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Multi-proxy evidence of Late Quaternary environmental changes in the coastal area of Puerto Lobos (northern Patagonia, Argentina)

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ABSTRACT

A multidisciplinary approach involving geomorphology, taxa composition of mollusks and taphonomy performed on bivalve shells, linked to mineralogical and microstructural analyses, provide evidence of Late Quaternary environmental changes in the coastal area of Puerto Lobos, in northern Patagonia. Digital elevation models (DEMs) showed a beach ridge system developed parallel to the coast, indicating sea level variations during MIS1, MIS5e, and earlier in the Pleistocene. These ridges can be correlated with other marine ridges along the Patagonian coast, showing a similar geomorphological pattern and similar temporal evolution. In relation to faunal composition, when comparing the Pleistocene with the Holocene, the most relevant differences are the presence of *Tegula atra* and *Mactra patagonica* in the Pleistocene sediments and a diversification of taxa in the Holocene. During the late Holocene, the coastal area of Puerto Lobos also recorded a faunal shift in which species belonging to the Magellan Province displaced the fauna of the Argentinean Province to the north, probably in coincidence with the Little Ice Age (LIA). Taphonomic analysis on *Glycymeris longior* and *Venus antiqua* shells, two common taxa in these beach ridges, indicate greater energy in the depositional environment correlated with the youngest Holocene beach ridge. These shells exhibited taphonomic differences between them in relation to fracturing, explained on the basis of higher elasticity in the *G. longior* shell than in *V. antiqua* shell, because of its crossed lamellar microstructure.

1. Introduction

The configuration of the Patagonian coast, located in southern Argentina, is the result of several factors related mainly to changes in sea level associated with isostatic compensation, with glacioeustasy and geotectonic processes (Clapperton, 1993; Rostami et al., 2000; Schellmann and Radtke, 2010; Pedoja et al., 2011). Pleistocene and Holocene marine sediments are restricted to a narrow coastal strip, where these levels are preserved as marine terraces and beach ridges formed of gravel, sand and varying amounts of calcareous mollusk exoskeletons. The thickness of the deposits is variable, and they are located at different altitudes and distances from the present coastline (Feruglio, 1950; Cionchi, 1988; Schellmann and Radtke, 2000; Codignotto, 2005; Fucks et al., 2009; Isola et al., 2011).

As in other marine coastal areas of the world, the coastal area of Puerto Lobos (Chubut, northern Patagonia) (Fig. 1) has been affected by marine transgressive–regressive processes which occurred during the Quaternary. As a result of these events, morphosedimentological features can be found above the present sea level. This study will focus mainly on fossiliferous sandy and gravel littoral ridges located between 11 and 2 m above sea level (m.a.s.l.) and related to a Holocene transgression (Bayarsky and Codignotto, 1982).

These ridges are important because they record faunal turnover that could be related to a migration of the boundary between the Argentinean and Magellan malacological provinces (Martinez and Del Río, 2002; Martínez et al., 2011). Marine faunal distribution is mainly related to global water temperature gradients (Valentine et al., 1978; Valentine and Jablonsky, 1985; in Martínez et al., 2011). The thermal gradients existing in the SW Atlantic and produced by the arrival of the warm Brazil Current from the north and the cold Malvinas (Falklands) Current from the south have facilitated the demarcation of the biogeographic unit known as the Argentinean

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