Following the obsidian trail: clues to prehistoric exchange networks in Baja California

Lee Panich
University of Santa Clara

Antonio Porcayo Michelini
Centro INAH Baja California

Introduction

In keeping with the theme of "Maritime Routes, Mission Trails and Native Pathways," this paper will explore the movement of obsidian artifacts and raw material across the indigenous trails of northern Baja California during the late prehistoric period. The data from our paper are drawn primarily from recent excavation, survey, and geological studies led by Antonio Porcayo Michelini. This work focused on northeastern Baja California, including the site of Campo Mazatlán, near San Felipe, and in the Sierra de las Tinajas, during Proyecto Registro y Rescate de Sitios Arqueológicos de Baja California: Fase Municipio de Mexicali, Temporadas 10-12 (Porcayo y Rojas 2016, 2017, 2018). From these projects, we analyzed approximately 250 obsidian artifacts and geological specimens using x-ray fluorescence (XRF) provenance analysis. We compare this large dataset to regional patterns in the distribution of obsidian artifacts throughout northern Baja California, as well as a growing body of ceramic provenance data. Ultimately, we aim to address long-standing questions about where indigenous people acquired raw geological nodules and how they moved obsidian from those source areas to sites across northern Baja California and into southern California.

This research builds on a long, but intermittent history of research into archaeological obsidian in Baja California (e.g., Banks 1971; Bouey 1984; Douglas 1981). Obsidian is an important material for understanding ancient exchange networks because of the fact that each geological source exhibits a unique chemical signature. One of the most basic tasks for obsidian researchers in any region, then, is to define the geological availability of artifact-quality obsidian nodules. In northern Baja California, this goal has been complicated by the relatively inaccessible nature of the desert terrain where many geological deposits of obsidian occur. A further challenge is the fact that most known obsidian chemical groups occur in secondary geological deposits such as arroyos or beaches that in some cases stretch for dozens of kilometers. Accordingly, the primary geological outcrops may have been less important in prehistory, and in some cases may no longer exist. Nevertheless, our research over the past decade has identified most of the major obsidian chemical groups used by the region's indigenous people and we have begun to define the areas in which geological nodules could be acquired from either primary or secondary contexts.

Direct access or exchange?

Despite lingering uncertainties about the exact location and chemical variation of northern Baja California's many obsidian sources, archaeologists have noted several patterns in the distribution of archaeological obsidian. These patterns, in turn, point toward hypotheses about how indigenous people acquired and conveyed obsidian in the past.

One of the first interpretations of regional obsidian conveyance was presented by Jerry Moore (2001), based on his work in the El Rosario-San Quintin region. He noted obsidian artifacts at 15 out of the 275 sites recorded in his regional surveys, nearly all of which yielded radiocarbon dates between roughly AD 700 and the onset of the colonial period. Most of the artifacts in his sample originated at source areas along the Gulf of California, such as Puerto el Parral and San Felipe (see Panich et al. 2017 for updated source assignments). Based on the initial XRF results, Moore interpreted the obsidian form his El Rosario-San Quintin sites as evidence of a "cross-peninsular" settlement system in which obsidian was "likely acquired during seasonal movements between the Gulf, the interior and Pacific coast zones" (Moore 2001:45; and see Gay et al. 2017). This direct access hypothesis, however, fits poorly with the generally accepted model of indigenous social organization in northern Baja California, which focuses on localized patrilineal clans (Hicks 1963; Mixco 2006; Ortega 2004; Owen 1965). If these clans, called *shimuls*, each maintained its own territory, then it seems unlikely that Pacific coast groups would have been able to obtain obsidian directly from geological deposits on the opposite side of the peninsula.

In his Master's research, Danny Sosa Aguilar (2014) tested whether obsidian conveyance on the Baja California peninsula conforms to the expectations of a down-the-line exchange system. In this model, the prevalence of a particular obsidian chemical group decreases at a regular rate as distance from the source, or source area, increases. His research suggests that sources such as Valle del Azufre do fit with the down-the-line exchange model, although his research did not cover the entirety of the northern peninsula. Perhaps the important implication of Sosa Aguilar's research is that obsidian conveyance in Baja California does not exhibit a clear directionality, suggesting that certain social factors structured its movement across the landscape.

A final observation regarding obsidian distribution was first elaborated by Don Laylander (2005), who noted that native language boundaries may have constrained the north-south distribution of obsidian from particular geological sources. Our research over the past decade has largely supported this hypothesis, at least for the northern peninsula where the precontact distribution of particular ethnolinguistic groups is relatively well understood (Panich et al. 2015, 2017). For example, our studies have demonstrated that artifacts made from San Felipe and Puerto el Parral obsidian are fairly common in the Kiliwa ethnolinguistic province but rarely occur to the north, in the territories of groups speaking Paipai, Kumeyaay, or Cucapá. Similarly, obsidian from Tinajas, Lágrimas de Apache, or Obsidian Butte is rarely found south of the proposed border between the Paipai and Kiliwa ethnolinguistic ranges. Within the northern region, Tinajas obsidian is most closely associated with Paipai and Kumeyaay sites, while Lágrimas de Apache seems to have been used primarily by Cucapá groups.

Thus, it appears that language boundaries limited the distribution of obsidian along the north-south axis of the peninsula, at least in our study area. The cultural processes that structured east-to-west movement of obsidian, however, remain an open question. Here we address two basic mechanisms of obsidian conveyance. As suggested by Moore (2001), one possible scenario is that native people practiced a cross-peninsular settlement pattern in which they directly acquired obsidian from source areas in the eastern peninsula and carried it to sites on the Pacific coast. A second possible explanation would be that obsidian artifacts traveled along exchange networks between localized *shimuls*, in a down-the-line exchange system between obsidian-rich groups in the east and others living to the west where obsidian does not naturally occur.

Methods and materials

In March of 2018, we analyzed several hundred obsidian artifacts from throughout northern Baja California at the laboratory of the Baja California INAH Center in Mexicali. The archaeological obsidian was primarily drawn from the Campo Mazatlán site and sites recorded in the Mina Real de Ángeles project, notably MRA-20 and MRA-21. As discussed in other papers in this symposium, we additionally analyzed a small sample from archaeological sites on the Pacific coast, including La Jovita, Bajamar, and Costa Azul. Previous archaeological obsidian provenance studies conducted by the authors provided additional contextualization to the patterns we discuss in this paper.

For the analysis, we used a Bruker Tracer III-SD handheld x-ray fluorescence spectrometer using standard instrument operating protocols and calibration procedures (see Panich 2016:522-524). Artifact data calibrated to parts-per-million were compared to our library of geological obsidian samples from the region, which had been previously analyzed using the same XRF instrument.

As an exploratory exercise, we also analyzed several ceramic artifacts from the sites of MRA-21, La Jovita, and others using the same XRF instrument in March 2018. Unlike obsidian, there is no widely accepted calibration curve used to generate quantitative data for ceramic artifacts using the Bruker handheld XRF instrument. Instead, we employed a semi-quantitative "net peak area" technique to explore chemical similarities and differences of the ceramic artifacts.

Obsidian results

MRA area

We analyzed 78 obsidian artifacts from the MRA project area, including 51 from MRA-20 and 23 from MRA-21. Both sites are approximately 5 km from the Lágrimas de Apache obsidian source, near the mouth of the Colorado River. Interestingly, the sites are located along an arroyo that contains obsidian nodules that have eroded out of a primary geological deposit somewhere to the west, in the Sierra de las Tinajas. Our preliminary analysis of these nodules indicates that they are chemically very similar to the nearby Lágrimas de Apache source, but further analysis is certainly warranted. We are awaiting the results of radiocarbon dates from site MRA-20, but the deposits are thought to date to the late prehistoric period, ca. AD 1600-1800.

Not surprisingly, the results of the obsidian provenance analysis of artifacts from the MRA project area demonstrate a heavy reliance on materials available in the immediate vicinity. Eighteen specimens match the Lágrimas de Apache source, some 5 km to the east. Another 33 could either be from the Lágrimas de Apache source or the chemically similar obsidian found in the arroyos adjacent to the sites. Twenty specimens, including two projectile points, were manufactured using Tinajas obsidian, which we have documented in secondary geological deposits in the nearby Laguna Salada. The closest location of these secondary Tinajas deposits to MRA-20 or MRA-21 is approximately 30 km to the northwest, but closer deposits may exist. The remainder are almost all from an as-yet-unknown obsidian chemical group.

Campo Mazatlán

We also analyzed 115 obsidian artifacts from Campo Mazatlán. This sample included all 28 projectile points collected from the site, but just a small fraction of the several hundred pieces of obsidian debitage in the assemblage. The Campo Mazatlán site is a large shell midden, approximately 40 km south of the city of San Felipe. The site is directly in the middle of a large alluvial fan where multiple arroyo systems wash out of the Sierra de San Felipe directly to the west. Our geological samples include nodules from these arroyos, as well as from beaches in close proximity to Campo Mazatlán. All of the geological obsidian nodules analyzed from this area match the San Felipe chemical group (Panich et al. 2012). Although the exact location of the primary geological deposits remains unknown, it is safe to say that artifact-quality obsidian from the so-called San Felipe source was available just meters from the native settlement at Campo Mazatlán.

The vast majority of obsidian artifacts in our current sample from Campo Mazatlán match the San Felipe chemical group. This included 24 of the 28 projectile points, as well as more than 95 percent (n=83) of the debitage in our sample. This is not surprising, given that prehistoric people living at Campo Mazatlán could obtain limitless supplies of obsidian from the beach just footsteps away. Nevertheless, we did note seven artifacts, including three projectile points, that appear to be from the Puerto el Parral obsidian source roughly 30 km to the southwest. One additional projectile point is from the more distant Lágrimas de Apache source. We observed a similar pattern at the nearby site of El Faro, where projectile points exhibit some source diversity and nearly all the debitage is from the locally available San Felipe source (Panich et al. 2015).

Regional Context

Sites like Campo Mazatlán and those in the MRA area were clearly centers of obsidian acquisition. They are in close proximity to geological deposits of obsidian and contain large numbers of obsidian artifacts. Yet we know little about how these sites fit within patterns of regional obsidian conveyance. Do they represent the easternmost edge of the cross-peninsular procurement ranges proposed by Moore? Or were they key nodes in a regional exchange network that sent obsidian from eastern supply areas to communities living to the west in the peninsular ranges and on the Pacific coast? To begin to answer these questions, we can look to broader regional patterns in the distribution of archaeological obsidian.

Northern Baja California has three major physiographic zones: the Gulf coast and adjacent deserts, the mountain ranges that run down the center of the peninsula, and the Pacific coast and nearby coastal plains. Moving from the obsidian-rich eastern desert region of northeastern Baja California, the next major zone includes the Sierra Juárez and the Sierra San Pedro Mártir.

Eastern Deserts

In 2015, we analyzed a sample of 81 obsidian artifacts from the site of El Gran Abrigo, on the southern edge of the Laguna Salada. A single radiocarbon date from this site indicates an occupation between AD 900 and 1020. Almost 95% of the obsidian artifacts were from the Tinajas source, which is available in secondary geological deposits no further than 15 km to the west. Most of the other artifacts were from the nearby Lágrimas de Apache source (Panich et al. 2017). As with MRA-20 and MRA-21, this site is likely indicative of the local procurement of geological obsidian nodules through direct access to the deposits.

Sierra Juárez and Sierra San Pedro Mártir

In the Sierra Juárez, we note relatively robust obsidian assemblages at certain sites. Focusing on obsidian from the Tinajas chemical group, Abrigo del Metate at El Vallecito had 33 pieces of Tinajas debitage, while Mission Santa Catalina to the south had 35 pieces of Tinajas obsidian, including both debitage and projectile points (Panich et al. 2015). Surprisingly, we have identified no obsidian artifacts from the Lágrimas de Apache source at sites in the Sierra Juárez.

Very little obsidian provenance data is available for sites in the Sierra San Pedro Mártir, but one site in our study included nine artifacts made from San Felipe obsidian that would have been available from geological deposits to the east.

Despite their limitations, these data suggest that groups living in the mountains could acquire obsidian materials originating further east but that such access was not equal to that of people living closer to the source areas. One possible exception is the site of BC-73, where Frederic Hicks collected 100 pieces of debitage and four projectile points in the late 1950s. The site location is unknown except for its description as a "series of small caves" somewhere in ancestral Paipai territory, presumably in the Sierra Juárez. Recent research by Brandon Gay and colleagues (2017) determined that all the specimens matched the Tinajas chemical group.

Pacific coast

Comparatively more research has been conducted on the Pacific coast of northern Baja California, including Moore's regional surveys between El Rosario and San Quintin as well as more recent excavation projects between Ensenada and Rosarito. Obsidian, however, is rarely recovered from Pacific coast sites. As noted above, Moore (2001) reported obsidian at just 15 of the 275 sites he recorded. Most of those artifacts were from the Puerto el Parral source, although other obsidians from eastern Baja California were also represented (Panich et al. 2017). Further north, we have collaborated with other INAH researchers, including Dr. Manuel Pérez, Arqlga. María Flores, Arqlgo. Rubén García, and Arqlga. Gengis Ovilla, to analyze obsidian from the sites of La Jovita, Bajamar, and Costa Azul. Thus far, our sample for these three sites contains just 25 artifacts, including 11 from Costa Azul, nine from Bajamar, and five from La Jovita. Nearly all were from the Tinajas chemical group. One flake from La Jovita was from the Lágrimas de Apache source, whereas Costa Azul had one artifact each from Obsidian Butte and Coso Volcanic Field, both of which are north of the international border in California. Over half of the obsidian artifacts from these Pacific coast sites were projectile points.

Down the Line Exchange?

Taken from a broad perspective, these findings align with the expected patterns of down-the-line exchange. In this type of system, obsidian will make up nearly all of the flaked stone artifacts at sites near the source areas but will represent steadily decreasing proportions of lithic assemblages as geographic distance from the source area increases. Within this pattern, obsidian farthest from the source areas should include a large proportion of bifaces, whereas sites closest to the source area should exhibit more diversity in form (Baugh and Ericson 1994; Eerkens et al. 2008). We admit that our study suffers from poor geographic coverage and uncertainties about the other lithic artifacts recovered from many sites in our sample, but the general pattern in northern Baja California points toward down-the-line exchange as the principal mechanism by which obsidian was conveyed from east to west across the peninsula.

Within the overarching parameters of such as system, we note some additional factors that must be considered. One issue, noted by Richard Hughes (2011) in his study of exchange systems in California and the Great Basin, is the difference between geographic distance and social distance. In the case of the latter, social barriers like linguistic boundaries may hinder the flow of materials across even minor distances. Yet, in the case of Baja California, it is thought that most broadly defined ethnolinguistic groups occupied east-west ranges that included both Gulf and Pacific coast territories. Theoretically, then, *shimuls* speaking the same language may have exchanged obsidian in an east-to-west direction more easily than they could north or south. This social distance may explain why we see so little Lágrimas de Apache obsidian—the geological source or sources of which are in the Cucapá ethnolinguistic territory—in Paipai and Kumeyaay sites directly to the west in the Sierra Juárez.

Ceramic Studies

If obsidian represents an important material that was conveyed from east to west in a down-the-line exchange system, we may also consider what types of materials moved in the other direction. To begin to address this issue, we can turn to the semi-quantitative chemical data obtained from ceramic artifacts collected from sites present in our obsidian study. At this time, this list includes MRA-21 in the east, from which we analyzed of 25 artifacts, including a large number of modified ceramic disks. From the Pacific coast, we analyzed various vessel and smoking pipe fragments from La Jovita (n=24), Bajamar (n=9), and Costa Azul (n=3). Due to the synthetic nature of ceramic artifacts, their chemical characterization is more complex than it is for uniform materials like obsidian, but we make the following observations.

At a broad level, the chemical data suggest clear compositional differences between buffwares and brownwares. Buffwares are characteristic of the alluvial clays of the eastern deserts and Colorado River delta, while brownwares are indicative of the residual clays of the peninsular ranges and the western portions of the region. The chemical groups that macroscopically correspond to buffwares occur only at MRA-21 and not at any of the Pacific coast sites. This pattern suggests that ceramics, unlike obsidian, were not a commodity that was regularly moved from east to west. This is perhaps to be expected, given that all groups in the region made pottery prior to the arrival of Europeans, and therefore presumably would not need to acquire pots via regional exchange.

Among the brownwares, we identified several chemical groups, nearly all of which were present at two out of the three Pacific coast sites. In our previous studies, we have assumed that the most common chemical group associated with fragments of storage or cooking vessels would represent local manufacture (Panich and Porcayo 2014). The small number of sherds from individual sites in this study preclude strong inferences about locally made vessels, but we note that two-thirds (n=16) of the ceramic specimens from La Jovita cluster together, possibly suggesting local manufacture at or near that site. In terms of exchange, sherds from the primary La Jovita group occur at all four study sites including three artifacts from MRA-21. At least 10 other artifacts from MRA-21 also cluster with the brownware fragments from Pacific coast sites, representing roughly one-half of our ceramic sample.

The presence of brownware ceramics at MRA-21 is unexpected given that residents of the site presumably produced buffwares from locally available clays, as indicated by the relatively large chemical group restricted to MRA-21. One clue may be that none of the ceramics from MRA-21 in our sample were utilitarian wares; instead they were all unusual specimens such as modified ceramic disks or smoking pipes. These items likely circulated more widely in precontact Baja California than did vessels used for domestic use. As such, they represent one material that was conveyed from west to east, possibly in exchange for obsidian. Other such materials may include shell beads and pendants, which are known to have been important exchange items throughout the three Californians. Marine shell objects from Pacific coast species, for example, were present at Mission Santa Catalina in the Sierra Juárez (Panich 2010).

Conclusion

The mechanisms of obsidian exchange in northern Baja California are not well understood. In our study, we used the provenance analysis of obsidian artifacts from sites across the region to differentiate between two different possibilities: direct access and down-the-line exchange. Although our data are relatively coarse-grained, they generally fit with the fall-off or "distance decay" pattern associated with down-the-line exchange. In this scenario, we suggest that certain localized lineages controlled obsidian-rich areas near primary or secondary geological sources, from which they exported obsidian material to neighboring *shimuls* in exchange for other items. Based on regional patterning of obsidian distribution, these exchanges most often occurred within generalized ethnolinguistic boundaries. Our findings are supported by provisional ceramic provenance analysis, which shows that brownware ceramics associated with Pacific coast sites are present at the MRA-21 site near the Lágrimas de Apache and Tinajas obsidian source areas. Future research will undoubtedly fill in the gaps in our data collection and geographic coverage, but we believe that by following the obsidian trail we will unlock more clues to the prehistoric exchange networks of Baja California.

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