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Author

Raven, Christopher

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A Stone Alignment in the Northern Great Basin with a (Probably) Coincidental Astronomical Orientation

CHRISTOPHER RAVEN

... the eye adjusts itself to a twilight where the dead stone is seen to be batrachian, the aphyllous branch ophidian.

— T. S. Eliot, *The Family Reunion*

ALTHOUGH prehistoric alterations of the desert floor figure importantly (if enigmatically) in the archaeological record of southern California and the American southwest (Davis and Winslow 1965; Harner 1953; Hunt 1960; Solari and Johnson 1982), they have been reported neither frequently nor systematically from the northern reaches of the Great Basin. In fact, while such features long have been known to occur, notice of them has been inexplicably casual, passed by word of mouth or, at best, by snapshots traded as curiosities at professional meetings (for some exceptions, see Dansie 1981; Roney 1977; Tuohy 1981). We present here a description and some preliminary observations on one of these ground figures recently "rediscovered" in northern Washoe County, Nevada, some two decades after it was first visited by archaeologists.

The figure lies on the eastern margin of Duck Flat (Fig. 1), a broad basin once flooded by the waters of pluvial Lake Surprise (Russell 1927). At historic contact, Duck Flat fell within the territory of the Northern Paiute, probably of the *Gidutikadu* or *Kamodokado* bands, whose cultural profiles were

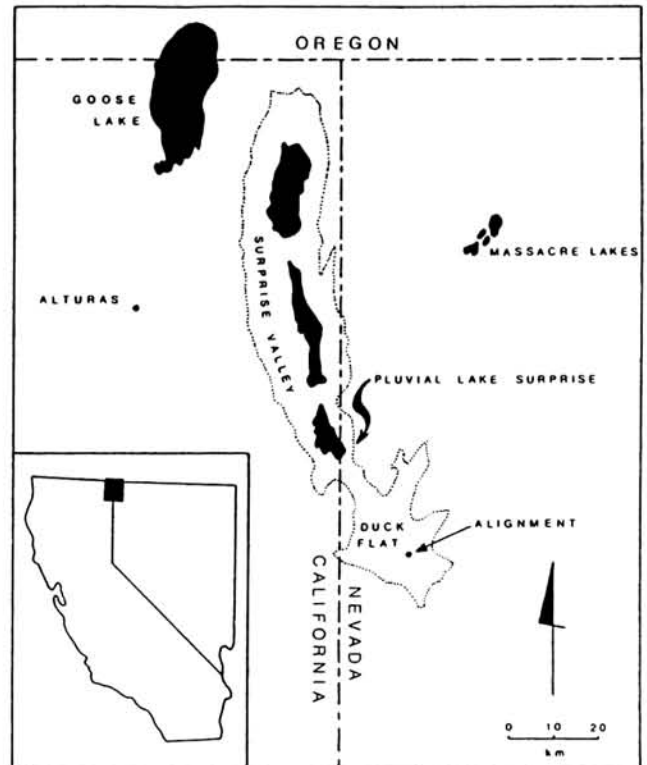


Fig. 1. Location of the Duck Flat stone alignment.

sketched in the Culture Element Distribution lists and in the documents prepared for the Indian land claims cases (Kelly 1932; Steward and Wheeler-Voegelin 1974; Stewart 1939, 1941). Because the Paiute are believed to have been relative latecomers into this corner of the Great Basin, entering the region only about 1,000 years ago (Bettinger and Baumhoff 1982; Lamb 1958; Miller 1966), undated archaeological features may have something like one chance in ten (assuming a 10,000-

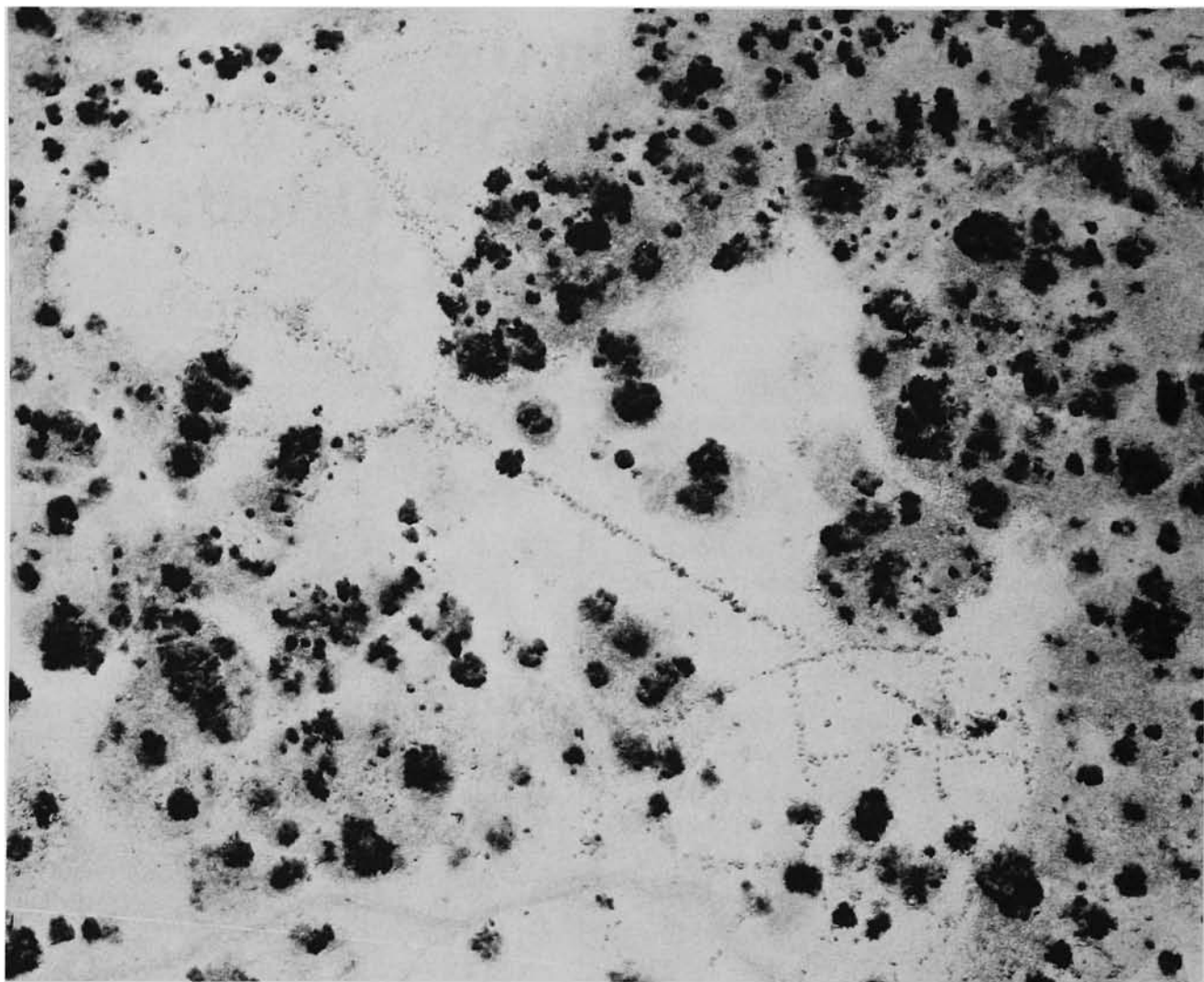


Fig. 2. Oblique aerial view from northeast.

year human occupancy of the area) of falling within the Paiute era. But at some time in the past the Paiute or their anonymous precursors or other, later, visitors decided, for whatever reason, to organize about 700 stones on Duck Flat into an intentional pattern.

The design was executed on a large scale, too large, in fact, to be grasped clearly from an eye-level perspective (Figs. 2, 3). Measuring roughly 37 x 19 m., it is composed of an assemblage of tufa rosettes, calcareous concretions that formed around pebbles in many pluvial lakes in the Great Basin and which

occur by the tens, if not by the hundreds, of thousands in Duck Flat. The stones employed in the design measure from about 10 to 30 cm. in diameter, a range which closely duplicates that of the unsorted stones in the vicinity and suggests that the selection of pieces was fairly indiscriminating. Each was placed "upside down," that is, with the rosette facing downward, inverting its natural aspect (Fig. 4).

The figure consists of two roughly elliptical chambers joined and transected by a principal axis. The southern chamber is sub-

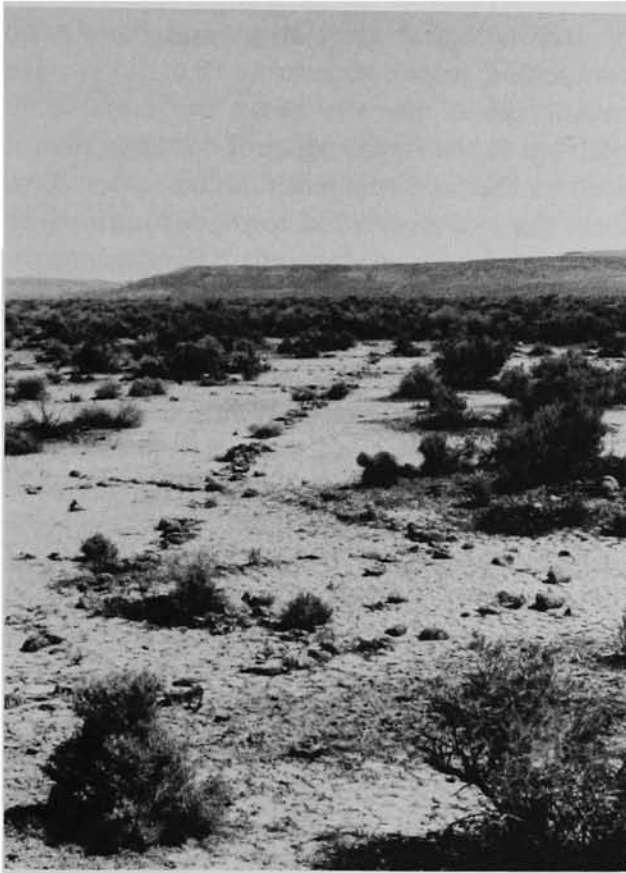


Fig. 3. Ground view from northwest, along principal axis.

divided by a secondary axis nearly perpendicular to the principal, and has a faint lobe projecting from its western arc traced by a sparse line of stones. The internal structure of the northern chamber is far more complex and far less clear, consisting of a network of intersecting alignments which effectively subdivide it into at least half a dozen irregular cells. Understanding of the northern chamber is impeded by severe disturbance of its eastern half by the passage of off-road vehicles; many stones have been broken or displaced, and while the principal elements of the original outline of the design can be reconstructed with confidence (Fig. 5), many aspects of its internal structure appear hopelessly scrambled.

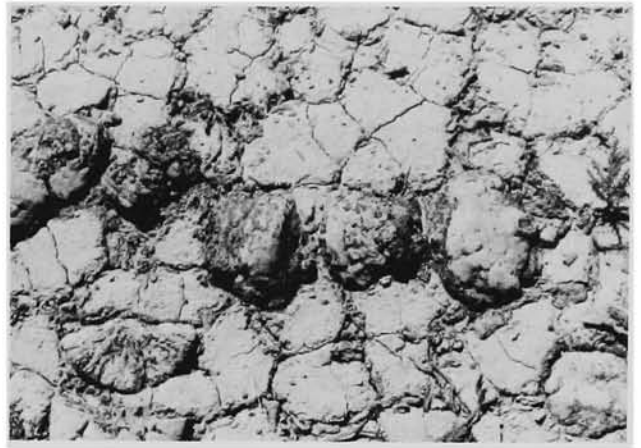


Fig. 4. Tufa rosettes in situ, principal axis. Diameter of stone in lower left = 24 cm.

The figure occupies a position marginal to, yet within, a large prehistoric occupation site. Knowledge of the site rests, at present, entirely upon the results of surface reconnaissance, but it appears to display a pattern fairly typical of Duck Flat, where over 400 sites already have been recorded. A spring lies at its center, and clearly provided the chief attraction. Over an area of approximately 100 acres, the zone of prehistoric activity is marked by an astonishingly dense scatter of lithic debitage; the highest densities noted by actual count, in the vicinity of the springhead, average 800-900 flakes per square meter. The preferred material was obsidian, though a small fraction of basalt and various cherts also occurs. Much of the chippage consists of large primary flakes, many retaining cortex, testimony to the vast fields of obsidian nodules that lie less than one mile to the east and that presumably served as sources for most of the lithic material. The assemblage reflects, however, the entire scenario of lithic reduction, from primary hard-hammer nodule breakup to fine pressure retouch. A concern with plant foods is signaled by the presence of numerous millstone fragments, although other nearby processing stations on Duck Flat appear to

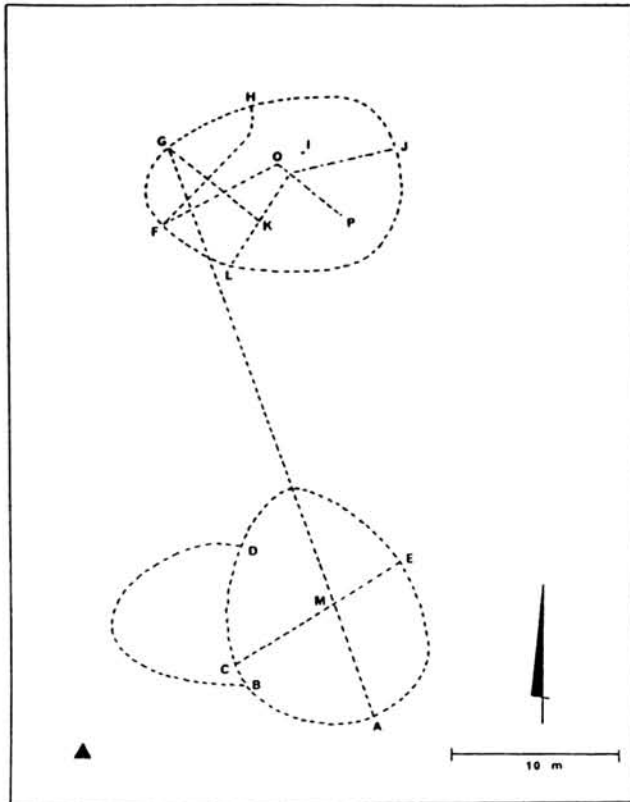


Fig. 5. Plan of alignment. Intersections are designated to establish coordinates (Table 1) and derive orientations (Fig. 6); datum is coordinate 0/0.

have been used more intensively.

So far, dating of the site remains ambiguous. The surface assemblage has yet to yield, despite hours spent on hands and knees, a single diagnostic fragment of a time-marker projectile point. Two factors probably contribute: (1) the site has been known to collectors for at least 30 years (it was they who first reported it to archaeologists), and its surface, like that of most of Duck Flat, has suffered an annual Memorial Day gleaning; and (2) the strategic orientation of Duck Flat valley-floor sites appears never to have stressed hunting to the degree that prevailed in the surrounding uplands, with the result that projectile points simply are less abundant elements of even pristine assemblages there.

Of course, even the most unequivocal dating of the site would not necessarily date

the figure; surface propinquity is a feeble test of archaeological association, and there is no compelling reason to assume that the surface assemblage of the site bears any closer relationship to the figure which it contains than it does to the jeep tracks which it also contains. Even the assumption of aboriginal authorship is a leap of faith contingent upon comparative data that may or may not be forthcoming, but it is one that we are willing to make in the interest of pursuing the following discussion.

Because the figure contains several quite clearly defineable alignments, and because the quest for astronomical orientations in such designs has preoccupied many students lately (Aveni 1975, 1977, 1981; Hudson, Lee, and Hedges 1979), we visited the site, armed with few expectations, on the occasion of the 1980 summer solstice. The sunset of June 21 (with a 3° western horizon) returned no convincing observations of a solstitial intent in the pattern, and our party of seven consoled itself with a dinner of *Huachinango a la Veracruzana* cooked over a sagebrush fire. The sunrise of June 22, however, rewarded those of the party who had dragged themselves from their sleeping bags with an inarguable congruence between the cross-axis of the southern chamber (line C-E in Fig. 5) and the emergence of the full orb of the sun above the 2° eastern horizon. This seemed sufficient and, congratulating ourselves that we had found Stonehenge in the Great Basin, we retired from the field.

ARGUMENT

Some afterthoughts to our naive excursion have been prompted by the nagging enigma of the figure and by the more organized scrutiny brought to bear by other students. Envious of the confidence of the cogniscenti, I hope in the following remarks at least to provide them with useful data, and to signal for the more general archaeological audience some of the pitfalls of which most

specialists are already aware. Four issues merit particular attention:

Tolerance of Error

The Duck Flat alignments do not describe neatly unequivocal orientations, and observations on their supposed “targets” must accommodate not only the degree of latitude (or lassitude) tolerated in the original placement of the stones, but also the effects of centuries, or perhaps millennia, of overwash, frost-heave, livestock trampling, and the modern horror of dune buggies. As well, the judgment of modern observers as to what will or will not be accepted as a reflection of the intent of the original further filters the information. Some of the longest alignments simply do not mark straight lines save from end-point to end-point and, though the deviation is slight, it broadens, and thus somewhat diffuses, the pin-point accuracy with which we should like to be able to identify orientations. In practice, when we mapped the figure with theodolite readings against timed solar bearings, it proved necessary to approximate a line which would cross the midpoints of the greatest number of stones within each alignment and we judged, both in the field and later in analysis, that the accuracy of our observations was limited by at least a $\pm 2^\circ$ tolerance of error. This means that any agreed orientation actually defines a 4° arc, and we suspect that few published orientations can confidently claim greater accuracy save in those instances where only two features define the straight line. Table 1 provides the measured coordinates of the design, and Figure 6 depicts the alignment orientations derived therefrom.

Limitation of Possibilities

Over three decades ago, Charles Erasmus (1950) pointed out to archaeologists that in any comparison the likelihood for correlation increases as the possibility for variance dimin-

Table 1
COORDINATES OF PRINCIPAL STATIONS
(cf. FIG. 6)

	Meters North/Meters East from Datum (0/0)
A:	2.44/17.53
B:	4.42/9.91
C:	5.64/9.30
D:	12.65/9.60
E:	11.73/19.35
F:	32.61/4.88
G:	37.03/5.33
H:	39.47/10.21
I:	36.58/13.41
J:	37.03/19.05
K:	32.61/10.67
L:	30.02/8.99
M:	9.14/15.24
O:	35.97/12.04
P:	33.22/15.54

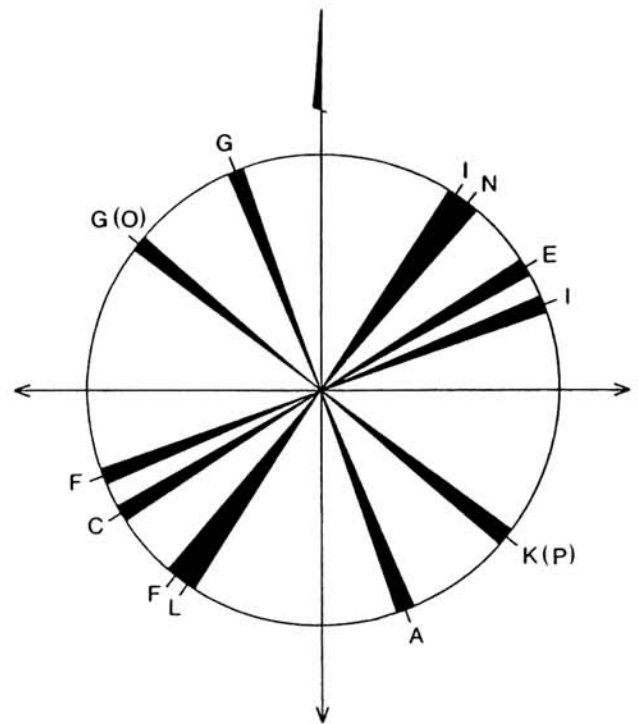


Fig. 6. Principal intrinsic orientations. Rays depict $\pm 2^\circ$ tolerance of error.

ishes. A critical look at the Duck Flat figure demands that the following caveats to acceptance of its solstitial orientation be observed:

1. Any defined alignment points in two

directions so that, with 1° accuracy, there is one chance in 180 (i.e., two chances in 360°) that it may correspond to a given astronomical event.

2. We have already accepted a $\pm 2^\circ$ tolerance of error (4° arc) as the best that we can do in reconstructing the intent of the original Duck Flat design. With this error factor there becomes one chance in 45 (i.e., $180^\circ/4$) that any orientation will correspond to a given astronomical event.

3. The Duck Flat figure contains at least seven provisionally reconstructable alignments, only one of which falls within 2° of another. For any given astronomical event, then (such as a solar solstice rising), we may anticipate one chance in 6.4 (i.e., $45/7$) that one of the alignments will demonstrate an acceptable congruence.

4. Since summer solstice and winter solstice find the sun rising and setting in different quadrants of the sky, the probability increases to one chance in 3.2 that one of the Duck Flat figure's alignments would acceptably mark one or another solstitial solar event.

5. Lunar orientations provide an even wider range of possible congruence, as each of the moon's rising and setting azimuths swings through about 16° of arc over a 9.6-year period. Thus, about 18% of the horizon will target a summer or winter solstice rising or setting of the moon within any decade. In light of the previously rehearsed probabilities, the chances are about 5:1 that at least one member of a seven-branched alignment such as that at Duck Flat will, with a 2° tolerance of error, fall within the range of variation of lunar solstitial events. In fact, we find at Duck Flat that of the 14 orientations (defined by seven two-way alignments), five acceptably target the moon on the solstice horizon (two orientations mark the summer moon-rise solstice, two the winter moon-rise solstice, and one the winter moon-set solstice).

Stellar Orientations and a Limited Field of Action

Not all celestial features are observable anywhere in the world, although the sample of visible night-sky events increases as one approaches the equator. Archaeoastronomical orientations tend to target fixed stars (of which the North Star is the only one in the sky), or the points on the horizon at which important celestial bodies rise or set. Not all celestial bodies do this, however; north of the equator there occurs a *zone of perpetual apparition*, centered on Polaris, within which the circle of northern stars never dips below the horizon. Being always visible, this zone, with the exception of the pole star itself, is effectively subtracted from the circle within which we confidently can designate astronomical rising or setting orientations. Likewise, the southernmost stars are obscured in a *zone of perpetual occultation*; they never rise above the horizon, and thus can play no role in the astronomy of northern latitudes. The same effect, of course, occurs in the southern hemisphere with the poles reversed.

Also, the altitude of the local horizon reduces the effective field of vision. Simply put, you see fewer stars, for less time, from the bottom of High Rock Canyon than from the center of the Black Rock Desert. An horizon of an average 3° altitude surrounds Duck Flat, and limits by this margin the always-seen sky while comparably increasing that which is never seen.

From the perspective of Duck Flat, which lies at about latitude 41° N, this means that 82° , or 46% of the celestial arc, is either always seen every night or never seen any night, and therefore does not rise or set on the horizon. The effective rising/setting sky is limited to 98° , or 54%, of the total celestial arc, with the result that many bright stars are excluded from the zone in which orientations can be recognized.

Era of Orientations

Within the 98° of active stellar rising and setting azimuths visible from Duck Flat, correlations between ground alignments and the horizon intersections of the brightest celestial objects become acceptable only when they can be associated with a specific era. While solstitial solar risings and settings have varied little, stellar events have deviated from their present pattern anywhere from one to 30° over the course of the past several thousand years. The Southern Cross, for example, currently visible in the United States from the southernmost reaches of Florida and Texas, was visible throughout the Great Basin and, in fact, as far north as Quebec, in 3000 B.C. (Duncan 1946:117).

Of the 25 brightest stars, no more than 16 have been active at any one time on the Duck Flat rising/setting horizon since 1500 B.C. The coincidence of their rising and setting azimuths (at 500-year intervals) with the orientations expressed in the Duck Flat alignment is depicted in Figure 7; the calculations

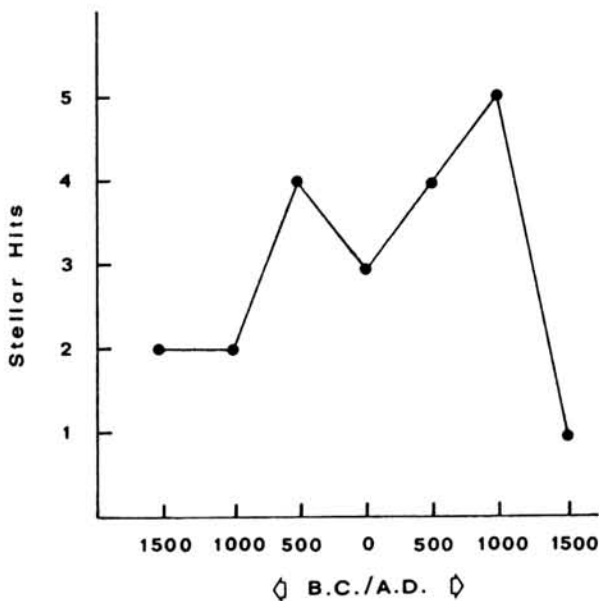


Fig. 7. Incidence of targeted bright-star rising and setting azimuths at 500-year intervals, 1500 B.C. - A.D. 1500.

are based on Aveni's (1972) printouts of celestial events at latitude 41° N.

The point of this exercise is to demonstrate the ease with which potential astronomical orientations may be found over any extended period. Since 1500 B.C., 58% of Duck Flat's active rising/setting horizon has been blanketed by bright stars at one time or another. It seems almost overkill here to point out that the chances are greater than 30:1 that a two-way, seven-branched figure, given a 2° tolerance of error, will target at least one of the past risings or settings. It may be worth noting, however, against future chronometric research, that the best congruence occurred at A.D. 1000, with five hits on stellar risings or settings, and that solstitial events are targeted then as well as they are at any other date.

ALTERNATIVES

The sailor imagines the mermaid as having a pair of legs, and the cat imagines her as being all fish.

— Nabokov, *Pnin*

The foregoing remarks have not been intended to discourage the search for (and discovery of) astronomical orientations in the archaeological record of the Great Basin. Rather, it has seemed important to invest the quest with a just measure of caution. Since acceptable congruences are so easy to come by, we must embrace a certain wariness of what blind chance can do, we must base arguments on more pattern regularities than the data make presently available, and we must admit, at least for consideration, that other explanations may be equally plausible. Three non-astronomical models of the Duck Flat feature spring to mind:

1. *The figure consists of orientations the referents of which are geographic rather than astronomical.* Among the landscape features that might so be targeted are sacred places, occupation sites, and major resource locales.

In fact, pressing this "map" reading well beyond prudence, one may note an eerie similarity between the shape of the figure and the general configuration of Duck Flat (the southern chamber) and the adjacent lower Surprise Valley (the northern chamber). The principal axis that connects the chambers points pretty directly to the spillway between the two basins, which provides the only reasonable access to foot traffic from one to the other. Does the figure then plot a portion of a seasonal round, however schematically? And if so, why? We know just enough to make this line of inquiry dangerous, because we can "map on" to our perception of the figure an appropriate suite of known landmarks — there's the Bare Ranch, there's NV-WA-193, there's the seasonal movement up Tuledad Canyon, there's the little man and there's his little hat The exercise quickly becomes masturbatory because we simply do not control enough data on subsistence/settlement geography to make our observations anything but selective or our predictions anything but self-fulfilling.

2. *The figure contains no external orientations, but instead defines internal spaces.* Any culture is prone for a variety of reasons to segment ground space; game boards, ball courts, freeways, parking lots, and the floor of the stock exchange are obvious examples from our own culture, where the segmentation serves the interests of trade, travel, administration, and play. Some among us even grid archaeological sites. Among hunter-gatherers we might posit cosmological models, recreational or ceremonial surfaces (not necessarily mutually exclusive), or the still-undefined motive behind the production of the admittedly not dissimilar Great Basin petroglyphs. But if the dwellers on Duck Flat had any of these in mind, they left us a virtually unreadable message; we simply do not know enough about their predilections, even in the recent ethnographic past, to allow

us to sort from the possible alternatives those that are likely. And even if we could, a demonstrable congruence in one of these arenas would not force rejection of other (for instance, astronomical) models; after all, one out of every 5.6 shuffleboard courts, anywhere in the world, contains an acceptable solstice-rising orientation.

3. *The figure is an expression of individual, random, irrational, or ultimately perverse behavior with identifiable cognates in neither the natural nor the cultural universe.* If so, who cares?

CONCLUDING REMARKS

I would apologize for the frankly agnostic tone of this paper did I not believe that the limitations of the data strongly support agnosticism and that a more assertive statement now would likely demand greater apology in the future. Since such figures are only beginning to be recorded adequately in the northern Great Basin, and since rumor has it (somewhat more confidently than the published literature) that the data bank will bulk fairly large, it seems enough to have brought this single example to attention. I urge strongly, however, that such figures discovered or reported in the future be examined for astronomical, geographic, or ethnographic referents, and that the coordinates and bearings of all possible alignments be recorded with as much metric precision as possible before the cows and the dune buggies and the attrition commanded by natural forces erase them. The history of petroglyph studies offers probably adequate proof that the data bank will never grow large enough for the facts to speak for themselves, but the much smaller data bank on large, complex stone alignments barely enables us at present to ask any questions that are at once both interesting and answerable.

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REFERENCES

- Aveni, Anthony
 1972 *Rising and Setting Azimuths of Principal Astronomical Bodies*. Unpublished computer printout in possession of the author.
 1981 *Archaeoastronomy*. In: *Advances in Archaeological Method and Theory*, Vol. 8, Michael B. Schiffer, ed., pp. 1-77. New York: Academic Press.
- Aveni, Anthony, editor
 1975 *Archaeoastronomy in Pre-Columbian America*. Austin: University of Texas Press.
 1977 *Native American Astronomy*. Austin: University of Texas Press.
- Bettinger, Robert L., and Martin A. Baumhoff
 1982 *The Numic Spread: Great Basin Cultures in Competition*. *American Antiquity* 47: 485-503.
- Dansie, Amy
 1981 *Pebble Mound Complexes in Northwestern Nevada*. *Nevada Archaeologist* 3(1): 16-29.
- Davis, Emma Lou, and Sylvia Winslow
 1965 *Giant Ground Figures of the Prehistoric Deserts*. *American Philosophical Society Proceedings* 109(1): 8-21.
- Duncan, John C.
 1946 *Astronomy* (fourth edition). New York and London: Harper Brothers.
- Erasmus, Charles J.
 1950 *Patolli, Pachisi, and the Limitation of Possibilities*. *Southwestern Journal of Anthropology* 6: 369-387.
- Harner, Michael J.
 1953 *Gravel Pictographs of the Lower Colorado River Region*. Berkeley: University of California Archaeological Survey Reports No. 20: 1-29.
- Hudson, Travis, Georgia Lee, and Ken Hedges
 1979 *Solstice Observers and Observatories in Native California*. *Journal of California and Great Basin Anthropology* 1: 39-63.
- Hunt, Alice
 1960 *Archaeology of the Death Valley Salt Pan, California*. University of Utah Anthropological Papers No. 47.
- Kelly, Isabel T.
 1932 *Ethnography of the Surprise Valley Paiute*. University of California Publications in American Archaeology and Ethnology 31(3): 67-210.
- Lamb, Sydney M.
 1958 *Linguistic Prehistory in the Great Basin*. *International Journal of American Linguistics* 24: 95-100.
- Miller, Wick R.
 1966 *Anthropological Linguistics in the Great Basin*. In: *The Current Status of Anthropological Research in the Great Basin: 1964*, Warren L. d'Azevedo, Wilber A. Davis, Don D. Fowler, and Wayne Suttles, eds., pp. 75-112. Reno: Desert Research Institute Publications in the Social Sciences No. 1.
- Roney, John
 1977 *Cultural Resource Survey for Geothermal Leasing near Fallon, Nevada*. BLM Cultural Resources Report CRS-164(P) on file at the Bureau of Land Management, Winnemucca.
- Russell, Richard Joel
 1927 *The Land Forms of Surprise Valley, Northwestern Great Basin*. University of California Publications in Geography 2: 323-358.
- Solari, Elaine Maryse, and Boma Johnson
 1982 *Intaglios: A Synthesis of Known Information and Recommendations for Management*. In: *Hohokam and Patayan*, Randall H. McGuire and Michael B. Schiffer, eds., pp. 417-432. New York: Academic Press.

- Steward, Julian H., and Erminie Wheeler - Voegelin
1974 *The Northern Paiute Indians*. *Paiute Indians*
III. New York: Garland Publishing.
- Stewart, Omer C.
1939 *The Northern Paiute Bands*. *University of*
California Anthropological Records 2(3):
127-149.
- 1941 *Culture Element Distributions, XIV: North-*
ern Paiute. *University of California Anthro-*
pological Records 4(3): 361-446.
- Tuohy, Donald R.
1981 *A Brief History of the Discovery and Explor-*
ation of Pebble Mounds, Boulder Cairns, and
Other Rock Features at the Sadmat Site,
Churchill County, Nevada. *Nevada Archae-*
ologist 3(1): 4-15.

