approach to the site was predicated on the assumption that the circles of stone represent the remains of Plains Indian activity, and even though stones were arranged in circles for other purposes (e.g., religious), we believe that most of the circles at Biscuit Hill functioned to hold down domestic tipi covers. Ethnographic and historic information has, for many years, indicated that stones were used in the construction of Plains Indian tipis. Grinnell (1892:198), for example, noted that “. . . stones were used to hold down the edges of the lodge to keep it from being blown away.” The terms “stone circles,” “tipi rings,” and “lodges” are often used interchangeably to refer to the rock remains used in this way. None of the rings at Biscuit Hill contained enough stones to represent more than one single, discontinuous course of rocks.

SITE DESCRIPTION

The Biscuit Hill Site (5WL1298) is located in northwest Weld County, in a broad, relatively flat basin near the headwaters of Lone Tree Creek, at an elevation of 1800 m. Lone Tree Creek, 500 m west of the site, originates in the Cheyenne Ridge approximately 8 km to the north. Lone Tree Creek is an intermittent stream that today has little to no surface water running in it. The drainage meanders to the south and eventually enters the South Platte River near Greeley, Colorado. The Lone Tree Creek drainage was surely a focal point of nomadic Plains people for considerable time because the Lindenmeier site, which dates to around 11,000 BC, is located within 20 km of Biscuit Hill (Wilmsen 1974). Three other recorded stone circle sites in Lone Tree Creek drainage are located within 5 km of Biscuit Hill: 5WL270 with 18 rings, 5WL271 with 5 rings, and 5WL272 with 5 rings (Flayharty and Morris 1974; Colorado State Historical Society Site Files).

Today the basin offers productive grazing for domestic cattle and a large number of antelope. The site was once included within the vast Warren Land and Livestock holdings. The present owners of the site have recently reintroduced bison to the area as a commercial venture.

Biscuit Hill derives its name from a prominent oblong sandstone remnant that rises 23 m above a bench on which the site is located (Figure 1). Biscuit Hill is the conventional name for this hill, but it is also referred to as Buffalo Hill by some local residents. The level bench, which extends south from Biscuit Hill approximately 200 m, was formed by Lone Tree Creek when it flowed in a now abandoned meander to the east of the site. It cut the west flank of the shallow valley (east edge of site) to a depth of about 5 m. Today, only winter runoff puddles at various spots within this abandoned meander, with pools persisting as late as July or August. Rock outcroppings appear about 250 m to the east of the site and may have provided opportunities for observing animals, ambushing or traps. The soils are shallow, sandy

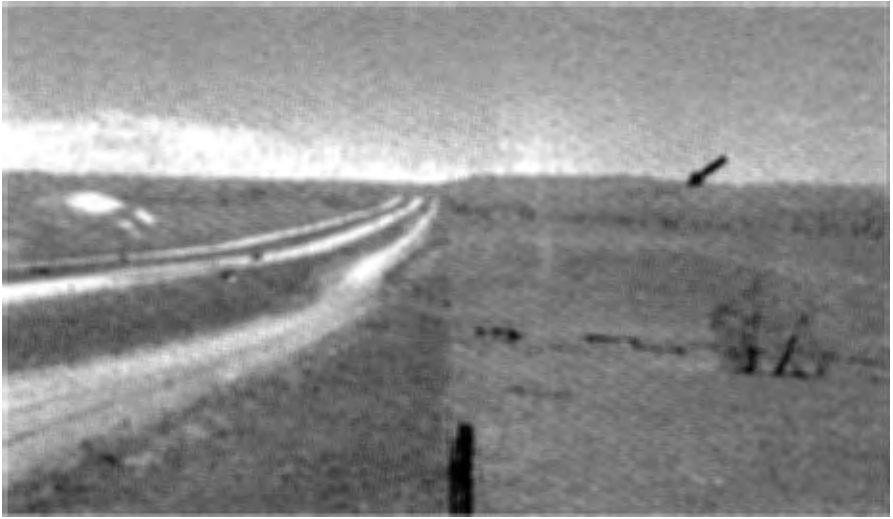


FIGURE 1. View of Biscuit Hill and surrounding area looking north. The site is located at the base of Biscuit Hill, which is indicated by the arrow. The photo is taken from a frontage road fence. The light-dark contrast that runs vertically through the photograph reflects vegetational differences resulting from differential grazing practices on either side of the fence.

to gravelly, over a base of river cobbles. A group of columnar sandstone formations called the Natural Fort is located northwest of Biscuit Hill. This formation is bisected by I-25, but portions of it remain on each side of the highway and are now used as rest stops for motorists. For years, lithic tools and projectile points have been removed from the Natural Fort by artifact collectors. Local legend holds that the Warren Livestock Co. once offered 10 cents for each lithic artifact that its employees turned in. The response was overwhelming and the offer was soon withdrawn.

SPECULATION ON SITE SELECTION

Many teepee rings are along valleys but in the early days they did not camp in valleys but on flats in high places but they often had to carry water a long way (Stands in Timber 1967:123).

The choice of a camp site and organization of a camp were matters vital to meeting the Plains Indians' subsistence needs. Experienced, successful tribal members provided guidance in camp location and organization. Surely, the proximity to game and plant foods, good visibility, availability of fuel, defensibility, and sanitation were all carefully considered before establishing a camp. The Biscuit Hill Site appears to have satisfied these needs. Although bison and other game were probably attracted to Lone Tree Creek while Indians were camped at the site, these animals probably would not have congregated in the basin. The camp would have been used as a base from which these animals could have been hunted through more widespread foraging. Besides availability of water, the loca-

tion would have been attractive for other reasons. The Lone Tree Creek basin often remains free of snow throughout the winter, and visibility from the top of Biscuit Hill is 40 to 50 km in all directions. Undoubtedly, prevailing winds from the west and northwest vented their dwellings, carrying away smoke and helping to minimize flying insects.

INVENTORY OF SITE FEATURES

One hundred stone features were identified at 5WL1298 (Figure 2), but only 78 clearly show a circular pattern and are considered the stone circle population of the site. Of the remaining features, 13 are judged to be individual hearths or hearth groups, three are probably stone circles but are poorly defined, one is a large pile of small heat fractured cobble stones, and five are unidentified features.

A number of the stone circles on the site have closely associated artificial mounds (Figure 2) that now stand about 25 to 70 cm high. While these low mounds were not carefully recorded or assigned feature numbers, the diameters of most ranged from 1 to 3 m. The mounds associated with Stone Circles 31 and 36 completely fill these circles. They could be backdirt piles from pothunting activity, even though no obvious pothole depressions were found associated with the piles. The mounds remind other archaeologists who have visited the site of abandoned prairie dog mounds. It is also possible that they could be features constructed during the original occupation(s) of the site. After visiting a large Cheyenne encampment, Alexander Henry (1897:382) writes, "Beside each large tent is a smaller one . . . which appears to be used for cooking, preparation of meat, dressing leather, etc." This type of activity could have easily produced the mound-circle associations and the large circle-small circle associations (small rings 31, 35, 36, and 37).

INVENTORY OF SURFACE ARTIFACTS

Fourteen flakes were found in and around the stone circles. In addition, one heavily reworked projectile point, one end scraper, and one glass bead were found on the surface. The opaque, aqua blue (Munsell = 5B 6/6) glass bead is a type commonly called a seed bead. Its outside diameter ranges between 2.3 and 2.5 mm, its length is 1.4 mm, and it has a hole diameter of about 1 mm. This bead conforms to the IIa37 type in the Kidd and Kidd (1970) classification system. The bead was found in Circle Feature 100, a large (8.92 m diameter), but incomplete rock circle.

The projectile point remnant (Figure 3) was made from greyish-green, fine-grained quartzite. Tool material similar to this can be obtained in outcroppings of the Morrison Formation. The nearest of such outcroppings can be found about 32 km west of Biscuit Hill on the Roberts Ranch, but the Morrison Formation outcrops all along the Front Range in Colorado and Wyoming. The material is identical to what informally has been called Roberts Ranch Quartzite (E.A. Morris, personal communication 1996). About 80 to 90 percent of the toolstone material at sites excavated by the CSU Field School in the 1970s and 1980s on the Roberts Ranch is made

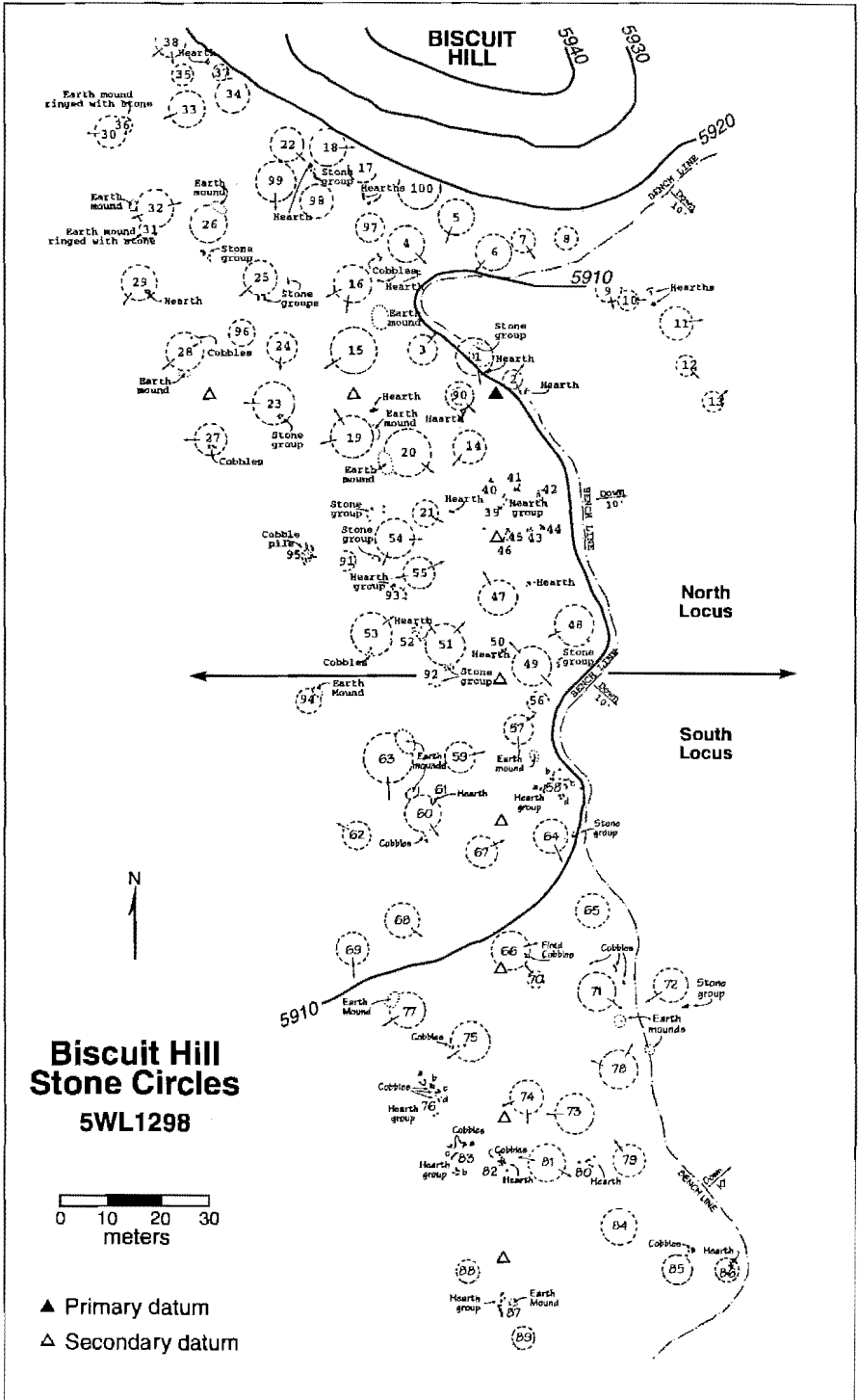


FIGURE 2. Map of Biscuit Hill Stone Circle Site feature locations.

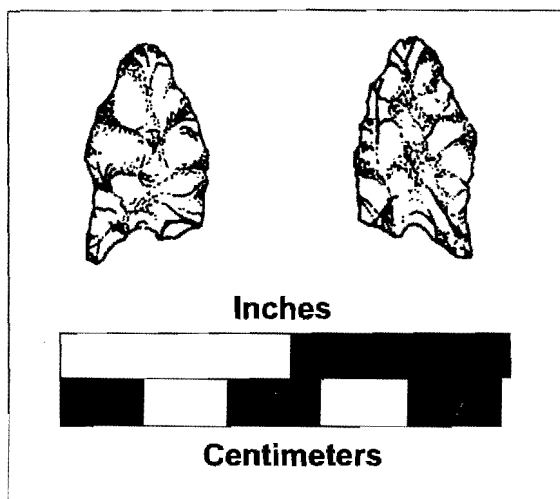


FIGURE 3. Illustration of a heavily reworked projectile point, recovered from the surface of the Biscuit Hill Stone Circle Site.

from this material. The tip appears to have been so heavily reworked that its final use could have been as a drill. The piece now measures 2.51 cm by 1.45 cm by 0.53 cm. The hafting area has a shallow concavity on one side and a basal indentation.

Based on the presence of a high percentage of cortex, nine of the flakes were probably primary or secondary decortication flakes, while seven others were removed in biface thinning or tool retouch. One of the flakes and the end scraper were found in Feature 29.

ANALYSIS OF THE STONE CIRCLES

Recording the Site Features

A primary datum point is located 30 m due south of the southern edge of Biscuit Hill and close to the east edge of the bench. Six secondary datums are located at 30 meter intervals due south of the primary datum, and three secondary data are located due west of the primary datum, again at 30 meter intervals. All data are marked by 1.3 cm by 40 cm iron pins driven into the ground. The center of each feature was located by reference to at least two datum points.

The method of Smith (1974) was adapted to map each feature. Polar coordinate graph paper was taped to a 0.8-cm thick by 30-cm square piece of smooth fiberboard with 0.6 cm holes drilled through each corner and one hole in the center of the board. The board was placed at the approximate center of each stone circle and oriented in a north-south direction, correcting for the local magnetic declination of 13.5° E. Nails were driven through the corner holes to hold the board in place. A nail through the center of the graph paper and through the center hole on the board, extended slightly above the board to allow a string line and tape measure to be fastened to it. The string line and measuring tape were stretched from the

center point, aligned with the north axis of the graph paper, and extended to a point one meter outside the approximate circumference of the stone circle. A nail on the circumference end held the string line taut. The string was rotated in a clockwise direction starting from the north, centered on each stone as it was encountered. The distance to the center of each stone was measured and recorded. The stone was then drawn to scale on the graph paper at the observed distance and bearing.

The stones were recorded consecutively as they were encountered. Every fifth stone was pried loose and carefully lifted from its bed. Its approximate cubic dimensions were recorded, the depth to the deepest point in the stone's bed was measured from the current soil surface, and the stone was replaced. All rocks in each circle were recorded in this way (Tables 1 and 2). For several of the analyses it was convenient and informative to divide the stone circles into octant observations. An octant consists of 45° of arc centered on each cardinal and semi-cardinal direction.

Spatial Distribution

The site map, Figure 2, provides a plan view of the site and aids in recognition of the spatial patterns and camp organization that is not obvious on the ground. Of particular interest is the noticeable decrease in ring density in the southern portion of the site. The average distance (measured from center to center) between nearest neighboring ring in the North Locus (N = 41) is 11.4 m and 14.6 m (N = 24) in the South Locus. In addition, the embedded depth of stones forming the circles averages less than 10 cm in the Northern Locus but averages greater than 10 cm in the Southern Locus (Table 2). Given that this north-south distinction might have some interpretive value, the site was arbitrarily divided into North (N=41 circles) and South (N=24 circles) loci (Figures 4 and 5).

Evidence for Multiple Occupations?

In terms of spatial patterning, there is no positive evidence of multiple occupations. None of the circles overlap, and only Stone Circles 6 and 7 are tangential. Except for the circles at the base of Biscuit Hill, none have large sections of their circumferences robbed of stones as might happen during reoccupation. None of the stone gaps, which could indicate entrance locations (see discussion below), from immediately adjacent circles face each other. Thus, neither overlaps nor robbery nor gaps provide evidence that these circles could not have been conveniently occupied at the same time, nor does the spatial distribution of rings of different sizes suggest multiple occupation. As discussed below, it has been suggested that on the Great Plains larger tipis appeared late in Plains prehistory/history with the arrival of horses. While not subjecting these data to rigorous spatial analysis, it is our impression that the large and small circles are pretty thoroughly mixed up and show no subgrouping, as if two, slightly separated (spatially and temporally) camps had been occupied.

TABLE 1. Observations on Stone Circle Features in the North Locus.

Circle ID Number	Diameter (m)	Avg. Rock Depth (cm) ^a	North	NE	East	SE	South	SW	West	NW	Total Rocks	Circumference (m)	Rocks per Meter ^b
1	7.82	10.97	9	4	5	4	1	6	8	10	47	24.57	1.91
2	4.02	5.99	5	1	2	2	3	4	7	5	29	12.63	2.30
3	6.35	9.98	9	1	4	7	4	5	5	2	37	19.95	1.85
4	7.01	10.51	9	9	0	4	7	4	12	10	55	22.02	2.50
5	7.28	9.32	1	2	1	7	3	6	6	6	32	22.87	1.40
7	4.65	11.10	5	7	5	1	5	10	4	3	40	14.61	2.74
11	6.97	11.68	10	10	1	3	7	7	5	8	51	21.90	2.33
12	4.82	10.46	5	6	1	1	3	3	1	2	22	15.14	1.45
13	4.37	10.67	3	0	1	0	6	4	2	2	18	13.73	1.31
14	7.14	8.03	9	6	9	8	4	2	5	5	48	22.43	2.14
15	9.81	9.91	11	10	13	15	9	8	9	13	88	30.82	2.86
16	7.80	9.52	13	7	8	8	7	9	8	11	71	24.50	2.90
18	7.62	7.87	9	1	0	6	8	9	8	9	50	23.94	2.09
19	8.67	5.64	6	0	0	2	9	12	7	3	39	27.24	1.43
20	10.08	9.93	6	5	3	6	3	0	2	4	29	31.67	0.92
21	5.27	6.07	4	2	3	1	4	7	6	3	30	16.56	1.81
22	7.08	9.19	8	2	6	11	16	9	6	5	63	22.24	2.83
23	8.68	5.92	19	13	18	21	12	13	12	14	122	27.27	4.47
24	6.27	7.24	5	10	7	7	4	10	12	12	67	19.70	3.40
25	7.22	5.92	16	15	17	19	19	12	13	14	125	22.68	5.51
26	8.03	9.04	10	4	15	15	21	10	13	11	99	25.23	3.92
27	6.63	8.94	7	9	5	3	7	8	7	7	53	20.83	2.54
28	7.97	6.22	18	14	15	9	1	4	10	9	80	25.04	3.20

29	7.36	9.12	9	10	13	6	8	9	7	10	72	23.12	3.11
30	6.47	7.62	10	0	1	9	4	4	5	7	40	20.33	1.97
32	7.92	8.79	13	16	8	13	2	1	6	10	69	24.88	2.77
33	7.72	9.85	20	14	10	7	6	2	4	2	65	24.25	2.68
34	7.4	10.16	2	4	4	3	5	14	1	4	37	23.25	1.59
35	4.51	5.92	7	9	5	2	3	2	2	3	33	14.17	2.33
47	8.63	7.70	5	4	5	3	4	4	9	3	37	27.11	1.36
48	8.66	11.99	8	8	10	10	8	5	5	9	63	27.21	2.32
49	7.95	10.16	5	5	1	0	7	4	9	2	33	24.98	1.32
51	7.89	12.06	6	5	6	4	11	10	6	5	53	24.79	2.14
53	8.55	10.24	4	0	6	6	9	2	2	3	32	26.86	1.19
54	8.16	6.68	16	11	9	8	8	11	13	16	92	25.64	3.59
55	6.82	8.56	10	0	2	8	11	6	12	12	61	21.43	2.85
90	5.53	9.45	12	3	5	5	18	13	10	6	72	17.37	4.14
96	5.04	7.16	10	5	5	4	6	6	10	4	50	15.83	3.16
97	6.06	7.57	9	12	9	12	7	13	15	9	86	19.04	4.52
98	6.91	8.79	15	12	6	19	8	12	12	8	92	21.71	4.24
99	8.46	8.84	13	14	20	14	7	12	24	12	116	26.58	4.36
North Total			371	270	264	293	295	292	320	293	2398		

^aAverage rock depth refers to the average depth of the rocks in a 20% sample of the rocks from each circle.

^bRocks per meter refers to the average number of rocks in each meter of circle circumference.

TABLE 2. Observations on Stone Circle Features in the South Locus.

Circle ID Number	Diameter (m)	Avg. Rock Depth (cm) ^a	North	NE	East	SE	South	SW	West	NW	Total Rocks	Circumference (m)	Rocks per Meter ^b
57	4.43	11.25	4	1	5	3	2	2	6	7	30	13.92	2.16
59	5.70	8.89	6	3	7	6	8	8	6	7	51	17.91	2.85
60	7.31	13.38	6	7	6	4	1	9	7	3	43	22.97	1.87
62	5.68	8.64	4	8	6	7	8	4	6	3	46	17.84	2.58
63	10.29	15.39	4	0	4	7	2	5	3	3	28	32.33	0.87
64	7.33	10.49	10	5	7	7	5	5	11	10	60	23.03	2.61
65	7.46	10.16	3	4	6	7	6	6	4	6	42	23.44	1.79
66	7.95	10.79	11	8	7	7	5	10	12	7	67	24.98	2.68
67	6.66	12.17	7	1	6	7	11	6	8	7	53	20.92	2.53
68	7.34	11.71	5	4	2	3	6	9	8	7	44	23.06	1.91
69	6.80	9.80	10	7	7	5	3	7	6	5	50	21.36	2.34
70	3.55	10.67	3	3	3	5	6	4	4	1	29	11.15	2.60
71	8.16	13.16	5	9	6	3	5	4	8	6	46	25.64	1.79
72	5.21	13.23	2	1	5	3	6	5	6	5	33	16.37	2.02
73	8.69	11.53	9	5	8	13	7	9	3	3	57	27.30	2.09
74	6.94	10.34	7	8	4	4	0	2	6	5	36	21.80	1.65
75	8.55	11.15	7	7	11	12	9	9	7	6	68	26.86	2.53
77	7.28	12.57	5	10	9	6	9	4	6	4	53	22.87	2.32
78	7.73	13.82	1	7	9	7	2	5	2	6	39	24.28	1.61
79	6.70	13.54	4	3	2	5	6	5	4	3	32	21.05	1.52
81	7.96	12.01	5	5	2	3	8	3	3	6	35	25.01	1.40
84	7.58	12.06	2	3	1	3	7	6	4	2	28	23.81	1.18
86	4.97	9.52	3	5	2	4	2	2	4	3	25	15.61	1.60
94	5.54	12.52	7	1	1	2	4	4	7	3	29	17.40	1.67
South Total			130	115	126	133	128	133	141	118	1024		
Site Total			501	385	390	426	423	425	461	411	3422		

^aAverage rock depth refers to the average depth of the rocks in a 20% sample of the rocks from each circle.

^bRocks per meter refers to the average number of rocks in each meter of circle circumference.

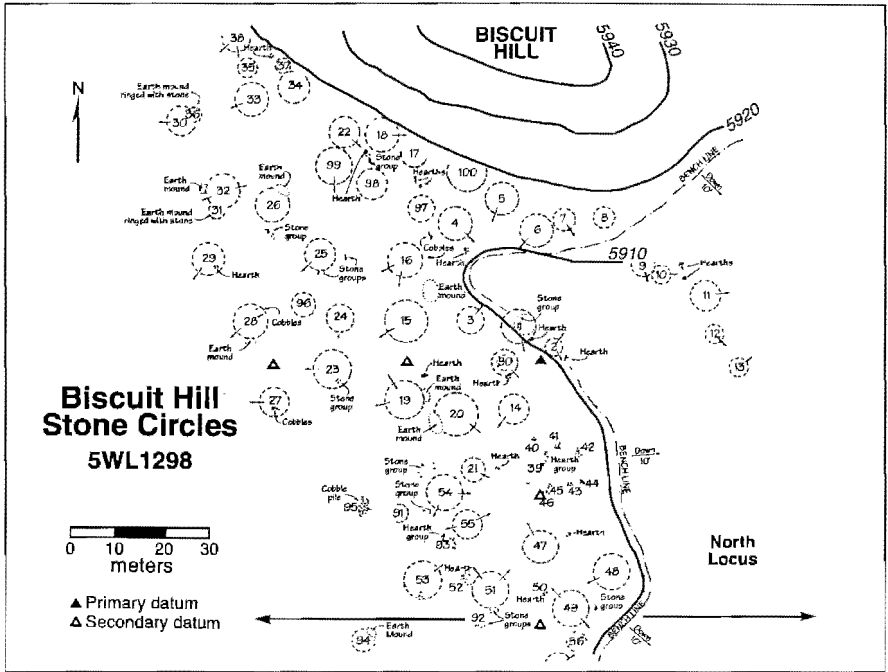


FIGURE 4. Details of feature locations in North Locus.

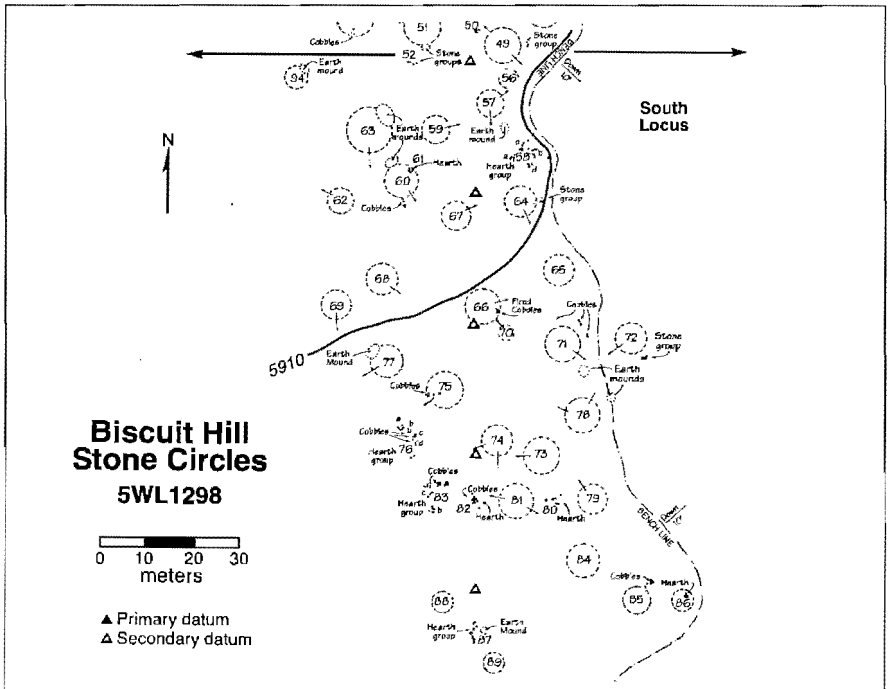


FIGURE 5. Details of feature locations in South Locus.

CIRCLE SIZE AND STONE GAPS

Stone Circle Size

Tables 1 and 2 summarize the diameters of the stone circles at Biscuit Hill. The diameter of each stone circle was determined from a calculated radius. The radius for a given stone circle is the average distance from the center of a circle to the center of each stone around the circumference of that circle. The diameters for each circle reported in Tables 1 and 2 are simple averages based on all observed stone-to-center distances. This value is different from many diameters reported in the stone circle literature. It is not an inside or an outside diameter; rather it is based on an average observed distance. The actual diameter of a circle when in use may have been somewhat less than the observed diameter because it is likely that the stones would have been displaced or physically moved outward when the structure was taken down. In our judgment, subtracting a meter from the reported diameters of Biscuit Hill circles will produce values close to the “inside” diameter values that are often used by other circle researchers.

Figure 6 presents the distributions of the circles by size and locus. Three observations on the spatial and size distributions of circle diameters are worth mentioning. First, there is no significant difference in the size distribution between the North and South Loci. North Locus circles have an average diameter of 7.11 m ($N = 41$; s.d. = 1.43 m), and South Locus circles have an average diameter of 6.91 m ($N = 24$; s.d. = 1.51 m).

Second, the range of circle diameters tends to be larger than is typical of other reported rock circle sites. The average of all calculated diameters on complete circles is 7.04 m ($N = 65$; s.d. = 1.45 m). While stone circle diameters are known to range up to 9 m, the typical range, 2 to 8 m, is smaller than that observed at Biscuit Hill where most diameters are between 4 and 9 m. Circles 15, 20, and 63 are larger than 9.5 m. The fact that many researchers report “inside” diameters might partly explain the larger diameters calculated for Biscuit Hill circles, but subtracting about a meter from the observed diameters to create an inside diameter still leaves a range and average diameter at Biscuit Hill that is somewhat larger than is typical of stone circle sites. The 13 incomplete, anomalous circles recorded at this site are smaller than are the complete circles ($\bar{X} = 5.57$ m; s.d. = 1.60 m). Combined, the complete and incomplete stone circles from Biscuit Hill still average a large 6.79 m.

Third, it is clear that several of the large stone circles are associated with the artificial mounds (Figures 4 and 5). If these are backdirt mounds from pothunting activity, and if the pothunters systematically moved the stones outward as they explored the center of some of the circles, then it is possible that some of the circles are larger than they were originally. Fourteen of the circles can be associated with one or more mounds (numbers 15, 19, 20, 26, 28, 30, 32, 57, 60, 63, 71, 77, 78, and 94). These circles average about 7.82 m in diameter, which is a full meter larger than the mean of the remaining rings (6.80 m).

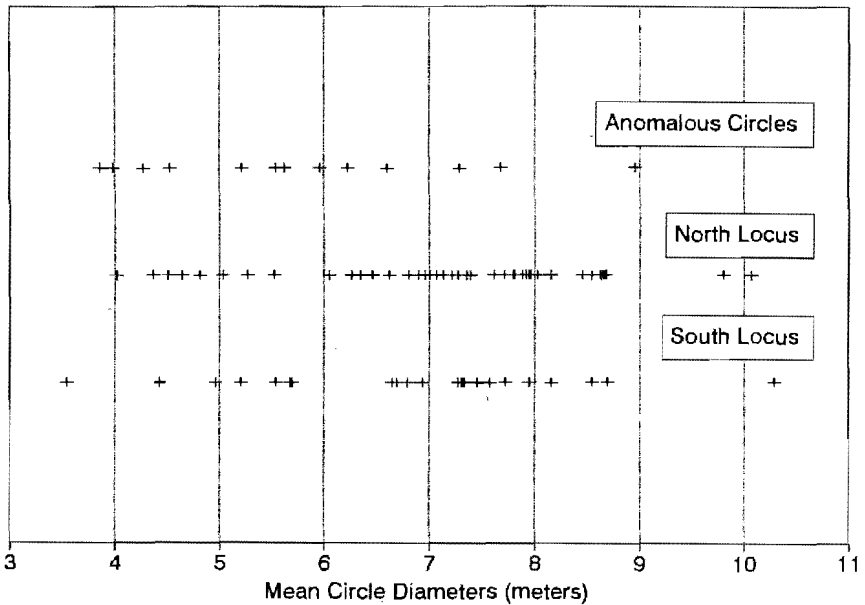


FIGURE 6. Distribution of Biscuit Hill circle diameters by locus and anomalous circles.

Thus, it is possible that the average circle diameter at Biscuit Hill is only 6.80 m or, roughly, 5.80 m “inside” diameter. However, it should also be emphasized that the large end of the range may not be due to pothunter disturbance because 1) no obvious evidence of pot holes could be found and 2) sites with large diameter ranges are not unknown for northern Colorado. Morris *et al.* (1983), for example, report a site, 5LR110, in nearby Larimer County, Colorado, with at least 12 large stone circles, 6 to 10 m in diameter.

Finally, we note that the average size of the Biscuit Hill stone circles is partially a function of several very large circles. Circles 15, 20, and 63 are larger than 9.5 m. Ethnographically, large tipis are often noted in Plains Indian camps. Dave Frenchman told T. Kehoe (1960:436) that there would sometimes be a large “chief” tipi in the middle of a camp circle. Council or society lodges were an important part of tribal gatherings. The Omaha had three sacred tents; the Cheyenne has two special tipis, one for the medicine arrows and the other for the sacred hat (Laubin and Laubin 1977:299). Stansbury (1849) refers to a Sioux “traders lodge,” 30 feet in diameter, using 24 poles and requiring 26 hides (Bushnell 1922:68). The extremely large circles at Biscuit Hill might reflect these special purpose tipis.

Further Observations on the Possible Cause of the Large Circle Size

It has been suggested that Plains Indian tipis increased in size (diameter) during the historic era (cf. Kehoe 1960; Quigg 1979). This suggestion

stems from the idea that mobility of the Plains Indian increased when they acquired horses and is supported by the testimony of several Plains Indian informants. The adjustment in mobility probably gained momentum about AD 1680 when many horses suddenly became available during the Spanish Revolt. The use of horses spread among the Plains tribes, reaching the northernmost tribes by AD 1770 (Haines 1938; Ewers 1955). George Bull Child, Blackfeet, recalled that:

The tipi was not very large before my people got the horse. A certain dog would carry the tipi skin alone. The lodge poles were smaller in those days so the dogs could pull them. A big cover would be ten skins, later on when my people got the horse, 18-20 skins was average. (Kehoe 1960: 434)

A horse could transport three to four times as much weight as could a dog. Kehoe (1960) notes that the introduction of the horse was followed by an increase in the size of the tipi from diameters of roughly 3 m in pre-horse days to 3 to 5 m after adoption of the horse. Canvas in large quantities was not available to the Plains tribes until about mid-nineteenth century, but this light weight, strong material allowed even larger lodges, some as large as 10 to 11 m in diameter (Laubin and Laubin 1977:216). Canvas became increasingly important, of course, with the decimation of the bison.

Gaps in Circle Circumferences

Significant gaps in the rings of stones were noted while recording the individual rock circles. These gaps are indicated on the site feature maps with arrows pointing through the circumferences. They are subjective identifications based largely on the relative paucity of rocks and a discontinuous distribution of rocks in the circumference. Some idea of this judgment can be obtained from Figure 7, which illustrates four examples of stone circle features mapped at Biscuit Hill. Gaps in the rock distributions can be observed, and our judgment about the location of gaps in these found features can be found in Figure 2.

It has often been observed (e.g., Brumley 1982; Davis 1982; Finnigan 1982; Quigg 1979) that circle circumferences have more rock in the direction of the prevailing wind, and several Biscuit Hill circles conform to this pattern. Two reasons are generally given for this preference. One is the need to seal the windward side of the tipi from the wind, and the other is to orient the door and smoke flaps leeward to better accomplish a good internal draft. For a good portion of the coldest part of the year the prevailing winds at Biscuit Hill are from the northwest. Accordingly, the number of stones is slightly higher in the northern octant than in any other octant (Table 2), and only one gap was noted in the northern octants of the Biscuit Hill circles (Table 3). It is possible that these gaps reflect doors situated away from the prevailing wind and/or the fact that the lee side of tipis may not have been as carefully secured as the windward side. However, octant rock volume estimates calculated from the 20 percent sample of rocks selected for detailed measurement do not indicate a greater volume of rocks in any par-

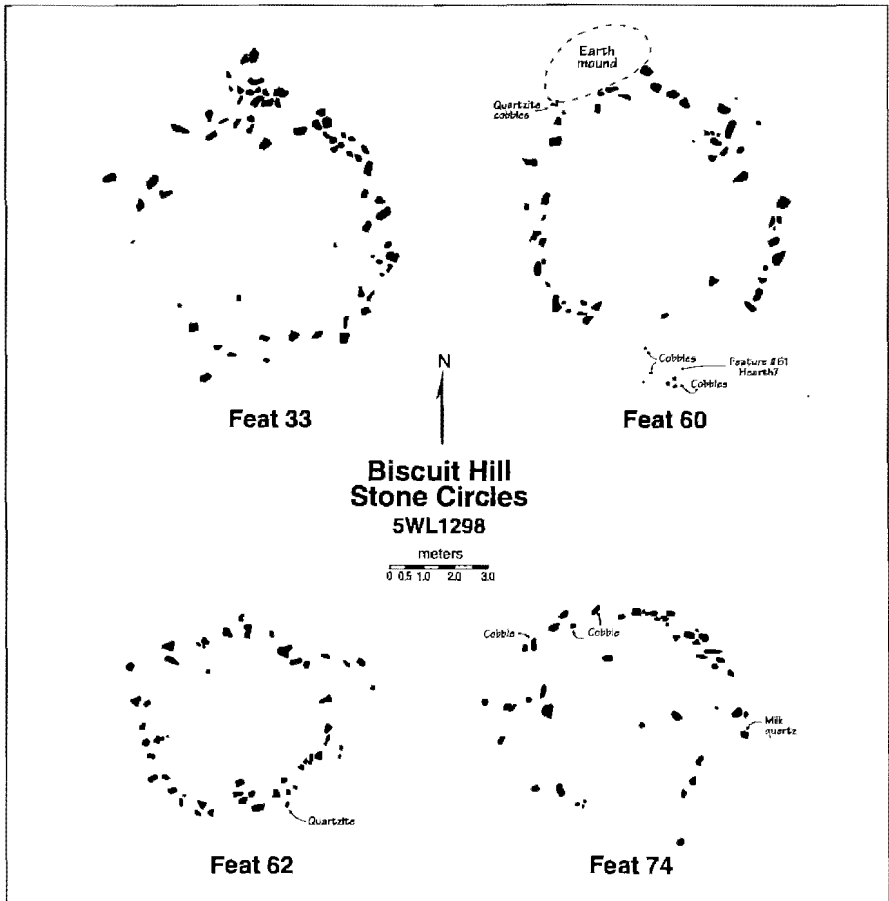


FIGURE 7. Examples of stone locations in four stone circles at Biscuit Hill.

ticular octant (Table 4). This fact could be due to sampling error or to the fact that what was needed to hold the tipis down was a fairly uniform volume or weight around the perimeter of the structure but also a larger number of rocks to securely seal the windward side.

ARRANGEMENT OF CIRCLES

Our tipis were round like the nests of birds and these were always set in a circle, a nest of many nests where the Great Spirit meant for us to raise our children (Black Elk, in Neihardt 1988:195)

According to some researchers (e.g., Reher 1983), the positioning of stone circles into subgroups is suggestive of intratribal or intraband social groupings where tipis were erected in a clustered fashion. This idea is supported by ethnographic accounts of highly structured camp arrangements. Grinnell (1923:89), for example, points out that at tribal gatherings the

TABLE 3. Observed Gaps in Each Octant of the Stone Circle Circumferences.

	North	Northeast	East	Southeast	South	Southwest	West	Northwest
North Locus Circles	0	9	4	7	4	7	7	3
South Locus Circles	1	3	3	3	5	5	3	2
Site Circles	1	12	7	10	9	12	10	5

TABLE 4. Calculated Volumes (cubic centimeters) in a 20 Percent Sample of the Rocks in Each Octant of the Stone Circles.

	North	Northeast	East	Southeast	South	Southwest	West	Northwest	Mean
North Locus Circles	4689	4697	4548	5538	4633	5420	5150	4791	4933
South Locus Circles	5900	6359	4704	6163	5900	8457	7752	4960	6277
Site Circles	5130	5310	4606	5769	5097	6540	6113	4851	5425

Cheyenne set up camp in a given order, the lodges of each group being placed close together.

Open space within clusters could be interpreted as a location where communal interests such as work or ceremony were focused. Certain activities, organized by these groups, might have been carried out in the common areas. A perusal of the Biscuit Hill site map reveals several open spaces that can be interpreted as possible communal areas, but none of these areas were archaeologically tested. We would like to take this idea one step further, however, by adding to it the idea of door gaps. Typically, rock gaps are interpreted as either door gaps or leeward gaps (see above discussion). If it is assumed that the gaps reflect door gaps and if the circle clusters and door gaps placements are due to social considerations, then door gaps were probably at least partially oriented toward the common area. Using these two criteria of 1) possible door gaps oriented toward 2) open spaces in the distribution of the circles, one can hypothesize the existence of three circle groups. Testing the reality of these hypothetical groupings will require additional investigations.

- Group 1. Hearth Features 39-46 are located in an open area surrounded by 13 stone circles consisting of Circles 1, 2, 14, 20, 21, 47-49, 51, 53-55, and 90. Most of these circles have stone gaps that face, in a general way, the open area.
- Group 2. Hearth Feature 58 is located in an open area surrounded by seven circles consisting of Circles 57, 59, 60, 62, 63, 64, and 67. Four of these circles have stone gaps that can be seen as oriented toward the open area.
- Group 3. Hearth Features 76, 80, 82, and 83 are located in an open area surrounded by 12 stone circles consisting of Circles 66, 68, 69, 71-75, 77-79, and 81. Well over half of these circles have stone gaps that orient toward the open area and its cluster of hearth features.

It is also noteworthy that two of the largest circles, Circle Features 20 and 63, are associated with Groups 1 and 2 respectively.

STONE EMBEDDEDNESS AND DISCUSSION OF POSSIBLE MULTIPLE OCCUPATIONS

The average depths reported in Table 2 for each of the 65 complete circles was derived from the 20 percent sample of the embedded stones (N = 697 stones) that were pried up and measured for depth from current ground surface. We were hoping that the distribution of the depth of embeddedness might provide clues to the age and number of occupations. The stones in North Locus circles are significantly less embedded ($\bar{X} = 8.8$ cm; s.d. = 1.8) than those in the South Locus ($\bar{X} = 11.62$ cm; s.d. = 1.67), suggesting that the North Locus may have been the site of a second, later occupation of the site. However, we are not completely convinced that the difference is due to two temporally separated occupations. In order to reach the two occupation conclusion, it will be necessary to exclude the possibility that the difference is due to geomorphological processes. As can be seen in Figure 8 and Table 2, deeply embedded stones tend to be at the base of Biscuit Hill

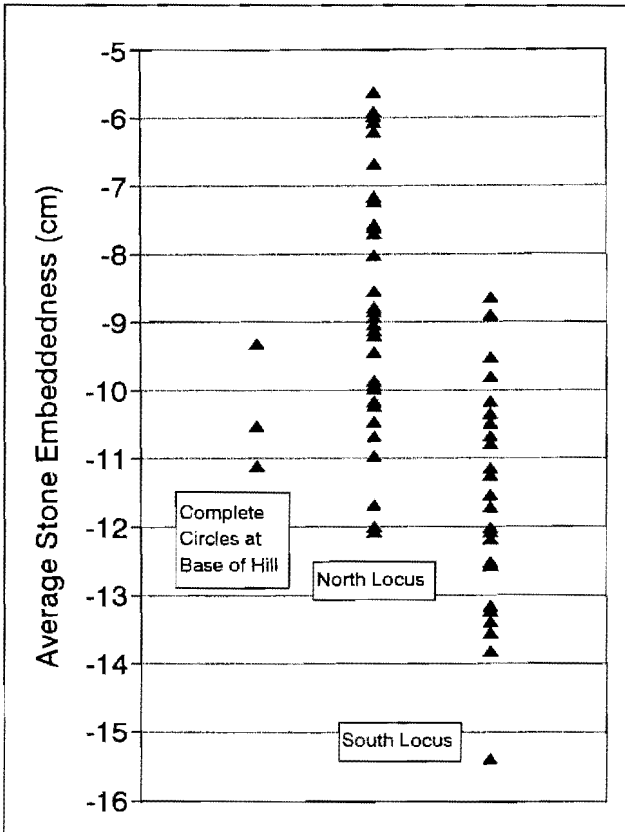


FIGURE 8. Distribution of average embedded stone depth for each complete circle for the North and South Loci and for the three complete circles (Features 4,5, and 7) at the base of Biscuit Hill.

and in the South Locus. We believe that slope wash off Biscuit Hill is probably covering the northernmost stones in the North Locus in a fan at the base of the hill. However, the circles in the lowest elevation and farthest from the base of Biscuit Hill (in the South Locus) are also deeply buried circles. We believe that it is possible that the stones forming the circles in the South Locus are covered with aeolian deposition, while those in the North Locus (excluding those in the fan at the base of Biscuit Hill) are less embedded because winds whipping around Biscuit Hill from the north could have scoured portions of the North Locus and deposited sediments further south in the South Locus. Thus, geomorphological processes could account for the distribution of deeply embedded stones. If this is the case, then two possibilities follow. First, all of the circles could be part of a single occupation, and, second, the low density of circles in the South Locus (noted above) could be due to the fact that some circles in that locus are completely covered. A thorough study by a geomorphologist should provide the data necessary to test these various hypotheses.

We investigated the relationship between embeddedness and circle diameter in order to address the possibility of a diameter-age relationship, but there is no strong relationship between the two variables. The North Locus circles with large diameters had stones that are slightly less embedded than are the stones in circles with smaller diameters. However, in general the relationship is so weak that drawing chronological conclusions from it is unwarranted.

AGE OF THE SITE

No chronometric data were available on the surface of 5WL1298. The only evidence for the possible age of the site is the single blue class bead recovered from incomplete Circle 100. Beads of this type were readily available to the Plains Indians during the nineteenth century and very common after 1850. Beads very similar to the Biscuit Hill bead were associated with a radiocarbon date (Uga-816) of 250 ± 85 BP at the nearby Lykins Valley Site (Ohr, Kvamme, and Morris 1979). The surface nature of the circles is not inconsistent with a nineteenth century age assignment for the site.

As was mentioned above, there is no way at present to determine definitively whether the site was occupied once or several times.

WHO USED THE SITE?

Although the total length of occupation/reoccupation and the specific time of occupation are unknown, it is likely that the site was probably occupied during the mid- to late-1800s. During the nineteenth century, several groups were known to have occupied or used north-central Colorado, but no one tribe seems to have had exclusive use of the area. In fact, Kingsbury describes north central Colorado as part of a "neutral ground," frequented by various war and hunting parties (Berthrong 1973:76). Comanche, Kiowa, Cheyenne, Arapaho, Pawnee, Shoshoni, and Ute are known to have used the northern portion of the Central High Plains during the nineteenth century

(Gunnerson and Gunnerson 1988). Of these tribes, the Cheyenne and Arapaho were probably the most frequent inhabitants/visitors to the region north of the South Platte during the nineteenth century. Lewis and Clark maps show the Arapaho between the North and South Platte early in the nineteenth century. John C. Fremont and Rufus Sage on separate occasions encountered Cheyenne and Arapaho on the South Platte in 1842 and 1843 (Gunnerson and Gunnerson 1988:38-39). Until a more definitive age can be assigned to the site, discussion of possible use of the site must remain highly speculative because both blue beads and stone circles are so generic that ethnic or cultural affiliation cannot be determined based on their morphology alone.

There is one bit of local lore concerning the aboriginal use of the area around Biscuit Hill that we would like to correct. As was mentioned above, the Biscuit Hill Site is not far from the Natural Fort Rest Stop on I-25. Local lore holds that a Blackfeet/Crow battle was supposed to have occurred at the Natural Fort. The information sign at the rest stop reads:

1831 was an unmercifully dry year. Buffalo were forced to follow streams to their source to get water. Indian tribes were forced from their places of abode to follow the buffalo to get meat. The Blackfeet tribe belonged west of the Yellowstone Park and Crow tribe east of it. The two tribes were deadly enemies. One day a group of around 600 Crow hunters led by Jim Beckwourth, a mulatto chief, surprised a group of around 160 Blackfeet hunters and chased them onto these rocks. A bloody battle ensued in which the Crows killed the Blackfeet one by one. Old Jim modestly admitted he killed no more than 11 Blackfeet, an understatement for him. Natural Fort probably resembled a fortress more in 1831 than it does today as the area has been haunted by souvenir hunters.

We believe that it is unlikely that this encounter took place at the Natural Fort or that the Biscuit Hill Stone Circle Site has anything to do with these Blackfeet and Crow. Historic records, including Beckwourth's biographical account (Bonner 1972) and an account by Zenas Leonard (see Wilson 1984), who witnessed the Crow attack, indicate that the encounter actually took place in "Crow country," an area to the north of Colorado. Beckwourth's and Leonard's accounts give the date as 1833 and set the number of Blackfeet killed as somewhere between 70 and 160. It is unlikely that the rest area information sign is correct in attributing the Natural Fort as the site of the Crow attack.

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