Journal of Archaeological Science: Reports xxx (2017) xxx–xxx

Contents lists available at ScienceDirect

Journal of Archaeological Science: Reports

journal homepage: www.elsevier.com/locate/jasrep

Palaeoenvironmental conditions for human settlement at the Fuegian steppe (Argentina) based on diatom analysis. Lake Arturo as a case study

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ARTICLE INFO

Article history:
Received 17 December 2016
Received in revised form 24 March 2017
Accepted 24 March 2017
Available online xxxx

Keywords:
Tierra del Fuego
Shallow lake
Sedimentary record
Diatoms
Hunter-gatherers

ABSTRACT

This paper adds information on the palaeoenvironmental evolution in northern Tierra del Fuego, using subfossil diatom analysis. The archaeological evidence suggested the presence of hunter-gatherer groups during the Holocene at the Fuegian steppe. Some shallow lake basins have denser archaeological record than others; thus, it is interesting to evaluate and discuss if that might be related to different environmental conditions in the past. Lake Arturo offered opportunities for wildlife (guanacos and birds), and then, strategic meeting points for humans. A sediment core was taken from the lake with a Livingstone gravity corer. Diatom results suggest a brackish and shallow lake at Lake Arturo almost along the entire Holocene. The lacustrine basin started to desiccate during Middle Holocene or it had, at least, a similar configuration and dynamics as it has today. The diatom analysis is an interesting approach to evaluate how variable the local resources could have been in the studied lake, both on the spatial and the temporal scale, and the degree in which lakes could have affected or influenced the routes of hunter-gatherer mobility in the past.

1. Introduction

The peopling of southernmost South America occurred during the end of the Late Glacial times (16,000 and 10,000 years BP), as it has been demonstrated in several sites of continental Patagonia (Borrero, 1999, 2008; Miotti, 2006; Miotti and Salemme, 1999; Salemme and Miotti, 2008; among others). Tierra del Fuego was the last southern tip to be explored and colonized by people after the Last Glacial Maximum (Borrero, 2004; Salemme and Miotti, 2008). Cultural and faunal remains recorded at Tres Arroyos 1 archaeological site (Fig. 1; Massone, 2004) proved that a group of hunters occupied the NW portion of the present island at ca. 10,500 yr ago, when Tierra del Fuego was still part of the continent (McCulloch et al., 2005; Rabassa, 2008). After a hiatus of approximately four thousand years since the Middle Holocene, the archaeological record denotes population increase (Salemme and Santiago, 2017).

In the northern part of Tierra del Fuego, between Chico and Grande rivers, the archaeological record was studied from a distributional perspective (Oría, 2014; Santiago, 2013). This criteria considers the archaeological record as a *continuum* with higher density peaks (Dunnell and Dancey, 1983) which reflects human activity in a large space and not only where the action took place. In the study area, the shallow lake basin suggests a continuous and heterogeneous use of the inland environments of the Fuegian steppe during the Holocene (Oría, 2014).

The interaction between humans and environment has been an important topic in anthropological literature concerned with the perceptions and use of landscape by people in the past. At the Fuegian steppe, some shallow lake basins have denser archaeological record than others (Oría et al., 2014); thus, it is interesting to evaluate and discuss if that might be related to different environmental conditions in the past. For this reason, the use of several proxy analysis results is an accurate approach to reconstruct the palaeoenvironmental history of shallow Lake Arturo during the Holocene. Diatomological and archaeological records from the shallow Lake Arturo as case study are presented herein.

2. Setting

The climate of the region is temperate-cold, with mean temperatures of 10 °C in summer and 1 °C in winter. The mean annual precipitation is 379 mm (Tuhkanen, 1992). Intense and strong winds are permanent in the steppe, blowing mainly from northwest-west-southwest direction. The Aridity Index of 0.75 characterizes the hydric

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http://dx.doi.org/10.1016/j.jasrep.2017.03.056
2352-409X/

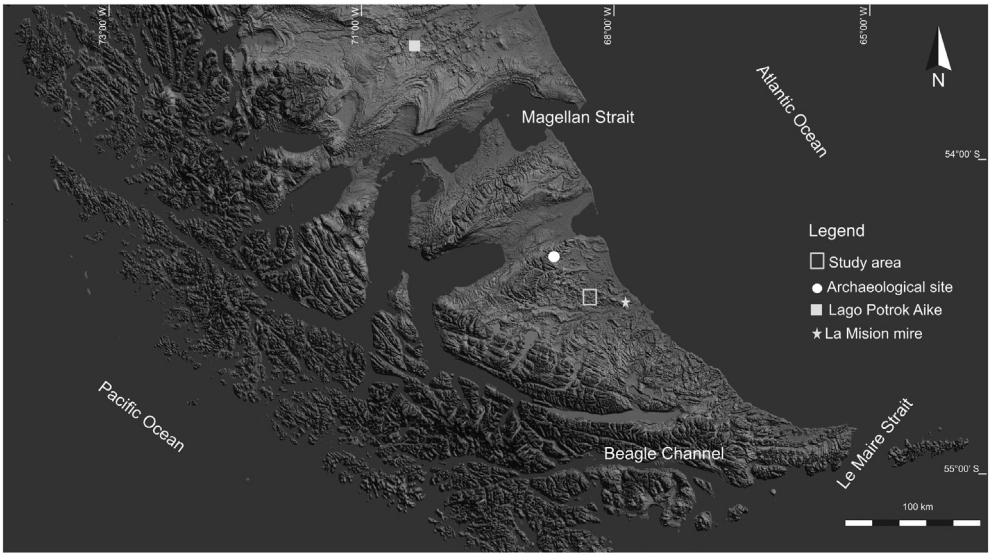

Fig. 1. Location of the study area and archaeological site.

regime for the Cold Subhumid Oceanic climate prevailing in this region (Coronato et al., 2008). The steppe vegetation is dominated by *Festuca gracillima*. Other species such as *Azorella* sp. and *Nassauvia magellanica* are also present.

2.1. Study site

Lake Arturo (53° 43′ S, 68° 18′W) is a shallow, saline, ephemeral, intermediate-sized water body located at 69 m a.s.l., in the semiarid steppe of northern Tierra del Fuego (Fig. 2A). It is located in a depression surrounded by smooth rocky hills covered by aeolian deposits. Almost circular in shape, its perimeter is 5.63 km long, the longest axis is 2.08 km long in the NE-SW direction, and the shortest axis is 1.6 km (Coronato et al., 2011). A cliff comprising 15 m of Neogene marine sedimentary rocks forms the southern shoreline of the lake. It is capped by 20.3 m of unconsolidated, fine-grained aeolian sediments (9 units), containing palaeosols (8 levels intercalated). The paleodune of Lake Arturo is exposed to northwest, north and northeast winds.

The maximum and mean water depths in the lake are unknown, but shallow waters are inferred by the authors from total desiccation of the lake during windy days in summer.

The studied shallow lake is settled on marine sedimentary rocks, which correspond to the Carmen Silva Formation (Codignotto and Malumián, 1981). This Formation has two members, the lower one of clay and sandy siltstones and the upper one of conglomerates and tuffs with abundant invertebrate fossils (Malumian and Olivero, 2006).

2.2. Archaeological record

Four archaeological sites were recorded in this lake -Arturo 1 (Coronato et al., 2011; Oría, 2014), Arturo 2 (Oría and Salemme, 2016), Arturo 3 and Arturo 4 (Oría et al., 2017), added to 12 isolated findings spread along the present lake coast. Bones and lithic artifacts

Fig. 2. Lake Arturo. A-Overview of Lake Arturo with its aeolian sequence on the south coast. B-Arturo 1 archaeological site in the deflation hollow. Note the ancient lacustrine terrace.

Please cite this article as: Fernández, M., et al., Palaeoenvironmental conditions for human settlement at the Fuegian steppe (Argentina) based on diatom analysis. Lake Arturo as a c..., Journal of Archaeological Science: Reports (2017), http://dx.doi.org/10.1016/j.jasrep.2017.03.056