

In Darwin's footsteps between a scientific and naturalistic challenge: the Bahia Bustamante coastal area (Patagonia Argentina).

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ABSTRACT

Thanks to its geographic position, Patagonia, can be considered a strategic land for the studies of climate changes. In this work the main geomorphological features of the Bahia Bustamante coastal area are depicted. Moreover, the relevance of these features for the studies of palaeo sea level are stressed.

Finally, taking into account the high geological value of this area, the motivations for proposing it as a geosite are presented. The concomitance of a high geological, biological and historical interest make the study area particularly suitable for the promotion of a sustainable tourism.

KEY WORDS: Climate change, Geosites, Patagonia, Sea level change, Sustainable tourism

INTRODUCTION

The Patagonia is the only continental landmass emerging along the mid to low-latitudes in the south Hemisphere, and this makes it a unique region in the world. Charles Darwin was the first naturalist who documented the geological and geomorphological features of the Patagonian coast, explored during the famous travel of the Beagle ship (1831-1836). The

Patagonia represents a key area for understanding the role of the southern hemisphere in regulating climate during the last hundred of thousand years. From the Andes to the Atlantic coast, Patagonia preserves an impressive geological record of the glacial events and sea-level oscillations. The Quaternary coastal deposits, often organized in spectacular successions of raised-beach-ridges, contain an almost unexplored archives of past climate. These natural archives can offer precious information on local relative sea-level changes, tectonic and glacial isostatic component, fundamental information on past surface ocean conditions and, through the study of the continental deposit related to beach-ridge systems, information also on terrestrial climate. In this context several sectors of the Gulf of S. Jorge have been studied in order to identify geomorphological /geoarchaeological markers of past sea level (Ribolini et al 2011; Zanchetta et al., 2012, Schellmann & Radtke, 2010). This work is aimed to highlight the geological heritage of Bahia Bustamante area (Fig.1) and its relevant scientific interest for the studies of palaeo sea level and climate changes.

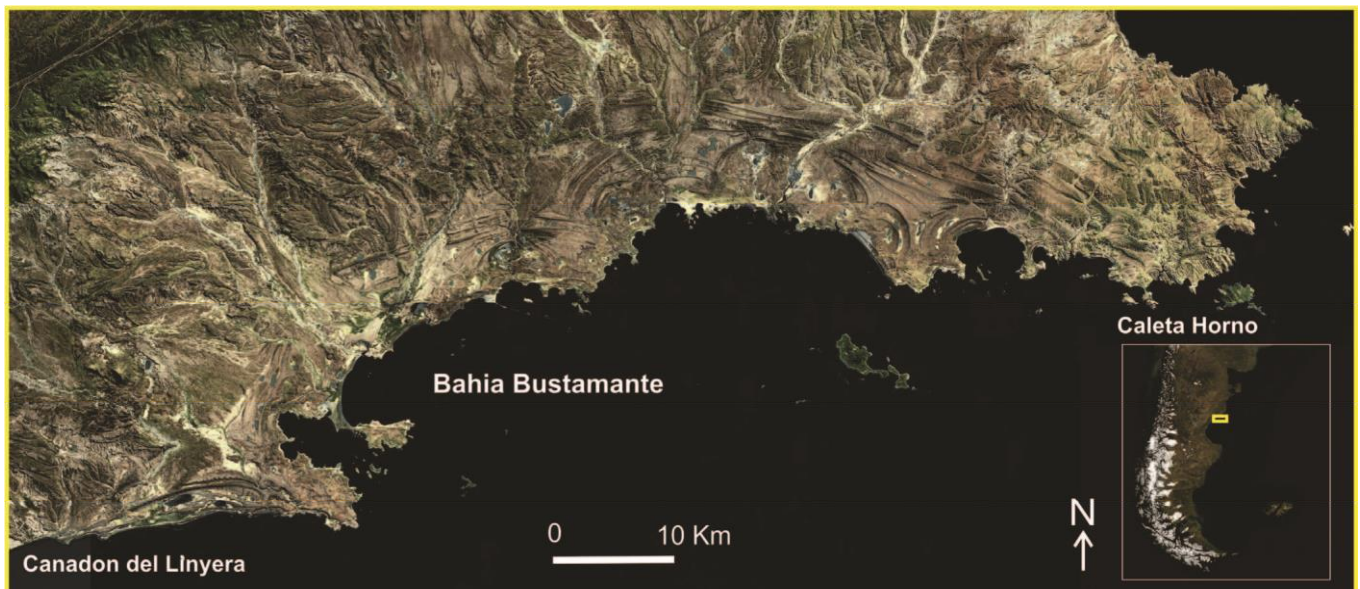


Fig. 1 – Study area location

SCIENTIFIC VALUE OF THE STUDY AREA

A geomorphological survey carried out in the area of Bahia Bustamante allowed the reconstruction of the main geomorphological features, suggesting the landscape evolution of this territory. The study area extends over more than 1,000

km² between the mouth of Cañadon del Linyera and the Caleta Horno (66°50'W – 65°47'W longitude and 44°54'S – 44°51'S latitude; Fig. 1). Here, an outstanding succession of raised beach deposits is exposed for a total area of more than 500 km², extending up to 10 km landward and reaching 100 m of elevation (a.s.l.). Past landforms and deposits are particularly well preserved because

weathering processes are very limited. The oldest rocky substrate, Complejo Marifil, consists of Jurassic rhyolites, ignimbrites and volcanoclastic conglomerates. It is often covered by thin to very thick debris deposits and crops out basically in current and paleo rocky shore lines, islands and cliffs. Subordinate outcrops are represented by the Paleocene marine deposits of the Formación Salamanca and the Paleocene continental deposits of the Formación Río Chico (Cionchi, 1984 Lema et al., 2001). The landward part of the area is characterized by the outcrop of a pediment surface covered by rounded volcanic pebbles and gravels in a sandy matrix, occasionally strongly cemented by carbonate. Wave action is the most important geomorphologic agent responsible for the past and present landscape. The coast is characterized by a high-energy system with intense storms and a macrotidal regime. Unfortunately, tidal data are not available, but a tidal range >4 m can be reasonably assumed for most of the Patagonian coast. The landscape is dominated by outcrops of marine deposits, predominantly organized as series of sandy to gravelly beach ridges, extending several kilometers inland (Fig.2), rising to more than one hundred meters above current sea level (Isola et al 2012). A large number of depressed areas lying in a back-beach ridge position are one of the characteristic elements of this region. They are remnants of old coastal lagoons locally known as “salitrales” (Figure 3a) formed in dry evaporative environments by sandy silt and clay deposits including mineral deposits, such as gypsum, that locally form crusts (Fig. 3b). This area is particularly relevant for geological evidences of sea level oscillations, especially for the great number and the dimensions of beach ridges. Preliminary data suggest that there

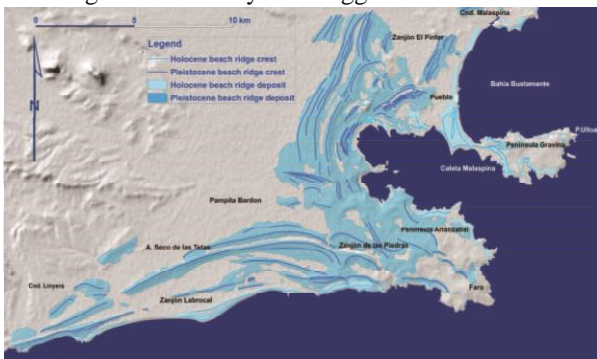


Fig. 2 – Beach ridge deposits in Caleta Malaspina - Peninsula Aristizabal area



Fig. 3 – a) salitral in Bahía Bustamante, b) gypsum crust

is a record comprising at least MIS 9 (Shellmann & Rudke, 2000, 2010), but probably MIS 11 and older beach ridges could be preserved here. In addition to the beach ridges commonly used as sea level markers also in other sector of the Patagonian coast, in the study area have been identified also notches carved in volcanic rock (Fig. 4). Even if studies on this topic are still in progress, their localization seem to be related to the High tide level providing additional information on palaeo sea level.

REASONS TO CONSIDER BAHIA BUSTAMANTE A GEOSITE

This sector of coast preserves impressive traces of sea level oscillations represented by marine deposits and erosional forms of high scientific value for understating climatic changes and tectonic uplift history in this area. In particular the Bahía Bustamante area, due to the great number and the excellent state of preservation of its landforms, represents one of the areas where the Quaternary period is best represented in all the Argentinean coast. Past landforms and deposits are in fact, particularly well



Fig. 4 – Active notch at the Canadon

preserved because Restinga mouth weathering processes and infrastructures are very limited. The landscape is dominated by the outcrops of marine deposits, prevalently organized in impressive series of sandy coastal system. It occurs during periods of sea-level fall which results in marine regression. The shoreline has been built seaward by accumulation of sand and pebbles stranded by

to gravelly beach ridges. Beach ridges are considered sedimentary structures formed during the progradation of the

storms waves. The waves activity rips benthic animals from the seafloor and accumulates them within beach ridges. From the fossilized shells preserved until nowadays, is possible to determinate the deposit age. Thanks to the great geomorphological paleoclimatic and naturalistic values the area of Bahia Bustamante is worthy of particular attentions, having all the characters to be a geosite. This area provides a direct and friendly interface which reveals the knowledge of Earth history to a public without specific geological background. It enables them to understand the events that have produced the current landforms and those phenomena that will modify and generate the future landscapes. This sector of coast is an environment of high natural values (however, it is threatened by oil exploitation, mining and increasing tourism) and represents a natural heritage that need to be preserved for future generations as reserve of marine and terrestrial biodiversity. Moreover in addition to the significant geological heritage this area preserve a relevant biological and historical heritage. From the biological point of view, the coastal area is one of the most important seabird nest-building zone of the Atlantic Patagonia. The islands and islets whose habitat is characterized by a combination of different substrates and vegetation, seabirds provide suitable environments to reproduce. The bird-watchers come to Bahia Bustamante to watch principally the two endemic species that inhabit these shores: the Orlog Gull (or Olrog) and Steam Duck, which are no-flying birds. From a historical point of view, a small village of fishermen of algae (Pueblo Algueros) took place in this area in 1947, hosting a company dedicated to the collection and processing of seaweed. Today a modern alguera industry is active in Bahia Bustamante village, with various products in the areas of nutrition and biomedicine. Moreover, the village which hosted up to 400 people has been recently converted into a sustainable village opened up to tourism, promoting natural resource trough the philosophy and ethic of reduce, reuse and recycle. Biological and historical heritage combined with geological heritage are key elements to support a geological tourism (Poli 1999). In this regard the area of Bahia Bustamante is suitable to promote a geological tourism and more in general knowledge on Earth Science.

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