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Population Dynamics on the Northwestern Great Basin Periphery: Clues from Obsidian Geochemistry

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The source direction of obsidian artifacts from archaeological contexts in Drews Valley, located on the northwestern Great Basin perimeter, provides evidence for an east-to-west shift in procurement or interaction spheres from Middle to Late Holocene times. For Elko and earlier periods, sources located to the northeast, in Oregon's Chewaucan Basin, are predominant, and most of the remaining exotic obsidian is from other Great Basin sources, primarily from the Goose Lake basin to the southeast. Within the last ca. 1,300 years, sources on the Modoc Plateau to the southwest predominate, while sources in the Chewaucan and other easterly basins are rare. This shift, precipitated by a combination of factors that may have included environmental stress, conflict, and changing economic opportunities, may mark the initiation of the ethnographic pattern.

THE dynamic nature of residence in the northern Great Basin has been a common theme in the regional archaeological literature for decades, considered in light of changing Holocene climatic regimes (Oetting 1989), population movements (Aikens 1995), subsistence strategies (Jenkins 1994), or economic spheres (Sampson 1985; Hughes 1986). Hughes (1985, 1986) first recognized temporal variation in south-central Oregon obsidian procurement and distribution systems with a study based primarily on two Klamath Basin sites—Nightfire Island (Sampson 1985), located within historical Modoc territory, and Kawumkan (*Ka'umkan*) Springs Midden (Cressman 1956), in the Klamath homeland. He found that in the period dominated by Elko series projectile points (ca. 3,300 to 1,000 B.P.), more distant and more numerous obsidian sources were used than in previous and subsequent periods (i.e., times when Northern side-notched points were predominant, ca. 5,000 to 3,300 B.P., and the period when Gunther, Rose Spring, and small side-notched series arrow points were predominant, ca. 1,300 B.P.).

Based on this evidence, Hughes (1986:201) suggested that the beginning of the Elko period "marked the inception of what was to become a regional exchange network" which, in turn, "broke down at the same time that Elko series points ceased being manufactured." The evidence for an apparent exchange system collapse was supported "by predominant use of volcanic glasses from the closest sources" coincident with the predominance of arrow-sized projectile points (Hughes 1986:202, 271).

Hughes' hypothesis differed from Sampson's (1985) interpretations regarding the Nightfire Island economic patterns. Rather than regional exchange ending with the Elko Period, Sampson (1985:514) concluded from the distribution of marine shell beads that "the most suggestive correlation with the advent of the bow-and-arrow is the inclusion of the site within the range of the olivella bead exchange network. These and other marine shell items suggest that trade contacts with the coast became firmly established at this time." As many have shown (e.g., Hughes and Bennyhoff 1986; Bennyhoff and Hughes 1987), economic relations were established between the Basin and Pacific coast throughout the Holocene; what Sampson (1985) observed is a substantial acceleration in trade activity within the last 1,300 years.

Taken together, these studies may suggest not the waxing and waning of trade intensity, but a shift in the focus of social contacts and/or residential centers in the last millennium, from the intermittently productive western Great Basin lake/marsh centers to the Klamath Basin, Modoc Plateau, Klamath River corridor, and other more westerly centers. We tested this hypothesis using trace element geochemistry of obsidian artifacts recovered from six sites in Drews Valley, south-central Oregon. Drews Creek drains the Klamath/Goose Lake Basin divide on the western Great Basin periphery, and empties into Goose Lake. Ethnographically, Drews Valley has been identified as a boundary area used by the Modoc (whose territory was centered to the west-southwest), the Klamath (whose principal settlements were to the west-northwest), and the Northern Paiute (located primarily in the northern Great Basin area to the east) (cf. Spier 1930; Ray et al. 1938; Ray 1963). Ray (1963) specifically identified Drews Valley as a location of Modoc summer camps. This boundary area serves as an ideal study area for measuring the distance and directionality of obsidian source locations.

PROJECT BACKGROUND

In preparation for planned improvements to the Klamath Falls-Lakeview Highway (Oregon Highway 140) through Drews Valley (Fig. 1), test excavations were conducted at 14 sites and data recovery mitigation work was conducted at six. The obsidian sample discussed here derives from these six sites. Cultural deposits were found to span the Holocene, although the last 4,000 years are best represented in the recovered samples.

Drews Valley and vicinity is the source of the Drews Creek/Butcher Flat (DC/BF) obsidian geochemical type, which occurs in eroded rhyolitic domes and lag deposits over a wide area (Skinner 1983). Lithic resource procurement was among the activities represented, particularly at the northernmost sites where Drews Creek debauches onto the valley floor and obsidian cobbles are readily available.

Because we were primarily interested in examining lithic procurement and distribution patterns on a regional scale, our sample for geochemical source analysis was weighted in favor of formed artifacts. A sample of 204 chronologically diagnostic obsidian projectile points was submitted to BioSystems Analysis for geochemical analysis and source identification by the x-ray fluorescence technique. Projectile points are the artifacts most likely to have been brought to the valley in finished form as part of mobile tool kits. An additional small sample of debitage (40 specimens) from sites at the northern and southern ends of the project corridor were all identified to the DC/BF geochemical source. Of the 204 projectile points analyzed, 63% are of the DC/BF geochemical type, and 37% represent exotic sources; of the exotics, 69 artifacts (34% of the total sample) are attributable to known sources, while six represent geochemical types of unknown provenience. Two broad-stemmed (Early Holocene?) projectile points probably predate the time periods considered here (ca. 4,500 B.P. and later), and were excluded from the analysis.

OBSIDIAN DISTRIBUTION PATTERNS

Chronological Assignments

For summary purposes, and following the general divisions discussed by Hughes (1985, 1986) to insure comparability, point types were collapsed into three broad time periods. Because of the great imprecision in typological cross-dating, the analytic periods presented here, while reliably sequent, are given overlapping time ranges. What we designated Period 1 dates between about 5,500 and 3,000 years B.P. based on our chronological evidence, and is signified by Middle Holocene dart points (44 sourced

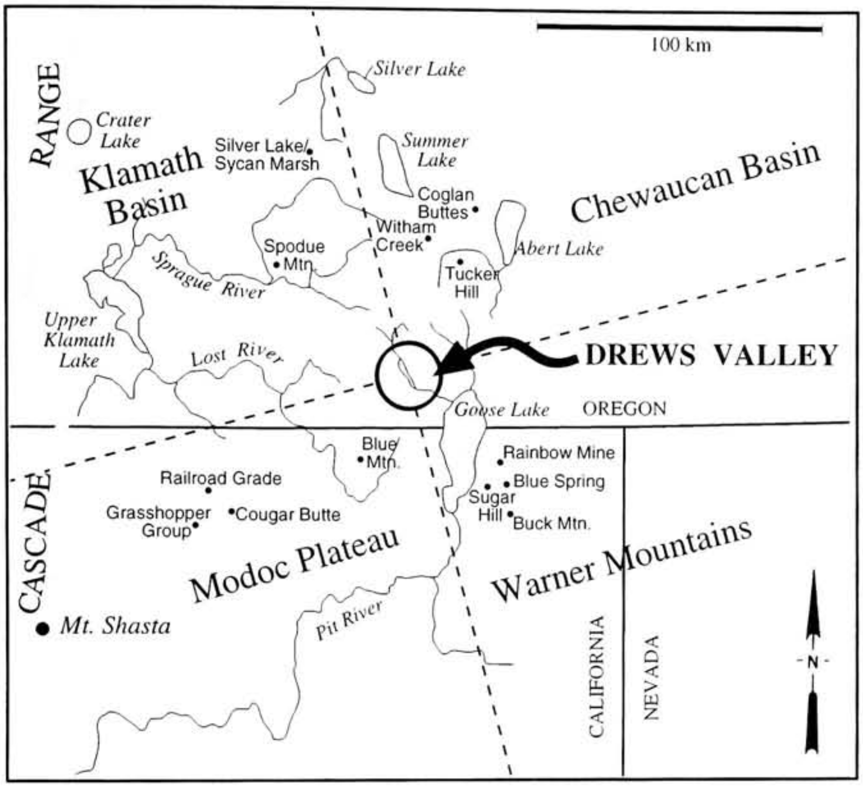

Fig. 1. Obsidian sources identified in the Drews Valley assemblages, and source areas discussed in the text.

specimens), including large side-notched and foliate types. Obsidian hydration analysis of two wide stem (Western Stemmed series) points in the present sample indicate their use contemporaneously with the Middle Holocene types (possibly representing scavenging and reuse of older artifacts), but, as mentioned above, we excluded these from the Period 1 sample because of uncertainty about their point of origin with respect to their apparent Middle Holocene use. Period 2 is marked by Late Holocene dart points (66 sourced specimens), including specimens assignable to the Elko, Gatecliff, and Humboldt series, which predominated in the area from 3,500 to 1,000 B.P. Arrow points (92 sourced specimens), including specimens assignable to the Rose Spring and Gunther series, were assigned to Period 3. Arrow-sized projectile points predominate in assemblages dating to within the last ca. 1,300 years.

Distribution Patterns

Because of the diversity of sources in the present sample, some represented by only one specimen, we viewed exotic obsidian artifacts in terms of four source directions from Drews Valley (Fig. 1). Sources from the northern Great Basin, northeast of Drews Valley in the Chewaucan and Silver/Summer lake basins, include Witham Creek, Tucker Hill, and Coglan Butte. Sources from the Warner Mountains, southeast of Drews Valley, include Buck Mountain, Blue Spring, Rainbow Mines, and Sugar Hill. Sources found in the Klamath Basin, northwest of Drews Valley, include Silver Lake/Sycan Marsh and Spodue Mountain. Modoc Plateau sources,

Table 1
SOURCE LOCATIONS OF OBSIDIAN PROJECTILE POINTS BY PERIOD

Source (Distance in km.)	Period 3	Period 2	Period 1	Total[a]
		Local Obsidian		
Drews Valley (N=128)				
Drews Creek/Butcher Flat (0)	70	37	21	128
Drews Valley Percent	(76%)	(56%)	(48%)	
		Exotic Obsidian		
Warner Mountains (N=18)				
Buck Mountain (65)	4	1	2	7
Blue Spring (55)	--	2	2	4
Rainbow Mines (50)	--	3	1	4
Sugar Hill (50)	1	2	--	3
Warner Mountains Total	5 (26%)	8 (29%)	5 (24%)	
Chewaucan Basin (N=24)				
Tucker Hill (45)	1	1	10	12
Coglan Butte (55)	1	7	3	11
Witham Creek (45)	--	1	--	1
Abert Basin Total	2 (11%)	9 (32%)	13 (62%)	
Klamath Basin (N=10)				
Spodue Mountain (60)	4	4	1	9
Silver Lake/Sycan Marsh (85)	--	1	--	1
Klamath Basin Total	4 (21%)	5 (18%)	1 (5%)	
Modoc Plateau (N=16)				
Blue Mountain (45)	2	3	2	7
Grasshopper Group (85)	5	2	--	7
Cougar Butte (85)	1	--	--	1
Railroad Grade (95)	--	1	--	1
Modoc Plateau Total	8 (42%)	6 (21%)	2 (10%)	
Total Exotic/Known Source	19	28	21	68
Mean Distance to Source	66	58	51	58
Other and Unknown				
Buck/Coglan?	--	--	1	1
Unknown 1	--	--	1	1
Unknown 2	1	--	--	1
Unknown 3	1	--	--	1
Unknown 4	1	--	--	1
Unknown 5	--	1	--	1
Total Exotic	22 (24%)	29 (44%)	23 (52%)	74
N Exotic Sources	11 (0.50)	13 (0.45)	9 (0.39)	17
Total Sourced	92	66	44	202

[a] Table excludes two broad-stemmed points, which may predate what is here called Period 1; one is assigned to the Drews Creek/Butcher Flat source, and one to the Spodue Mountain geochemical type.

southwest of Drews Valley, include Blue Mountain, Cougar Butte, Railroad Grade, and the Grasshopper Group (Grasshopper Flat, Lost Iron Well, Red Switchback) in the Medicine Lake Highlands region (Table 1). These named sources are those represented in the Drews Valley sample, not all obsidian sources available in each area.

We found that the primary source direction for exotic obsidians in Drews Valley changes

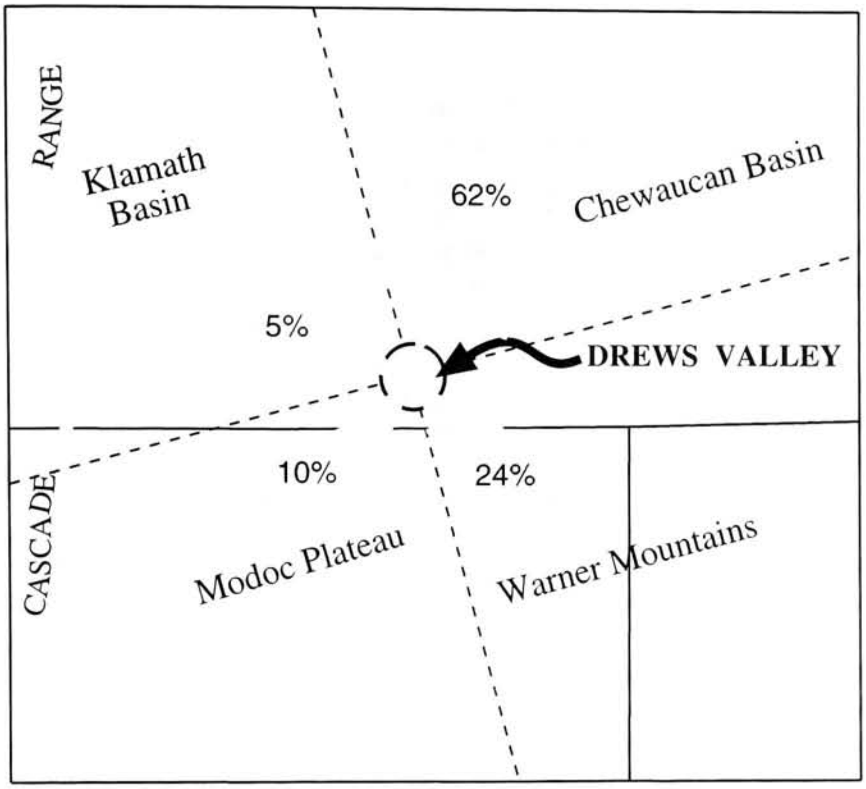

Fig. 2. Percent of exotic obsidian by source area entering Drews Valley during Period 1, ca. 5,500 to 3,000 BP.

through time, from primarily easterly and northeasterly in Period 1 to primarily southwesterly in Period 3. Chi-square tests show that the distributions (source area by period) diverge from randomness at the 0.05 significance level. For exotic-only obsidian, $\chi^2 = 14.409$ ($p > 12.592$, df = 6); for exotic plus local obsidian, $\chi^2 = 28.589$ ($p > 15.507$, df = 8). These tests should be evaluated cautiously, however, as our sample sizes are small.

For the Middle Holocene (Period 1) sample (n = 44), 52% are from exotic sources, while 48% are of the local DC/BF geochemical type (Fig. 2). Of the exotics, 62% derive from sources in the Chewaucan Basin to the northeast, and 24% are from Warner Mountain sources to the southeast. The combined Klamath Basin and Modoc Plateau sources represent only 15% of the sourced Middle Holocene types. During the Middle Holocene period, the primary source direction appears to have been easterly, especially northeasterly, in the northern Great Basin. Western sources are poorly represented.

The directionality of the Period 2 sample is less marked than that of Period 1 (Fig. 3). While Chewaucan Basin sources are still predominant (32% of exotics), there is a range of only 14% between these northeastern sources and the most poorly represented source direction (Klamath Basin to the northwest, representing 18% of the Period 2 sample). Additionally, the proportion of exotic material decreases from 52% in Period 1 to 44% in Period 2. The greater use of local material, and the directionally balanced representation of exotic sources, suggest that Drews Valley may have been more

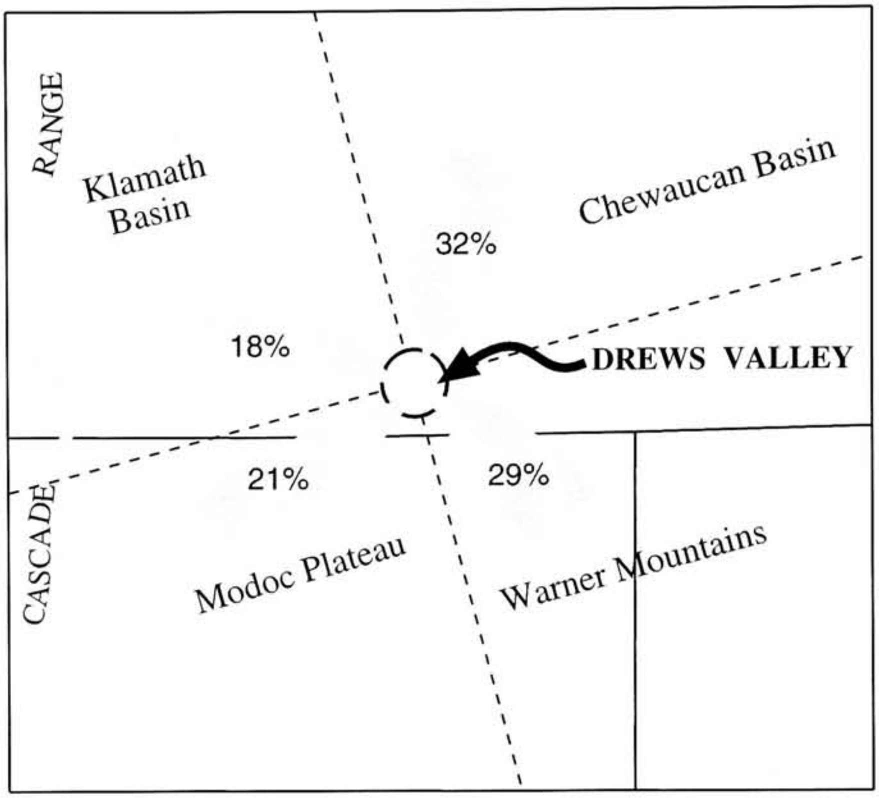

Fig. 3. Percent of exotic obsidian by source area entering Drews Valley during Period 2, ca. 3,500 to 1,000 BP.

centrally positioned in regional socioeconomic spheres at this time. The proportion of exotic material decreases further in Period 3, from 44% in Period 2 to 24% (Fig. 4). As with Period 1, the distribution of exotic sources is highly directional. Modoc Plateau obsidians, primarily from the Medicine Lake Highlands to the southwest of Drews Valley, represent 42% of the exotic specimens. Only 11% derive from Chewaucan Basin sources to the northeast, formerly the primary source of exotic glass.

DISCUSSION

If we take the patterns discussed above to reflect interaction or influence spheres, we see a shift from a northern Great Basin center in Period 1 to a California (Modoc Plateau) center in Period 3. For Elko and earlier periods, sources located to the northeast are predominant, and most of the remaining exotic obsidian is from southeastern sources. This pattern is most striking for the Middle Holocene Period 1, when more than 60% of exotic obsidian is derived from the Chewaucan Basin to the northeast. Western sources are poorly represented in the early periods. By Period 3, sources on the Modoc Plateau to the southwest are predominant (42%). Chewaucan Basin sources, predominant in Elko and earlier periods, are rare during the latest period.

Hughes (1986) suggested that the Elko Period was distinguished from earlier and later times by greater access to more distant and varied obsidian sources, suggesting that a wide-ranging trade network operated during this period that was not maintained in earlier or later times. Superfi-

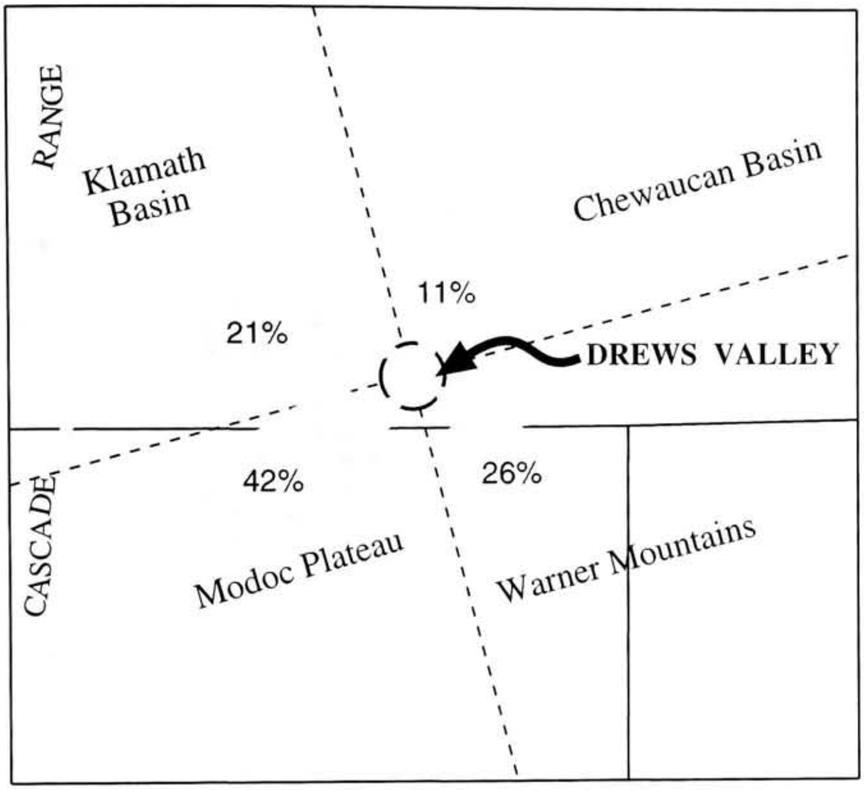

Fig. 4. Percent of exotic obsidian by source area entering Drews Valley during Period 3, post ca. 1,300 BP.

cially, this pattern is matched by our data: the Period 2 (Elko predominant) sample includes a greater number of different sources (although this is probably a function of the larger absolute number of exotics in the Period 2 sample), and a greater average distance to source, than the other periods. On further inspection, however, these distance measures do not necessarily support Hughes' (1986) interpretation. While the average distance to source is lowest for Period 3, this is due primarily to the fact that a relatively larger proportion of the sample is from the local DC/BF source. It is possible that the shift from dart to arrow points, which are more difficult to rejuvenate than to replace, could be a factor in the increased use of the local DC/BF source in Period 3.

This pattern may be better explained, however, in terms of a simple distance model: use of the local DC/BF source increases as distance to alternate sources increases. There is a strong relationship ($r^2 = 0.96$) between mean distance to source and percent of exotic material for each sampled period. We believe this relationship more directly relates to source direction from Drews Valley, rather than indicating trade intensity. For people coming to Drews Valley from the Modoc Plateau (consistent with the ethnographic record; cf. Ray 1963), alternate sources from this direction (primarily from the Medicine Lake Highlands region) are, on average, about 80 km. distant. For people coming to the valley from residential centers in the Chewaucan or other basins to the northeast (cf. Pettigrew 1985; Oetting 1989; Jenkins 1994), alternate sources from this direction average only about 35 km.

distant. In other words, what we observe here in the obsidian record is most likely the by-product of shifting settlement patterns, not trade patterns.

We present this interpretation tentatively, in light of the small size of our current sample. We note, however, that the apparent east-to-west shift in cultural centers, as reflected in the current Drews Valley obsidian evidence, is consistent with evidence for the presence of active residential centers in the northern Great Basin (e.g., Silver Lake, Chewaucan Basin, Warner Mountains) in Elko and earlier times, and less intense occupation in these areas during the last millennium (Pettigrew 1985; Aikens and Witherspoon 1986; Oetting 1989; Jenkins 1994; Aikens 1995). Aikens and Jenkins (1994) reported the presence of fishing hamlets in the Silver Lake Basin, dating between 5,000 and 3,500 B.P., now occupied by arid dune fields. Formerly stable residential village centers around wetland basins of the northwestern Great Basin were significantly depopulated in the last millennium, corresponding to a time of pronounced regional decline in effective moisture. Jenkins (1994) noted that small residential sites were dispersed in the western basin during the last thousand years.

Aikens (1995:40; cf. Oetting 1989) related the westward withdrawal of the ancestral Klamath-Modoc to this increased aridity, and argued that the "adaptive strategies on which they depended . . . required moister landscapes than their country could now provide. . . . By withdrawing only a few tens of miles westward and a few hundred feet upward in elevation, the Chewaucanians were able to continue their established lifeway in a habitat closely similar to that they had abandoned." In addition to environmental stresses, Spier (1930:24) noted that the Klamath were continually in conflict with "tribes of warlike habit to the north and east," a clear reference to the Northern Paiute. Paiute oral traditions (Kelly 1932) tell that the Klamath-Modoc once inhabited south-central Oregon east of the Klamath Basin as far as Steens Mountain, but were forced into the Klamath Basin by the Paiute. It is also possible that, in addition to pressures from the east and in consideration of the Nightfire Island shell bead data (Sampson 1985), population movement was affected by the lure of an increasingly vibrant economic sphere to the west (Hughes and Bennyhoff 1986; Mack 1996).

Regardless of the motives, a westerly withdrawal of the ancestral Klamath-Modoc is supported by the archaeological record, as evidenced in the striking parallels between archaeological remains from Oregon's Lake Abert/Chewaucan Basin and Klamath-Modoc material culture (Oetting 1989), as well as in the continuity between archaeological basketry assemblages from south-central Oregon and the basketry traditions of the Klamath and their neighbors (Eiselt 1997), which Cressman (1942:45, 1986:123) regarded as evidence for a direct genetic link. To this list, we can now offer supporting evidence from obsidian provenience studies. The ethnographic record links Drews Valley most directly with the Modoc, as Ray (1963: 210) identified the valley as a Modoc summer village site for "root digging, seed gathering, and hunting, particularly bears." The obsidian evidence suggests that the ethnographic Modoc dual village (winter-summer) pattern may have become established within the last ca. 1,300 years.

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Cross-Cultural Folk Classifications of Ethnobotanically Important Geophytes in Southern Oregon and Northern California

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A confusing variety of common names has been applied to "root foods" used by Native American peoples in the Far West. This analysis references many of these names to current scientific nomenclature. Such analysis provides a foundation for a better understanding of the role of these foods in the economies and cultures of indigenous peoples. This report concentrates on ethnographically recorded species in the Oregon-California border region, although the framework is more broadly applicable.

ELASTIC and inexact folk taxonomies exist for geophytes ("roots")[1] used as food resources in the Far West. These cross-cultural, geographically variable, and idiosyncratic taxonomies have been used by Native Americans, Euroamerican settlers, anthropologists, and historians to classify various species of Native American foods. Portions of these taxonomies survive in field notes, ethnographies, and historical sources, as well as within the folk vocabularies of Native American and Euroamerican peoples. Those who incorporated these categories into oral and written descriptions during the early postcontact period have left anthropologists to puzzle out their intended taxonomies as best they can.

An analysis of these folk categories provides a better perspective with which to evaluate ethnobotanical aspects of the ethnohistoric record, enabling anthropologists to more accurately identify plants mentioned in ethnographic, historical, and folk literature. In turn, this has enabled anthropologists to better evaluate the role of geophytes in the economies of native peoples of the Far West. Historically, the role of these plants in indigenous economies has been largely unappreciated; for example, a lack of understanding of the complexity and finesse involved in identifying, harvesting, processing, and storing these resources contributed to a derogatory use of the term "digger." Investigation of geophyte species and their role in the presettlement economies of the Far West is important, for it has led to a re-evaluation of the significance of these resources, as well as a concomitant re-evaluation of the importance of women's contributions to subsistence in traditional Native American economies (Hunn 1981; Thoms 1989; Prouty 1995).

Edible geophytes, most of which are found in the Apiaceae and Liliaceae families, are an enigmatic group of plants, both for botanists and anthropologists.[2] Botanists, using different criteria for assigning species designations, have shifted plants from one taxon to another. The vernacular nomenclature is even more confusing. Distantly related plants are often given the same common name, and individual species frequently