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REPORT

Obsidian on the Island: First Geochemical Characterization for Isla Victoria, Nahuel Huapi National Park (Patagonia, Argentina)

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Abstract
We present the first geochemical data of archaeological obsidian for Isla Victoria, Nahuel Huapi National Park in Patagonia. XRF analyses were performed on 15 samples of obsidian-like rocks from the Puerto Tranquilo 1 site. Only five of the artifacts—all of which come from upper levels of the site—correspond to obsidian as a raw material. The provenance analysis indicates the use of obsidian sources located in the Andean Forest area of southern Neuquen Province. Based on these preliminary results, we propose a north–south circulation axis for this raw material. These geographic results are discussed in relation to the information available regionally.

Resumen
Presentamos aquí los primeros datos geoquímicos de obsidianas arqueológicas provenientes de la Isla Victoria, Parque Nacional Nahuel Huapi, Patagonia, Argentina. Se realizaron análisis de fluorescencia de rayos X sobre 15 muestras de rocas macroscópicamente similares a la obsidiana del sitio Puerto Tranquilo 1. Los resultados indican que sólo cinco corresponden a obsidianas, todas provenientes de los niveles tardíos del sitio. Los análisis de proveniencia indican el uso de fuentes localizadas en el sector andino-boscoso del sur oeste de la provincia del Neuquén. Proponemos un eje de circulación norte-sur para esta materia prima en el área. Finalmente, estos resultados geográficos iniciales son discutidos en relación con la información disponible regionalmente.

Keywords: Late Holocene; obsidian; Isla Victoria; Nahuel Huapi National Park; Patagonia

Palabras clave: Holoceno tardío; obsidiana; Isla Victoria; Parque Nacional Nahuel Huapi; Patagonia

Human occupation of Nahuel Huapi Lake area in northern Patagonia dates to more than 12,000 cal years BP at the El Trébol site (Hajduk et al. 2006). Since that time, human populations have made use of the forest and lakes in this area with variable intensity and for different purposes, including habitation, transit, hunting, and gathering (Hajduk et al. 2006, 2008, 2011; Lezcano et al. 2010; Scartascini et al. 2020). However, human use has been discontinuous through time. In the last 2,500 years, the regional human signal became more systematic (Hajduk et al. 2018). During this time, the first human records appeared at the lake-island Isla Victoria in the Puerto Tranquilo 1 (PT1) archaeological site (Hajduk et al. 2018). During these occupations new technological and technical skills, boats, and, significantly, navigation capabilities developed. Although the use of boats is very infrequent in

Argentinean continental Patagonia (Braicovich 2004), aquatic adaptations that include navigation have been well represented in the insular Pacific coast of Chile since the Middle Holocene (e.g., Carabias et al. 2010; Quiroz and Sánchez 2004). This evidence, when added to the presence in the Nahuel Huapi region of other archaeological materials of "Pacific" origin, such as pottery styles and mollusks, suggests strong links with populations from the western side of the Andes (Hajduk et al. 2011). Yet the nature and intensity of these western contacts, which would have a long history in the area (see Dillehay et al. 2015; Hajduk et al. 2011), are far from clear.

It has been suggested that the Late Holocene occupations of the Nahuel Huapi area could have included populations migrating from the western Andean shed (Hajduk et al. 2011). The geochemical determination of obsidian provenance in archaeological sites of Isla Victoria is highly relevant to understanding the complex history of human use in the area.

Study Area

Isla Victoria is the largest island in Nahuel Huapi Lake, located in the Nahuel Huapi National Park in northwestern Patagonia, Argentina (Figure 1). It is in the phytogeographic ecoregion of the Patagonian Andean Forest (Cabrera 1976) in a geographically rugged area, within ancient deep glacial valleys (Lirio 2011).

The PT1 archaeological site is one of the 30 archaeological sites registered on Isla Victoria to date (Hajduk et al. 2018). It is an extensive rockshelter of about 234 m^2 located on the northern edge of the island, at the foot of a rocky cliff facing north about 150 m from the current lakeshore. The site has two radiocarbon dates from 1980: around ± 60 (2010–1730 cal) and about 640 ± 60 (663–520 cal) years BP. The surveys indicate the presence of technological items such as lithic, ceramic, bone, and metal tools; faunal remains from the forest (i.e., huemul), lake (birds, fish, mollusks), and steppe (guanaco), and two human burials: one in the basal levels of the site and the other identified as scattered bones in the upper levels (Hajduk et al. 2018).

Methodology

For this work, we analyzed 15 obsidian-like archaeological artifacts from the PT1 site. Trace element analyses on the obsidian artifacts were performed using a portable X-ray fluorescence (XRF) spectrometer Bruker Tracer 5i from the University of Missouri Research Reactor (MURR) Archaeometry Laboratory at the Laboratorio de Paleoecología Humana, FCEyN-UNCuyo (Mendoza, Argentina). The instrument was calibrated using a suite of 40 obsidian sources analyzed by multiple methods at MURR as described in Glascock (2020). This type of XRF analysis is fast, accurate, and nondestructive (Fernández et al. 2017; Millhauser et al. 2011), allowing the simultaneous measurement of 12 chemical elements: K, Ca, Ti, Mn, Fe, Zn, Rb, Sr, Y, Zr, Nb, and Th. Based on previous research, the most diagnostic elements for discriminating obsidian sources in northern Patagonia are Rb, Sr, and Zr (Glascock 2020; Pérez et al. 2019).

Results

Of the 15 samples analyzed, we only identified five as obsidian. The remaining 10 samples correspond to other types of volcanic rocks of intermediate to basic chemical composition (Supplemental Table 1). Their aphanitic and vitreous texture, combined with their small size (<10 mm), makes them macroscopically indistinguishable from obsidian. The five samples identified as obsidian correspond to three geochemically differentiated sources: Cerro las Planicies / Lago Lolog (CP/LL), Yuco (YC), and Quilahuinto / Lago Lacar (QU/AP; see Figure 2 and Table 1). Three (PT-18, 19, and 20) of the five obsidian samples analyzed correspond to fragmented pedunculated projectile points (apex fracture PT-20), and two correspond to angular flakes (PT-25 and PT-26; see Table 2). All five samples have small sizes (<30 mm) and low weight (< 1g).

Obsidian is the least frequent raw material in the site, represented only as formal instruments and knapping debris in layers pertaining to the last 600 years. Hence, the obsidian assemblage corresponds to late precontact or early hispanic times, also represented in the rock art and the zooarchaeological record in the site (Hajduk et al. 2018).

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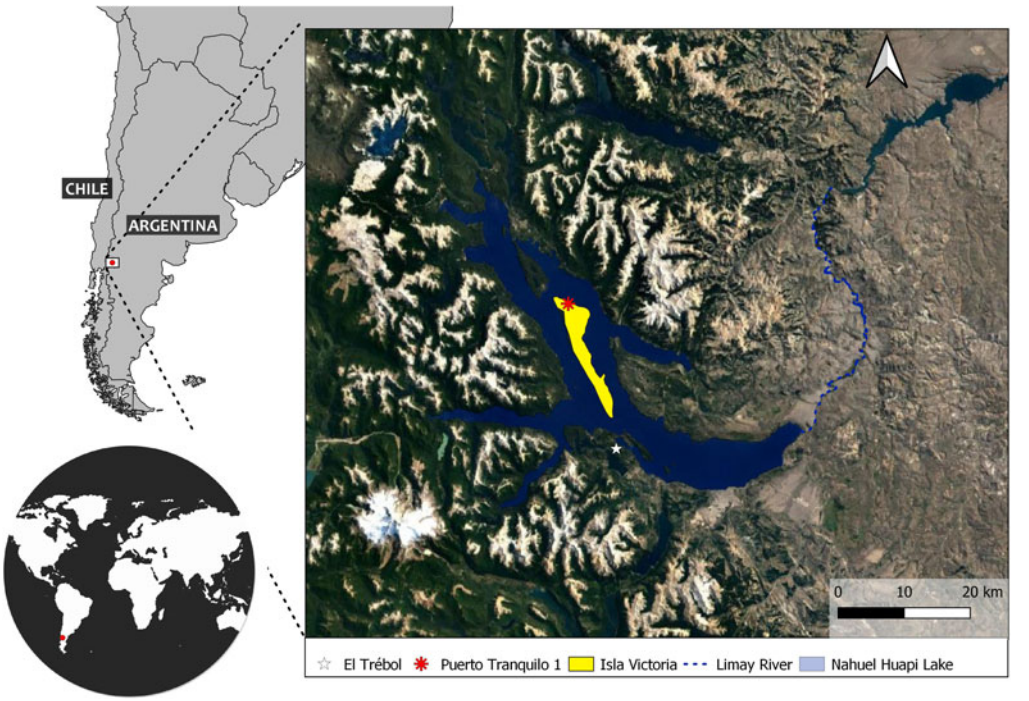

Figure 1. Study area in the Nahuel Huapi National Park, Argentina. Isla Victoria (yellow), Puerto Tranquilo (PT1) site (red), and El Trebol site (white). (Color online)

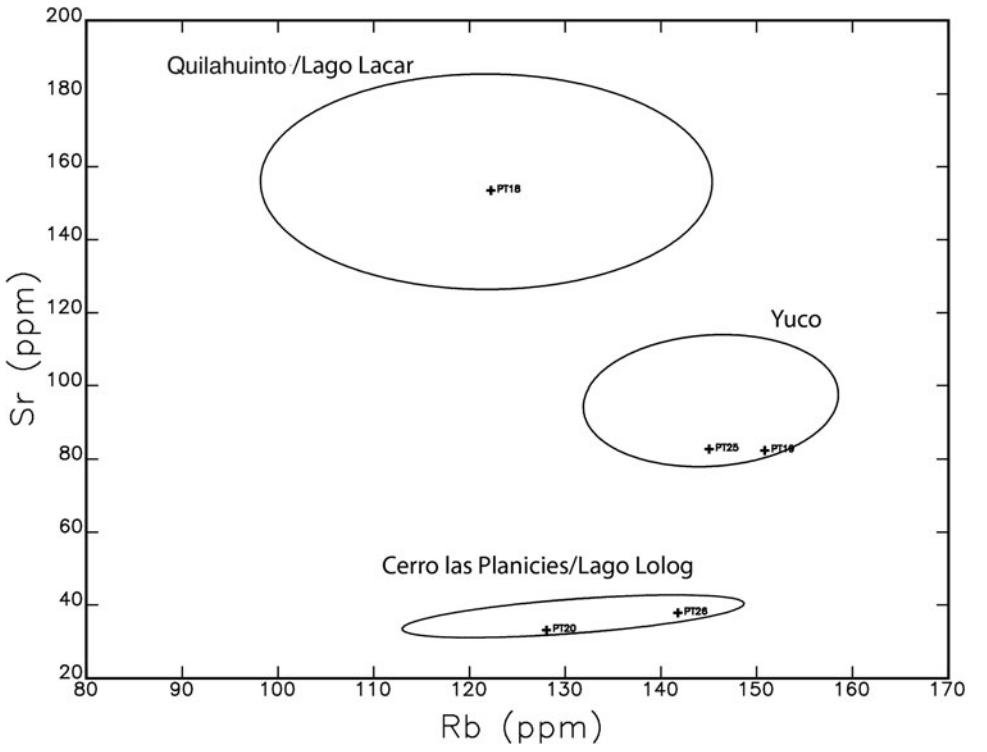

Figure 2. Scatterplot of Rb versus Sr showing artifacts from PT1 compared to 90% confidence ellipses of the obsidian sources.

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Table 1. Site Characteristics, Samples Description, and Provenance of Analyzed Obsidians.

Locality	Site	Lab Code	Chronology	Source	Characteristics
Isla Victoria	Puerto Tranquilo 1	PT-18	post-600	QU/AP	Translucent gray
		PT-19	post-600	YC	Translucent gray with banding
		PT-20	post-600	CP/LL	Translucent gray with black banding
		PT-25	post-600	YC	Translucent gray
		PT-26	post-600	CP/LL	Translucent black with banding

Table 2. Raw Materials and Technological Composition of Lithic Artifacts from PT1, Early and Late Components.

	Early			Late		
Raw Material	Tools (%)	Debris (%)	TOTAL	Tools (%)	Debris (%)	TOTAL
Obsidian	0 (0.0)	0 (0.00)	0 (0.0%)	3 (8.3)	2 (0.71)	5 (1.50%)
Silex	10 (83.3)	13 (72.22)	23 (76.6%)	15 (41.6)	139 (49.80)	154 (48.80%)
Basalt / Andesite	1 (8.3)	1 (5.50)	2 (6.6%)	8 (22.2)	20 (7.16)	28 (8.80%)
Other local	1 (8.3)	4 (22.22)	5 (16.6%)	10 (27.7)	118 (42.29)	128 (40.63%)
TOTAL	12	18	30	36	279	315

Discussion

Obsidian represents a minority of the raw lithic material recovered at PT1 (Table 2), as was also documented at most of the sites in the mountain forest of northwestern Patagonia (Bellelli et al. 2018; Boschín and Massaferro 2014). Despite the availability of other sources in open-steppe settings to the east and south, the only sources represented on the island are those located near the Lacar and Lolog Lakes (Pérez et al. 2012, 2019).

Our preliminary results suggest a north–south circulation axis for these raw materials, connecting Lacar, Lolog, and Nahuel Huapi Lakes (Figure 3). Lacar and Lolog Lakes are not the closest sources of these materials to PT1 (70–90 linear km), but they are in an environmental setting that is very similar to Nahuel Huapi National Park. The absence of use of alternative obsidian sources that are closer but are located outside the forest-lake ecosystem (see Figure 3: Sources 12, 14, 15, 16) is highly informative about the networks of human mobility: the only sources used are those located in sectors that are environmentally similar to Isla Victoria. These first results do not fit with the hypothesis suggesting a systematic forest–steppe complementarity along a west–east axis in the Nahuel Huapi area (Hajduk et al. 2018; Lezcano et al. 2010). Although not present in our preliminary study, the circulation of obsidian from east (steppe) to west (forest) is clearly observed in non-insular areas of the northern Patagonian Forest, even before the Late Holocene (Bellelli et al. 2018; Palacios et al. 2010). In contrast, the use of obsidian in PT1 seems to be restricted to very recent times (the last 600 years).

Despite the small sample size, the analyses show three different chemical groups among the five analyzed samples, pointing to a very restricted supply area. The use of three obsidian sources from the Neuquén Forest area (YC, CP/LL1, and QU/AP) reinforces the suggestion of a dominant north–south circulation axis within the forest ecosystem during the Late Holocene (see also Bellelli et al. 2006, 2018; Pérez et al. 2019). This trend would be related to a more intense use of the forest during the last 1,500 years (Fernández and Tessone 2014; Hajduk et al. 2018). Specifically, the use of Yuco (YC) obsidian could be linked to aquatic environments, and even to insular sectors, as was observed in Lacar Lake (Pérez et al. 2019).

To date, the use of obsidian from sources to the west (modern Chilean territory) has not been recorded, a pattern that seems to be recurrent throughout the North Patagonian Andean belt (Bellelli et al. 2006, 2018; Boschín and Massaferro 2014; Pérez et al. 2019). This evidence is striking, especially considering the presence from relatively early times of nonlocal elements circulating on both

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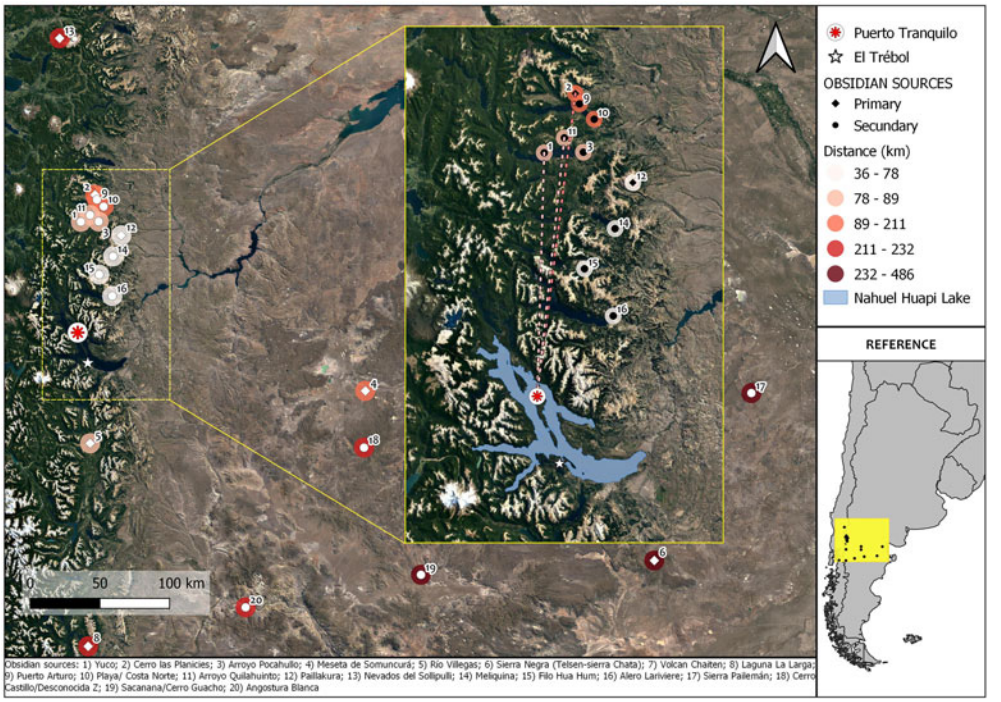

Figure 3. Regional distribution of primary and secondary obsidian sources. The colors indicate the distance from PT1 from white (closer) to dark red (farthest). The Nahuel Huapi and Lacar Lakes sectors are shown in greater detail. (Color online)

sides of the North Patagonian Andean belt, both in the Nahuel Huapi sector (Hajduk et al. 2011) and in Chilean territory (Dillehay et al. 2015)—and even in the Isla Mocha in the Pacific Ocean (Campbell et al. 2018). Yet, the use of boats and the development of specific human adaptations in the lake-forest environment of northern Patagonia seem to have occurred much earlier in the western Andes (Adán et al. 2004; Navarro et al. 2011). Taken together, the evidence suggests strong material and cultural ties on both sides of the Andes. The new geochemical data, however, suggest complex scenarios for the circulation of objects, people, and ideas during the final Late Holocene in the North Patagonian Andes.

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Data Availability Statement. The studied materials are kept in the Museo de la Patagonia Francisco P. Moreno, PNNH, Bariloche, Río Negro, Argentina.

Competing Interests. The authors declare none.

Supplemental Material. For supplemental material accompanying this article, visit https://doi.org/10.1017/laq.2023.42.

Supplemental Table 1. Concentrations of Elements in Parts per Million for Artifacts from PT1 Measured by XRF with Assigned Chemical Groups.

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