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17 de Marzo (Santa Cruz, Argentina): A new distal source of Pampa del Asador type black obsidian and its implications for understanding hunter-gatherer behavior in Patagonia

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ABSTRACT

Most obsidian artifacts from central and southern Patagonia were made of black obsidian from Pampa del Asador (PDA), an extended secondary source area centered at approximately 47°55′S and 71°08′W. Artifacts of obsidian from PDA have been found >600 km to both the northeast and south and along the Atlantic coast 300 km to the east of this major source area. Here we report a newly-discovered distal source of PDA-type black obsidian pebbles at 17 de Marzo (17M) located ~170 km southeast of the main PDA source area. ICP-MS trace element data confirm that the relatively small (≤48 mm) black obsidian pebbles from 17M are chemically similar to the four different types of PDA black obsidian. The dimensions of the pebbles compared to the sizes of PDA obsidian artifacts from archaeological sites in the vicinity of 17M, which date from as early as the late Pleistocene-Holocene transition, indicate that early hunter-gatherers could have used the pebbles from this distal secondary source of PDA obsidian to make tools. The pebbles appear to have been transported by fluvial-glacial processes along an ancient Chico River valley to their present site. 17M is part of the "Patagonian Gravel" deposits, which are widespread along the present Chico River valley suggesting that other distal PDA obsidian pebble sites along the river valley may possibly await discovery. The potential widespread availability of PDA obsidian pebbles along the Chico River drainage valley may help to explain why so many artifacts in this area were made of black PDA obsidian. Results obtained indicate that we can no longer assume that hunter-gatherers obtained raw PDA-type black obsidian only from PDA specific source. Black obsidian may have also been available, perhaps in pockets, over a considerable area east and up to ~170 km distant southeast of PDA.

1. Introduction

Obsidian artifacts have been recovered from many areas of Patagonia (Aguerre, 2003; Ambrústolo, 2011; Franco, 2002, 2004; Pallo and Borrero, 2015; Stern, 1999, 2004). Most black obsidian artifacts from central and southern Patagonia have been identified as coming from the area of Pampa del Asador (PDA), centered at approximately 47°55′ S and 71°08′W, in NW Santa Cruz province (Fig. 1; e.g., Espinosa and Goñi, 1999; Stern, 1999, 2000, 2004). Pampa del Asador is part of the fluvial-glacial sedimentary plateaus of the pampas of Patagonia (Ramos and Kay, 1992). Obsidian from PDA is present in the form of rounded black cobbles with a brown or gray weathering/alteration surface a few millimeters thick (Fernández and Leal, 2014). The primary source either no longer exists or has not been found. Some samples have been dated with ages ranging from 4.9 to 6.4 Ma (Stern, 1999, 2004), which coincides with the formation of some basaltic plateau lavas in the nearby Meseta del Águila area (Ramos and Kay, 1992). According to Stern (1999) and García-Herbst et al. (2007), there are at least four chemically different types of PDA obsidian (PDA1, PDA2, PDA3ab and PDA3c). Belardi et al. (2006) have recovered nodules of PDA-type obsidian in paleo-drainage channels and on an alluvial fan east of this pampa, expanding the area of availability of PDA obsidian to 47°58′S and 70°08′W.

Artifacts made from PDA obsidian have been found as far as Valdés Peninsula 800 km to the northeast of the main PDA source (Stern, 2004; Stern et al., 2000, 2013), and 600 km south along the Magellan Strait and further south on Tierra del Fuego (Morello et al., 2012; Stern, 2004; Stern et al., 1995a, 1995b). They have been recovered from numerous archaeological sites on both sides of the Andean range

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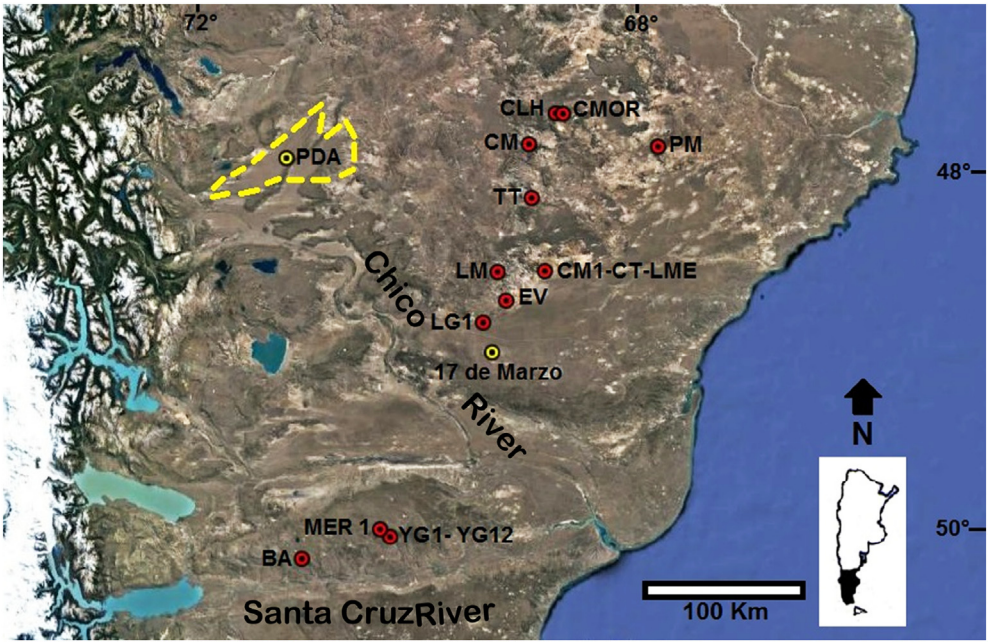

Fig. 1. Locations of obsidian sources (yellow circles) and archaeological sites (red circles) mentioned in the text shown on a Google Earth image. The dashed yellow line delimits the PDA alluvial cone. Obsidian sources are Pampa del Asador (PDA) and 17 de Marzo (17M). Archaeological sites: CLH-Cueva La Hacienda; CMor-Cueva Moreno; PM-Piedra Museo; CM-Cueva Maripe; LM-La Martita Cueva 4; EV-El Verano Cueva 1; LG1-La Gruta 1; CT-Cueva Túnel; LME-Cueva de La Mesada; CM1-Casa del Minero 1; TT-Cerro Tres Tetas Cueva 1; YG1-12–Yaten Guajen 1 and 12; MER1-Mercerat 1; BA-Bi Aike 3. (For interpretation of the references to colour in this figure legend, the reader is referred to the web version of this article.)

dating from the Pleistocene-Holocene transition until the late Holocene (e.g., Ambrústolo, 2011; Durán et al., 2003; Fernández et al., 2015; Hermo, 2008; Méndez et al., 2012). To explain this wide distribution, different acquisition models have been postulated for different time periods at sites located far from known sources of obsidian (e.g., Civalero and Franco, 2003; Franco, 2014; Hermo, 2008; Pallo and Borrero, 2015).

Although additional sources of black obsidian have been suggested in some areas of central and southern Patagonia based on information from local inhabitants (e.g., Aguerre, 2003), none has so far been discovered. Here we report on a previously unknown secondary deposit of small black obsidian pebbles located at 17 de Marzo (17M) between the Deseado Massif and the Chico River, ca. 170 km southeast of PDA (Fig. 1). In this paper we report the results of ICP-MS trace-element chemical analysis of eight 17M obsidian pebbles and compare the results with chemical data for obsidians from the main PDA source area. We also analyze the characteristics of obsidian artifacts from archaeological sites to the north and south of the 17M obsidian source to evaluate the possibility of its utilization by local inhabitants.

2. Methods

The studies outlined here were conducted during work on projects seeking to understand the effect of environmental variability on the behavior of hunter-gatherers. Within this framework we conducted excavations, surface surveys of artifacts, and examined potential sources of lithic raw materials in an attempt to understand human behavior and circulation.

To understand the lithic regional resource base (Ericson, 1984), sampling was carried out in localities with different environmental characteristics selected based on geological attributes. Because of the large area involved, detailed sampling was undertaken in areas with varied characteristics such as, in the case of secondary sources, places where cobbles of different sizes (and potentially, different raw material) could be expected (Franco, 2002; Franco et al., 2012, 2015b).

Raw material sourcing was carried out through systematic sampling when time and volume of samples were not limited but when either was limited, sampling was unsystematic (e.g., Franco et al., 2012, 2015b). Raw material analysis involved both macroscopic and petrographic analysis and when possible, geochemical analysis (Franco, 2002; Franco and Aragón, 2004; Franco et al., 2015a, 2015b). When the 17M obsidian pebbles were first discovered, samples were collected randomly but during a second visit to the site they were collected by three team members walking in a direction from south to north and then from west to east across the plateau for 90 min. The focus of this sampling was entirely on obsidian; other raw materials were not collected.

ICP-MS (Inductively Coupled Plasma Mass Spectrometry) was used to obtain geochemical data for eight black obsidian pebbles recovered from the 17M secondary obsidian source. Laboratory methods were similar to those described by Fernández et al. (2015). The samples were powdered in a shatter box utilizing a tungsten carbide container, dissolved in a mixture of HF and HCl and analyzed by standard ICP-MS techniques using an ELAN DCR-E instrument in the Laboratory of Environmental and Geologic Sciences at the University of Colorado. Methods for ICP-MS are similar to those described by Briggs (1996). Trace element compositions are considered precise to $\pm 10\%$ at the 2σ probability level (Fernández et al., 2015).

In order to evaluate if the 17 de Marzo obsidian pebbles could have been used by hunter-gatherers to produce artifacts, pebble dimensions were compared with the dimensions of artifacts collected from areas to the north and south of the obsidian source. Other data would be needed to determine direct versus indirect procurement (for example Dibble, 1987; Franco, 1991, 1994, 2014; Ellis, 2011; Jones et al., 2012; Renfrew, 1977; Torrence and Swadling, 2008) but this was not the focus of this paper. Some researchers have even suggested that obsidian cobbles and pebbles –rather than artifacts- were provisioned and transported, at least during some time periods (Civalero and Franco, 2003).

3. Results

3.1. Geology and geochemistry

The 17M black obsidian source consists of rounded pebbles in gravels mantling the plateau between the Deseado Massif and the