Coping with Conflagrations: The 1999 Archeological Prescribed Fire Survey at Lava Beds National Monument

Nelson Siefkin and Patrick Brunmeier, National Park Service, Redwood National and State Parks

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Recent research indicates that medium to high intensity prescribed fires and wildfires can have an adverse effect on obsidian hydration. This is problematic for Federal and state cultural resource managers in the western United States, where obsidian is ubiquitous and years of fire suppression have necessitated the use of fire to reduce hazardous fuel loads and to return fire to fire-dependent ecosystems. At the forefront of this effort is the National Park Service (NPS), where the use of fire as a management tool has been growing steadily since the 1960s. Lava Beds National Monument in northeastern California has both considerable amounts of obsidian and an active prescribed fire program. The entire Monument was listed as an Archeological District on the National Register of Historic Places in 1991, necessitating earnest consideration of the effects of prescribed fire on obsidian, such as degree of threat, sampling strategies, and protective measures. This process is discussed in relation to the Three Sisters Prescribed Burn Unit, which was surveyed for cultural resources in the summer of 1999.

Fire and Obsidian Hydration

Experimental studies identify fire temperature and duration as the key variables when evaluating the effects on obsidian hydration. The majority of the studies indicate that obsidian exposed to temperatures at or exceeding about 260° C will loose all or some of their hydration data (i.e., the hydration rind atrophies or disappears altogether), and the higher the temperature, the more severe the damage. The issue of duration is less well understood, and some researchers feel any artifact directly exposed to temperatures at or exceeding the 260° C threshold will be effected regardless of the duration of that exposure. In simplest terms, both temperature and duration relate most directly to fuel conditions; the heavier the fuels, the hotter and longer the fire will burn in a particular locale. The results of recent experimental studies on the Modoc, Eldorado, and Tonopah national forests clearly reveal the correlation between fuel loads and damage to obsidian hydration rinds (SLIDE 1).

Until recently and for a variety of reasons, cultural resource managers have considered the immediately tangible fire-related effects (e.g., cutting handline through a site) over the more “invisible” consequences, such as damage to obsidian hydration rinds. Central to this rationale has been the notion that such areas have burned many times in the past, and that all obsidian has been previously subjected to the effects of fire, or that sites contain subsurface components that are protected from the effects of fire. In the absence of obsidian and other studies, however, these are nothing more than untested hypotheses, and include some potentially untenable assumptions. For example, is it correct to assume that the intensity of today’s post-suppression fires is the equivalent of those that burned in pre-suppression times? Or, is it safe to conclude that subsurface obsidian (by its mere presence below surface) has not been exposed to the effects of fire in the distant or recent past? Further, Krista Deal has suggested that fire-effected surface obsidian hydration data may actually constitute an important source of information for landscape level fire history reconstructions. For example, higher ratios of surface obsidian with readable hydration bands than those without implies that few, if any, hot and/or long-smoldering fires occurred in those areas where the obsidian was found. Several researchers are exploring the possibility that heat-damaged obsidian may actually re-hydrate after being exposed to subsequent fire(s), and if physical markers of re-hydration can ultimately be discerned (e.g., wide diffusion front coupled with a bright, distinct, readable band), “dates” for past fire events may be obtainable. Together, these points indicate that surface hydration data have much to offer, whether fire-effected or not.

Presuming obsidian hydration data are considered a resource value worthy of protection, attempts should be made to evaluate the integrity of those data (through obsidian studies) and/or implement protective measures to preserve those extant data that may be present. Up to this point, a lack of funding and other issues have often weighed against an empirical evaluation of the former ("You don't expect Fire Management to pay for obsidian studies do you?"). In the case of the latter, a variety of options are available, ranging from tactics of total exclusion (e.g., handlines, sprinklers) to those that allow fire to occur within a site, but under conditions that will not effect the resources (e.g., collect artifacts prior to the burn, reduce on-site fuels, burn under cool/wet conditions). The decision to implement exclusionary or non-exclusionary tactics is usually based on a combination of the resources present, local vegetation, expected fire behavior, and long and short-term management considerations.

The Three Sisters Prescribed Burn, Lava Beds National Monument

The 5,000 ac. plus Three Sisters Prescribed Burn Unit is located in the east-central portion of Lava Beds National Monument, 4,460 ac. of which fall within the boundaries of the Monument, and the balance on Modoc NF (SLIDE 2). The unit ranges from 1,385 to 1,200 m. in elevation, and the rolling volcanic landscape is interspersed with volcanic trenches, collapses, lava flows (SLIDE 3) and a few low buttes (SLIDE 4). Vegetation is dominated by a sagebrush/bunchgrass community (SLIDE 5), as well as mature juniper woodland in the unit's southeastern corner (SLIDE 6). The nearest surface water is found in Tule Lake 2 km. to the northeast, but two ice caves are present at the unit's southwestern corner (SLIDE 7). Importantly, historic Lyons Road Trail, marking the western boundary of the unit, passes through one of the few lava-free corridors between Tule Lake and uplands to the south (SLIDE 8, SLIDE 9). It is very likely that this corridor was used in aboriginal times, and served both as a conduit for Medicine Lake obsidians and an access route to upland resources for the inhabitants of lakeside villages.

Eidsness and Smith identified a tripartite aboriginal settlement pattern for the Monument – Lakeshore Zone, Ice Cave Zone, and Intermediate Zone. The Lakeshore Zone is found within about 2.5 km. of the shore of former Tule Lake, and is largely absent from the Three Sisters Unit. It is characterized archeologically by very high site density, and a number of large sites with architectural remains, diverse artifact assemblages, abundant features, and well developed midden deposits. The Ice Cave Zone includes areas within a radius of 2.5 km. of each ice cave, and is characterized by moderate to high site density and moderately diverse artifact assemblages. Portions of Ice Cave Zone are found in the southwestern corner of the unit. The Intermediate Zone includes the balance of the Monument, and exhibits a low to moderate site density, and narrow range of artifact types (usually limited to flaked stone tools and debitage). The Intermediate Zone constitutes the vast majority of the Three Sisters Unit. Previous archeological survey in the Three Sisters Unit was restricted largely to inventory along the trails comprising the unit boundaries; lithic scatters were documented in association with both ice caves, and scattered along the western boundary.

The request for an archeological clearance in the Three Sisters Burn Unit prompted us to begin to think about such issues as the threat to obsidian, sampling strategies, and protective measures. In terms of threats, it was clear that fuel conditions in portions of the unit were sufficient to adversely effect obsidian hydration data. Fire history information indicated that several wildfires burned within and around the unit in the 1900s. However, the presence of oversized vegetation in portions of the unit suggests that past fires did not burn homogeneously (SLIDE 10), a fact that is readily observable in other recent prescribed burns (SLIDE 11, SLIDE 12). Further, pre-suppression fire return intervals in the sagebrush-bunchgrass community was probably less than 10 years, and past fuel loads were very likely not heavy enough to have caused major damage. While no funding was available from which to evaluate the integrity of hydration data within the unit, given the reasons above, it was suspected that readable hydration rinds should be present.

As such, it was decided that survey should be conducted in *all* areas likely to contain archeological resources (prescribed burns on the USFS lands in northeastern California are routinely subjected to 100% survey coverage). Given limitations in time and personnel, the Ice Cave Zone portions of the unit would be completed first, followed by the Lyons Trail corridor, and finally, all other lava-free areas. The dichotomy between the lava and lava-free areas was based upon the notion that the latter should have witnessed both the most intensive use and that fuels tend to be heavier and more continuous in non-lava contexts. This perception is admittedly biased towards the discovery of sites with obsidian, and we acknowledge that resources such as rock art, vision quest markers, and crack burials may be present and vulnerable to damage.

Previous archeological survey at Lava Beds revealed that lithic scatters, particularly those found in the Intermediate Zone, tend to be small (often less than 100 m^2), contain from a few to several hundred artifacts, and retain an extremely high degree of spatial integrity (SLIDE 13). Given that most probably resulted from a single or very few depositional events, it stands to reason that these scatters should be very useful for improving our understanding of regional landuse patterns, technological shifts, ethnic replacements, and source specific obsidian hydration rates, particularly when compared to the extensive but more muddled deposits found near the lakeshore and ice caves.

Discovering small sites in broken topography can be highly challenging, prompting us to deviate from the traditional survey methods previously employed at the Monument. First, digital orthoquads (at 1:6,000 scale) were used to identify lava and lava-free zones, and to keep track of survey coverage (SLIDE 14). Second, rather than try to traverse the unit with long-distance, narrowly-spaced transects, we instead constructed contiguous 50 x 50 m. cells across the landscape, marking the corners with flagging tape, and surveying the interior with 5 m. transects (SLIDE 15).

A total of 59 previously unrecorded sites and 91 isolates were documented during the course of the project. No survey acreage totals are available yet, but probably between 500 and 1,000 acres were inventoried. With the exception of one sparse scatter of freshwater clamshell and an isolated pestle fragment, flaked stone comprised all of the prehistoric resources. A number of diagnostic projectile points were encountered (SLIDE 16, SLIDE 17, SLIDE 18). Basic level debitage analysis revealed a predominance of early to late stage biface thinning flakes, and some late stage core reduction flakes. Most of the obsidian bears strong visual resemblance to Medicine Lake Highland sources.

As expected, survey in the Ice Cave Zone of the unit revealed a very high site density (SLIDE 19). Assuming many of these sites are related to the use of the nearby ice caves, obsidian hydration data may provide a useful means of evaluating the reliability of these caves as water sources through time – for example, gaps in the hydration record may be indicative of periods when water was not available. Another concentration of sites was detected along Lyons Trail in the northern portion of the unit (SLIDE 20). This area corresponds with a constriction in the lava flows that lie adjacent to the trail corridor. Site density tends to be much lower on either side of this constriction, with the probable implication that lava free corridors served as major routes of travel. Finally, a number of sites were encountered in and near the juniper woodland in the southeastern portion of the unit (SLIDE 21). The results from this area are important in that resource density is high despite being a fair distance from water and obvious travel corridors, and also that virtually no resources were recorded in the adjacent USFS portion of the unit where 30 m. transect intervals was used.

The principle goal of this project was to protect sites with surface obsidian from the effects of the prescribed fire. The typical strategy employed by the USFS in northeast California is to construct handline around each resource. While unquestionably effective, drawbacks to this tactic include extensive ground disturbance (generally frowned upon in wilderness areas of National Parks and Monuments), and the creation of unburned “islands” of fuel that will burn even hotter in the future and/or attract increasingly sophisticated artifact collectors. Given the rather small size of the sites, it was decided to manually clear vegetation as each was recorded. All larger brush was flush cut with bow saws and pulaskis, while smaller vegetation was pulled by hand (SLIDE 22, SLIDE 23). In a few instances, heavier fuels, such as standing (SLIDE 24) and fallen trees (SLIDE 25) were removed. For larger sites and those located on trails, a fire crew was utilized to clear vegetation at the end of the tourist season (SLIDE 26). The object of the process was not to completely denude the site area of vegetation, but rather to remove heavier accumulations and to break the continuity of the fuels such that fire would not carry well (SLIDE 27, SLIDE 28). Studies indicate that radiant heat in low and medium intensity fires is not expected to be intense farther than about one meter from the source, and this spacing was maintained when clearing vegetation around obsidian scatters. Emphasis was placed on protecting those obsidian artifacts that were detected in the field, and it is possible that scattered pieces on the margin of a site could be effected by fire. Finally, while most of the unit will be ignited via aerial ignition, areas with larger site clusters will be hand ignited to avoid inadvertent resource damage.

Recent studies indicate that even a very thin covering of mineral soil can successfully insulate obsidian from the effects of low and medium intensity fires. Archeology in the Lava Beds area is somewhat unique in that soil erosion and development is slow to non-existent, and that even very early sites are found in surface contexts. Nonetheless, subsurface deposits do occur, suggesting that a portion or all of the contents of some sites are already protected (SLIDE 29).

Finally, in addition to providing short-term protective benefits, vegetation clearing will act to protect obsidian in the event of wildfires and other unplanned situations. As a result of fire suppression, heavier fuels such as juniper and sagebrush have expanded at the expense of cooler-burning bunchgrasses. With the application of prescribed fire, a shift to more fire tolerant species should occur (SLIDE 30). In a perfect scenario, a single episode of manual fuel load reduction along with periodic maintenance prior to subsequent burns may provide a more-or-less permanent mitigation against fire effects.

It should be noted that conditions in the Three Sisters Unit lend themselves to the effective use of manual fuel load reduction, including relatively sparse fuels and small sites. However, because prescribed fire is a tricky business, it could be that a site needs to be treated more than once if there is a long interval between the survey and burn, or if the burn is delayed until the following year (SLIDE 31). Other areas of the Monument have very different fuel and site conditions (SLIDE 32- Ponderosa Pine), although manual fuel load reduction was recently employed with good success on a large, heavily forested lithic scatter in Lassen Volcanic National Park (SLIDE 33). What remains to be determined is the overall effectiveness of the technique as well as any unforeseen and long-term ramifications.

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