Prehistoric Use of the Coso Volcanic Field. Amy J. Gilreath and William R. Hildebrandt. Berkeley: Contributions of the University of California Archaeological Research Facility No. 56, 1997, x + 202 pp., 12 maps, 26 figures, 9 plates, 87 tables, $25.95 (paper).

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Over a century ago, William Henry Holmes inspected a gigantic pile of chert quarry blanks at Rock Creek, Maryland, not far from his home in Washington, D.C. The blanks bore a striking resemblance to paleolithic tools known from Europe, but Holmes realized that these implements were early stages in the manufacture of stone tools by more recent Native Americans. Holmes (1892) used these insights to help demolish the then-popular notion of an American Paleolithic.

Since Holmes's day, the study of lithic quarries has continued to be a fruitful avenue of archaeological inquiry. The reasons are obvious. Quarries are important because stone tools were essential to prehistoric native economies, not only in that how stone is crafted into tools strongly influences the nature of the archaeological record, but also because the distinctive qualities of stone obtained from certain quarries can allow one to trace ancient patterns of interaction and exchange in some detail.

Yet, despite their prehistoric importance and interpretive potential, quarries can be a real pain. The ethnographic record provides few clues about how stone tool production and transport were integrated into prehistoric economic systems, as metal tools often quickly replaced stone early in the contact period. Worse yet, quarries were usually visited time and again over the centuries. The "quarriers" often left dense jumbles of debris representing different ages and technologies—and then they took away all the useful end products! These factors can turn archaeological recording, sampling, artifact analysis, chronology building, and technological interpretation into daunting tasks indeed.

Such were the prospects and problems facing Amy Gilreath and William Hildebrandt in *Prehistoric Use of the Coso Volcanic Field*, a volume that represents the results of several years of toil at the Coso obsidian quarry in central eastern California. The principal research goal, state the authors, is "to monitor the prehistoric production, use, and exchange of Coso obsidian, and determine the relationship of these activities to other socio-economic developments in the region" (p. 7). Through judicious field sampling, detailed analyses of rejected tools and debitage, and extensive obsidian hydration dating, the authors develop a history of stone tool production at Coso and place it in the context of the vast economic network that Coso supplied. The result is valuable both as an account of changing production patterns at an important toolstone source for southern California, as well as an example of the application of well-grounded archaeological methods to solve some of the difficulties associated with studying quarries.

The Coso Volcanic Field, located south of Owens Lake in the northern Mojave Desert, contains thousands of separate quarry areas on its steep, glassy, rhyolite domes and surrounding ridges and fans. Quarries occur in both primary outcrops and secondary lag deposits. Primary outcrops such as Sugarloaf Mountain, West Sugarloaf, Joshua Ridge, and Cactus Peak are truly impressive, with hundreds of tons of large obsidian boulders. Smaller obsidian pebbles and cobbles are embedded in pyroclastic debris flows and air fall tephra beds. Scatters of these nodules frequently occupy ridgetops, left as a surface lag after finer matrix has eroded away. The nodules in these lag deposits are smaller than at the primary outcrops, but they are more widely distributed and generally more accessible than the primary outcrops.

The fine-quality glass available at Coso had attracted stoneworkers since earliest Archaic Period times, as indicated by numerous Great Basin Stemmed points and a few concave-based Paleoindian points. However, the number of projectile points in the region was not sufficient to put together a detailed chronology of quarry use. Instead, the authors rely mainly on obsidian hydration dating for chronometric control, employing a data base of over 4,600 hydration measurements from the project area.

How these hydration measurements are transformed into chronometers is an important matter. First, what is the hydration rate of Coso obsidian? Several induced hydration experiments have been attempted with Coso glass; indeed, Coso is becoming a sort of standard test bed for different approaches to experimental measurement of hydration rates. These experiments demonstrate that there is probably no single rate for Coso, but rather several different rates depending on the source and chemical content of the glass. However, different experimental protocols yield different and sometimes incongruous results, even when performed (presumably) on the same kind of glass (although a rigorous side-by-side comparison of different methods on known identical glass has yet to be done). The authors review these efforts, but feel that the rates obtained from these induced hydration experiments are not replicable, nor are they especially trustworthy. Instead, they adopt a single rate developed by Mark Basgall (1990), based on artifacts manufactured from West Sugarloaf and Sugarloaf glass found in well-dated, intact, depositional contexts at the Lubkin Creek site (CA-INY-30; Basgall and McGuire 1988) in the southern Owens Valley. For regional comparisons of hydration values, this rate is corrected for effective hydration temperature (EHT) in the region where the artifacts are found.

Having adopted a rate, the authors approach the problem of giving assemblages a date in a couple of ways. For assemblages with hydration values yielding ages less than about 5,500 B.P., the authors assign an assemblage to a certain period based on its average value. Periods used in this analysis correspond to those defined by Bettinger and Taylor (1974), with the Middle Archaic Newberry Period subdivided into early, middle and late. If the distribution of hydration values in an assemblage is bimodal or spread out, the assemblage may be assigned to two separate periods. Large hydration values, estimated to be older than 5,500 B.P., were considered simply "Early," because the hydration rate the authors use is less precise and less securely grounded after 5,500 B.P., and because the evidence suggests that older assemblages have more variable hydration measurements.

One may argue against using a single rate for Coso, when in all likelihood several rates probably apply; and the resulting chronology of events at Coso may change somewhat as Coso hydration rates become better known and more refined. However, the patterns of use at Coso adduced by the authors are unlikely to change much, in my opinion, since they seem to fit well with region-wide cultural patterns dated by other methods. In any case, it is refreshing to find an application of hydration dating that explicitly considers many factors known to be important in controlling rates, and states its assumptions about chronology-building clearly. The attention given by the authors is a signal that obsidian hydration dating is finally coming of age and can fulfill its considerable potential for regional chronological comparisons.

So what happened at Coso? Prior to about 3,500 years ago (Early and Little Lake times), quarry activities focused on lag deposits, with short-term occupations devoted to the on-site production of cores, early stage bifaces, unifacial tools, and formed flake tools. Core reduction dominated at the quarries, while the emphasis was on biface reduction at off-quarry localities. Stone tool production was generalized and opportunistic, "embedded within subsistence-settlement systems characterized by high degrees of residential mobility, minimal use of seed resources, a probable emphasis on hunting both large and small game, and little concern with the inter-regional exchange of obsidian" (p. 178). Evidence of subsistence pursuits dating to this time is limited to a few projectile points and very few millingstones, and most of the short-term occupation in the region was directed towards obsidian procurement.

From 3,500 to 2,300 B.P. (Early and Middle Newberry periods), use of lag quarries persisted, but use of these quarries had waned by Middle Newberry times. The abundance of off-quarry reduction areas increased significantly compared with the previous period. Bifaces were the focus of production both at the quarries and off-quarry staging areas. Occupation continued to be short-term with an emphasis on obsidian procurement, but a greater differentiation among site types and increased numbers of milling equipment, projectile points, and other tools may indicate a slightly greater subsistence focus and somewhat longer term settlements.

A major acceleration in lithic production and a marked shift in production patterns are recognizable from 2,300 to 1,275 B.P. (Late Newberry Period). Primary outcrops on Joshua Ridge and Sugarloaf Mountain (Elston and Zeier 1984) were heavily exploited for specialized biface production; lag quarries were no longer used. Quarries at these primary outcrops focused on high-quality seams of glass, yielding early-stage bifaces significantly larger than those previously made at the lag quarries. Biface production areas located away from the main primary quarry outcrops are also plentiful. Other kinds of end products (unifaces, flakes, cores) are extremely rare. The Late Newberry Period was the heyday of specialized biface production at Coso, with an extensive network of obsidian exchange that encompassed Owens Valley, the southern Sierra Nevada, and population centers in coastal southern California.

Between 1,275 and 650 B.P. (Haiwee Period), use of the Coso region declined precipitously: only one quarry and one biface production station are reported here. However, considerable obsidian continued to flow out of Coso, as attested by hydration profiles of obsidian artifacts from surrounding regions, especially the deserts to the south and southeast. Apparently, primary outcrops were still being quarried intensively, but did not involve many off-quarry staging areas. The authors surmise that "these changes probably reflect production by a limited number of local people who regularly exploited favored seams of obsidian, and transported the products to residential bases outside the Volcanic Field for further reduction (e.g., Coso Junction Ranch). Reduced access to the Coso quarries by non-local people is also supported to some degree by a region-wide reduction in mobility" (p. 179). A small number of seed processing stations, consisting of a hearth feature and a millingstone or two, also date to the Haiwee Period, reflecting limited subsistence activities in the area.

After 650 B.P. (the Marana Period), lithic production declined even further, with little or no specialized quarrying at either lag deposits or primary outcrops. Obsidian hydration profiles from outlying areas show that distribution of Coso obsidian virtually ceased. "Just when mobility had been reduced to a point where some level of control over the quarries could have been achieved," note the authors, "the obsidian production and exchange system collapsed, and the Volcanic Field became the focus of intensive seed processing activities" (p. 179). Seed processing stations substantially increase in number. The dearth of obsidian at these sites renders hydration dating ineffective, but radiocarbon dates on associated hearths consistently yield Late Prehistoric Period ages. Nonportable, well-worn milling equipment at these sites may indicate that they were established near productive seed patches and were regularly revisited.

This descriptive story is strongly supported by detailed chronological and technological analyses, both from Coso itself and from outlying regional records as well. Regarding the causes of the dramatic shifts in production at Coso, the authors are more speculative and tentative. Following a brief review of obsidian production curves elsewhere in California and Oregon, and a short discussion of previous explanations for notable shifts in production, the authors posit their own interpretation. The great surge in production during Late Newberry times, they suggest, resulted from a more regular settlement schedule among residentially mobile populations, coupled with heightened demand for toolstone. In turn, "[i]ncreased predictability of settlement locations during the annual subsistence-settlement cycle is hypothesized to have allowed regularized exchange relationships to develop" (p. 178), resulting in greater movement of high-quality glass between groups. Nonlocal people did not entirely rely on exchange, but may have scheduled visits to Coso to obtain their own supplies as well: "the acquisition and distribution of obsidian reached peak proportions when various groups had access to the quarries. Whether they originated from across the Sierra Nevada, or were east-side people conducting exchanges with westerners and southerners during a regularized seasonal round, the crucial point is there was a demand for obsidian and little or no constraints inhibiting its acquisition" (p. 181).

The shift in production and distribution during Haiwee times may have to do with increasing territoriality and a changing valuation of toolstone. Residential groups living near Coso may have controlled and limited access to quarry areas. Adoption of bow and arrow hunting technology and greater emphasis on plant foods may have reduced the need for large amounts of exported obsidian. Why the distribution of Coso glass seems to have shifted away from the Owens Valley/southern Sierra Nevada towards the deserts to the south and east at the same time, remains uncertain. The trends toward restricted territoriality and increasing seed exploitation culminated in the Marana Period, and the regional exchange system collapsed as obsidian declined as an exchange commodity, Coso was no longer an important toolstone source, and the Volcanic Field became a seed-gathering plot for local folk.

The causes put forward here, and the region-wide developments that they imply, should be grist for hypothesis-testing for years to come. In testing any such hypotheses, this volume will serve as a benchmark: the patterns of technology, production, and distribution of Coso obsidian that are carefully detailed in this volume will be important archaeological facts that any hypothesis must accommodate to be successful. Likewise, the methods of analysis used in this study of the Coso Volcanic Field should prove valuable at many other stone tool production sites. Should the causes suggested by the authors be substantiated by future research, they will no doubt yield important lessons for changing patterns of stone tool production and exchange in other regions of the world beyond Coso and southern California. All of which shows that laboring in the quarry can be well worth the effort.

REFERENCES

Basgall, Mark E.
1990 Hydration Dating of Coso Obsidian: Problems and Prospects. Paper presented at the annual meetings of the Society for California Archaeology, Foster City.

Basgall, Mark E., and Kelly R. McGuire
1988 The Archaeology of CA-INY-30: Prehistoric Change in the Southern Owens Valley, California. Report on file at California Department of Transportation, Office of Environmental Analysis, Sacramento.

Bettinger, Robert L., and R. E. Taylor
1974 Suggested Revisions in Archaeological Sequences of the Great Basin and Interior Southern California. Reno: Nevada Archaeological Survey Research Paper 5:1-26.

Elston, Robert G., and C. D. Zeier
1984 The Sugarloaf Obsidian Quarry. Naval Weapons Center Administrative Publication 313, China Lake, California.

Holmes, William H.
1892 Modern Quarry Refuse and the Paleolithic Theory. Science 20:295-297.

The Chumash and Their Predecessors: An Annotated Bibliography. Compiled and annotated by Marie S. Holmes and John R. Johnson. Contributions in Anthropology No. 1, Santa Barbara Museum of Natural History, 1998, xiv + 228 pp., 1 map, 3 indices, $32.50 (paper).

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Twenty years after Ballena Press published Eugene Anderson's (1978) updated bibliography of the Chumash, the Santa Barbara Museum of Natural History has released a beautifully produced current bibliography of the Chumash, compiled and annotated by Marie S. Holmes and John R. Johnson. Significant numbers of new published works in all areas of Chumash studies have appeared since the 1970s, as scholarly and educational interests in the cultural heritage of this southern California group has expanded. As a result, the full scope of this literature has grown far beyond the grasp of most individual scholars. Holmes and Johnson pull together an astounding 1,177 original references which feature information on one or more aspects of Chumash life, complemented by nearly 100 citations of published reviews of books and other major works on the Chumash. Every serious student of Native Californian lifeways will want to have this volume. It is a well-organized, eminently useful sourcebook for research endeavors of all kinds, and readers will undoubtedly share my experience in using it—finding, at the very least, dozens of previously undiscovered, interesting new (or old) entries.

The volume opens with a map of Chumash towns in the late 1700s, which helps to orient readers to the important placenames and major geographic features of the contact era. The eight major sections represented are *Ethnology and Ethnohistory, Rock Art, Linguistics, Archaeology, Physical Anthropology, First Contacts: 1542-1780, Juvenile and Education,* and *Reviews*. Three invaluable indices at the end allow quick access to authors, subjects, and archaeological sites. Johnson's *Foreword* describes the nature of Chumash population and political organization, the origin of the appellation "Chumash," and the history of some of the early explorers and researchers who contacted the Chumash between the 1540s and 1930s. While it is worth noting that Johnson's view of heterarchical relations among the Chumash is not one shared by all scholars working on these problems, the *Foreword* as a whole is a balanced and essential introduction to the big issues and influential contributions found within this impressive body of literature. Extensive and appropriate acknowledgement is given to John P. Harrington, whose 200,000-plus pages of rich, multilingual, convoluted notes on the Chumash, deposited at the National Anthropological Archives of the Smithsonian Institution, serve as the source