Obsidian sources of northern Baja California: the know and the unknown

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Introduction

This paper presents the most recent findings of our ongoing study of obsidian sources, distribution and use in Baja California. Even as obsidian provenance studies have proliferated in other parts of western North America, our understanding of the geological availability and cultural distribution of obsidian in the northeastern region of Baja California remains cloudy. The area around the modern city of San Felipe has been thought to be the geological source region of most obsidian artifacts found in archaeological contexts in the central and northern portions of the state of Baja California. Recent research, however, complicates this picture. New sources have been identified in the field, well to the north and south of San Felipe, and laboratory analysis of archaeological specimens and geological samples from secondary deposits has identified multiple unknown sources. In this paper we take stock of the state of knowledge regarding obsidian sources in the northern region of Baja California, ranging from the 30th parallel to the international border.

The data presented here are from an ongoing binational research project, organized by the authors. The project database includes archaeological and geological samples collected by Antonio Porcayo as part of the "Salvamento arqueológico San Felipe-Laguna Chapala", the "Salvamento arqueológico Mina El Arco", and the "Proyecto registro y rescate de sitios arqueológicos de Baja California - fase municipio de Mexicali", as well as archaeological samples collected by Lee Panich during his research at the site of Mission Santa Catalina from 2005-2007. Porcayo and Panich collected additional geological samples in 2011. Trace element analysis was conducted by Steven Shackley using a Thermo Scientific Quant'X energy dispersive x-ray fluorescence (XRF) spectrometer at the archaeological XRF laboratory in Berkeley, California, as well as by Lee Panich using a Bruker Tracer III-D Handheld XRF instrument at Santa Clara University.

The known and the unknown

Few systematic studies of archaeological obsidian have been conducted in the northern portion of Baja California. Relatively sporadic articles published in regional journals have furthered our knowledge of the sources of geological obsidian in the area, but until recently most obsidian from northeastern Baja California has been assumed to be from the San Felipe area. Our research suggests that the picture of geological obsidian availability is much more complicated than originally thought. In this paper, we will discuss the known and unknown sources of the

region as well as their archaeological distribution in cases where that information is available. Due to time constraints, we leave the full cultural implications of archaeological distribution of obsidian artifacts in this area for a future discussion.

The known sources

The first geological source in the region to be definitively located and characterized using comparable quantitative methods was the Puerto el Parral source, located directly south of Arroyo Matomí, northwest of Puertecitos in the northern extent of the Sierra Santa Isabel. This source was discovered during geological fieldwork by Joann Stock and others in the early 1990s (Martín-Barajas et al. 1995; Nagy et al. 1999; Stock et al. 1999), and consists of three localities where marekanites are found embedded in perlitic lava. The archaeological distribution of Puerto el Parral glass extends to the Pacific coast in the San Quintín-El Rosario region, where Moore (2001) reports that it was recovered from multiple sites from varying temporal contexts. It should be noted that Puerto el Parral obsidian is chemically distinct from "San Felipe" obsidian.

Lágrimas de Apache (ASU 12-1), was first recorded by Antonio Porcayo in 2008 (Porcayo and Rojas 2009). This source is located near the mouth of the Colorado River, making it the northernmost known geological source in Baja California. The obsidian is found in masses of perlite at the mid-elevations of a volcanic dome covered in rhyolitic boulders and rocks. Apparent extraction areas have been noted in three places on the dome; in each area, the surface rocks have been removed to expose the perlite lenses beneath. The perlite contains small, rounded to subangular obsidian marekanites, measuring 2-5 cm. The samples analyzed here were obtained directly from the perlite lenses. No debitage or other cultural materials have been noted at the extraction areas (Porcayo et al. 2011), and thus far, only one archaeological specimen, collected from El Mayor, has been assigned to the Lagrimas de Apache source.

El Regino is a small primary source locality approximately 10 km south of Puertecitos. The source was discovered during archaeological reconnaissance for the San Felipe-Laguna Chapala highway project (Porcayo 2011a), and it is characterized by an area of volcanic tuff that includes small, rounded to sub-angular obsidian marekanites up to 5 cm in diameter. The samples analyzed as part of this project were collected from the surface and from secondary deposits associated with road construction. A small rock shelter is located directly on top of the obsidian-bearing strata at El Regino, indicating that prehistory peoples were aware of the source (Porcayo et al. 2011).

The unknown sources

The obsidian referred to as San Felipe glass is perhaps the best known of the unknown sources in Baja California. San Felipe obsidian has previously been recovered from archaeological contexts as far north as Riverside and San Diego Counties, as far south as Bahía de Los Angeles, and as far west as the Pacific coast (Laylander 2006; McFarland 2000; Moore 2001), making it the most widely distributed source in northern Baja California. Yet its exact geological source is unknown. Although the terms San Felipe and Arroyo Matomí have often been used synonymously, it appears likely that the San Felipe source is not located in Arroyo Matomí.

The geological samples used by Shackley to characterize this source were collected in the 1960s, and their exact provenance is unknown. Paul Bouey also characterized San Felipe glass based on marekanites he collected from secondary obsidian-bearing deposits north of Arroyo Matomí (Bouey 1984:55). Furthermore, San Felipe glass was absent in samples collected from

secondary deposits at the beach where Arroyo Matomí empties into the Gulf of California, as we discuss below.

As part of our research, we have identified another as-yet-unknown obsidian group that is similar in chemical composition to San Felipe glass. This chemical group was first noted at the Dominican mission site of Santa Catalina in the southern Sierra Juárez, where a number of obsidian artifacts were recovered during surface collection and excavation (Panich 2011). None of the artifacts can be assigned to the existing list of obsidian sources in the region (including possible sources in Alta California), and while some variation exists, they appear to all derive from a single source or source area. Interestingly, three additional artifacts, all from the northern Sierra Juárez, also appear to belong to this chemical group (Panich et al. 2010). They include two samples collected by Julia Bendímez Patterson from the sites of Piedras Gordas and Murillo, as well as a sample collected by Antonio Porcayo at Vallecitos.

A third chemical group that suggests an unknown geological obsidian source derives from two nodules collected from the site of Kiekierly, located on the Gulf of California coast approximately 5 km south of Puertecitos. These nodules also exhibited elemental concentrations that failed to match the existing chemical signatures of obsidian sources in the region. The site is near an alluvial fan produced by the outwash of a small arroyo on the eastern slope of the Sierra Santa Isabel. The primary source locality for this glass could be near the coast, given its close proximity to the El Regino source, or it could be at a higher elevation in the sierra. Interestingly, an obsidian nodule collected by Porcayo during archaeological reconnaissance in the Laguna Chapala region clusters with the Kiekierly obsidian.

Other obsidian sources in Baja California

Further south, the regions around Bahía San Luis Gonzaga and Bahía de Los Angeles, including multiple islands in the Gulf of California, also contain geological sources of obsidian. The volcanic Isla San Luis is known to have extensive geological obsidian deposits (Paz and Demant 1999), although the archaeological use of this obsidian has not been documented. Eric Ritter (1995, 1997) has noted primary source localities at Bahía San Luis Gonzaga and Bahía de Los Angeles, the latter of which he dubbed Ensenada de Pescador.

Large quantities of obsidian apparently from the nearby Isla Angel de la Guarda have also been noted in archaeological contexts, although the exact source of this glass also remains unknown (Bowen 2009; Ritter 2006:174). Ritter's research has revealed several other unknowns along the Gulf coast and in the interior of this portion of Baja California (Ritter 1994, 1995). Obsidian artifacts from sites near the 28th parallel analyzed as part of this project are typically from the Valle del Azufre source, but we have noted at least two unknowns which may correspond to the sources identified by Ritter.

Secondary deposits

Complicating our understanding of the three unknowns in northeastern Baja California, as well as the cultural implications of indigenous obsidian procurement, is the fact that many of the obsidian sources in Baja California can be obtained in secondary deposits in the dunes and beaches of the Gulf of California coast, as well as in the arroyos of the eastern slopes of the sierra. Although systematic collection and analysis of secondary deposits in Baja California is still in its infancy, we offer the following observations.

In 2011, we collected and analyzed non-artifactual obsidian nodules from two beaches along the Gulf of California within the Puertecitos volcanic province. Of the sources discussed above, only the Puerto el Parral and El Regino sources were present in the sample. Judgmental samples collected from Los Olivos beach, within the main outwash area for Arroyo Matomí approximately 17 km north of Puertecitos, revealed a wide variation in chemistry. The majority of the analyzed nodules were assigned to the Puerto el Parral source, which is not surprising considering that source's proximity to Arroyo Matomí. Several outliers with enriched values for strontium and zirconium were also noted. However, none of the samples from this area of the Arroyo Matomí outwash cluster with the primary group of samples from the San Felipe source. This pattern provides further evidence that the geological source of San Felipe glass may not be located in Arroyo Matomí, but perhaps somewhere to the north, as initially indicated by Bouey (1984:55).

South of Los Olivos, several additional samples were collected from a beach roughly 800 m east of the El Regino source and at the northern end of the outwash of Arroyo Los Heme. Most of the samples from the Arroyo Los Heme beach cluster with the samples collected from the nearby El Regino source, although one nodule exhibited enriched strontium and zirconium values similar to the outliers from the Los Olivos beach.

The enriched values of the outliers from Los Olivos and Arroyo Los Heme beaches suggest that their origin(s) are distinct from the other obsidian sources of the Puertecitos volcanic province, all of which share relatively similar chemical signatures. This region of northeastern Baja California has a long history of volcanism, and it is likely that the variation noted in the beach samples is related to the differences between earlier arc-related volcanism and later rift-related volcanic activity (Martín-Barajas et al. 1995; Nagy et al. 1999). This topic certainly warrants further research, especially as several archaeological samples from the region also have enriched elemental values similar to those from the beach contexts. (These archaeological samples have only recently been analyzed and have not yet been integrated into our larger source database).

Thus far, the glasses recovered from Mission Santa Catalina and Kiekierly have been found only in archaeological contexts, although the proximity of the Kiekierly site to an arroyo outwash opens the possibility of secondary deposits. The availability in secondary contexts of San Felipe obsidian, however, is not in doubt, as the original nodules used to characterize the source (by both Bouey and Shackley) were found outside of the primary source locality. Archaeological investigations in the San Felipe area, moreover, have suggested that indigenous inhabitants preferred the uniform shape of water-worn nodules, presumably from beach contexts, in order to facilitate bipolar reduction of the small marekanites (Porcayo 2011b).

Conclusion

With the addition of the known and unknown sources discussed here, there appear to be at least six distinct sources of artifact-quality obsidian located in the northern region of Baja California. The primary source locality is known for three of the sources: Lágrimas de Apache, Puerto el Parral, and El Regino. The exact locations of the other three -- San Felipe and the obsidians recovered at Kiekierly and Mission Santa Catalina -- remain unknown. The nodules collected from beach contexts exhibiting enriched strontium and zirconium values suggest the possibility of other unknowns. Our understanding of these sources is further complicated by the availability of many of them through secondary deposits.

While our discussion is limited to the northern extent of the Baja California peninsula, it is

clear that the native peoples of the region potentially had access to far more numerous and varied obsidian sources than previously thought. The data and observations provided here are preliminary, and further provenance studies, including detailed survey and mapping of both primary and secondary obsidian deposits (Shackley and Henrickson 2009), will help to clarify the picture of obsidian distribution across the region and by extension to allow archaeologists to understand better the dynamics of obsidian procurement and trade in native Baja California.

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