



Contents lists available at ScienceDirect

Quaternary International

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

Characterization and dating of coastal deposits of NW Portugal (Minho–Neiva area): A record of climate, eustasy and crustal uplift during the Quaternary



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ARTICLE INFO

Article history:

Available online 18 February 2014

ABSTRACT

This study presents the characterization and numerical dating of Quaternary coastal deposits of NW Portugal, located between the mouths of the Minho and Neiva rivers. They record continental (small alluvial fans and streams) and transitional (aeolian dunes, interdune ponds, estuary, sandy and gravelly beaches) paleoenvironments. Quartz and K-feldspar optically stimulated luminescence (OSL) dating is employed as well as AMS ¹⁴C dating. A staircase of coastal terraces (abrasion shore platforms) was identified (altimetry, a.s.l.) and ascribed to the following probable Marine Isotope Stages (MIS): T1 – 20–18 m (MIS11); T2 – ca. 13 m (MIS9); T3 – 9.3–7.3 m (MIS7); T4 – 5.5–4.5 m (MIS5); T5 – 3.5–2.0 m (MIS5). The terraces have some preserved sedimentary facies that includes coeval beach sediments on the lowest four. A late Pleistocene to Holocene sedimentary cover comprises four sub-units: a) the lower sub-unit, corresponding to ferruginous stream deposits and aeolian dunes dated ca. 67–61 ka (MIS4), probably related with sub-humid to arid mid-cold conditions; b) on the slopes, the lower sub-unit is overlapped by sandy-silty colluvium and sandy alluvial deposits dated ca. 56–28 ka (MIS3) and probably reflecting cold/mid-cold and wet/dry climate conditions; c) this sub-unit is topped by soliflucted lobes and sandy-silty/silty deposits recording cold and dry climate dated 20–13 ka (MIS2), and d) a top sub-unit dated to 16–18th century, recording Little Ice Age events, consisting of fluvial sediments coeval with temperate climate evolving to aeolian dunes from the Maunder Minimum (cold windy dry conditions).

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1. Introduction

The interpretation of coastal terrace staircases in relation to causal mechanisms (eustasy, tectonics and climate) is still a subject of discussion (e.g. Benedetti et al., 2009; Ristuccia et al., 2013). Within Iberia, the coastal terrace staircases located near the mouths of rivers draining to the Atlantic Ocean could provide suitable archives to interpret the roles played by these mechanisms.

The interest in the Quaternary evolution of Minho coast, northwestern Portugal, began with the study of river and marine

terraces by Choffat (1894), Pinto (1932), Berthois (1949), and Zbyszewski (1958). Later, other studies were carried out by Alves (1989, 1995, 1996) and Meireles (1992). In the adjacent coastal areas of Galicia and Neiva-Aveiro, several studies on the Pleistocene and Holocene deposits were also made: Granja (1990), Granja and Carvalho (1991, 1992, 1993, 1995), Carvalho et al. (1995, 2006), Granja and Groot (1996), Granja et al. (1996, 1999, 2008, 2010), Carvalho and Granja (1997, 2003), Groot and Granja (1998), Pérez-Alberti et al. (1998, 2009), Alonso and Pagés (2000, 2007), Blanco-Chao et al. (2002, 2003, 2007), Fábregas Valcarce et al. (2003), Araújo (2001, 2004, 2005, 2008), Araújo et al. (2003), García-Amorena et al. (2007), Thomas et al. (2008), Araújo and Gomes (2009) and Ribeiro et al. (2010, 2011).

This paper focuses on the geomorphological and sedimentological characteristics of a Pleistocene coastal terrace staircase of

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NW Portugal, covered by extensive late Pleistocene to Holocene sedimentary units. The study area is located between the Minho River mouth (N41°51'54.22"; W8°51'44.02") and the Neiva River mouth (N41°36'45.77"; W8°48'37.72") (Fig. 1). The main purpose of this study of the Pleistocene–Holocene record is to: 1) give some of the first numerical ages for Pleistocene sequences in NW Portugal; 2) contribute to the understanding of the evolution of coastal processes and coeval sedimentary and geomorphic controls, 3) identify the main climatic stages and 4) clarify the tectonic evolution of the Minho region.

2. Geological setting

2.1. Regional lithology

In the study area, the most represented lithologies are those belonging to the metamorphic (mainly metapsamopelites, quartzites, metaconglomerates and micaschists) and magmatic basements (mainly granitoids). Pleistocene and Holocene sedimentary units are represented by siliciclastic fluvial, colluvial, aeolian, estuarine and beach deposits.

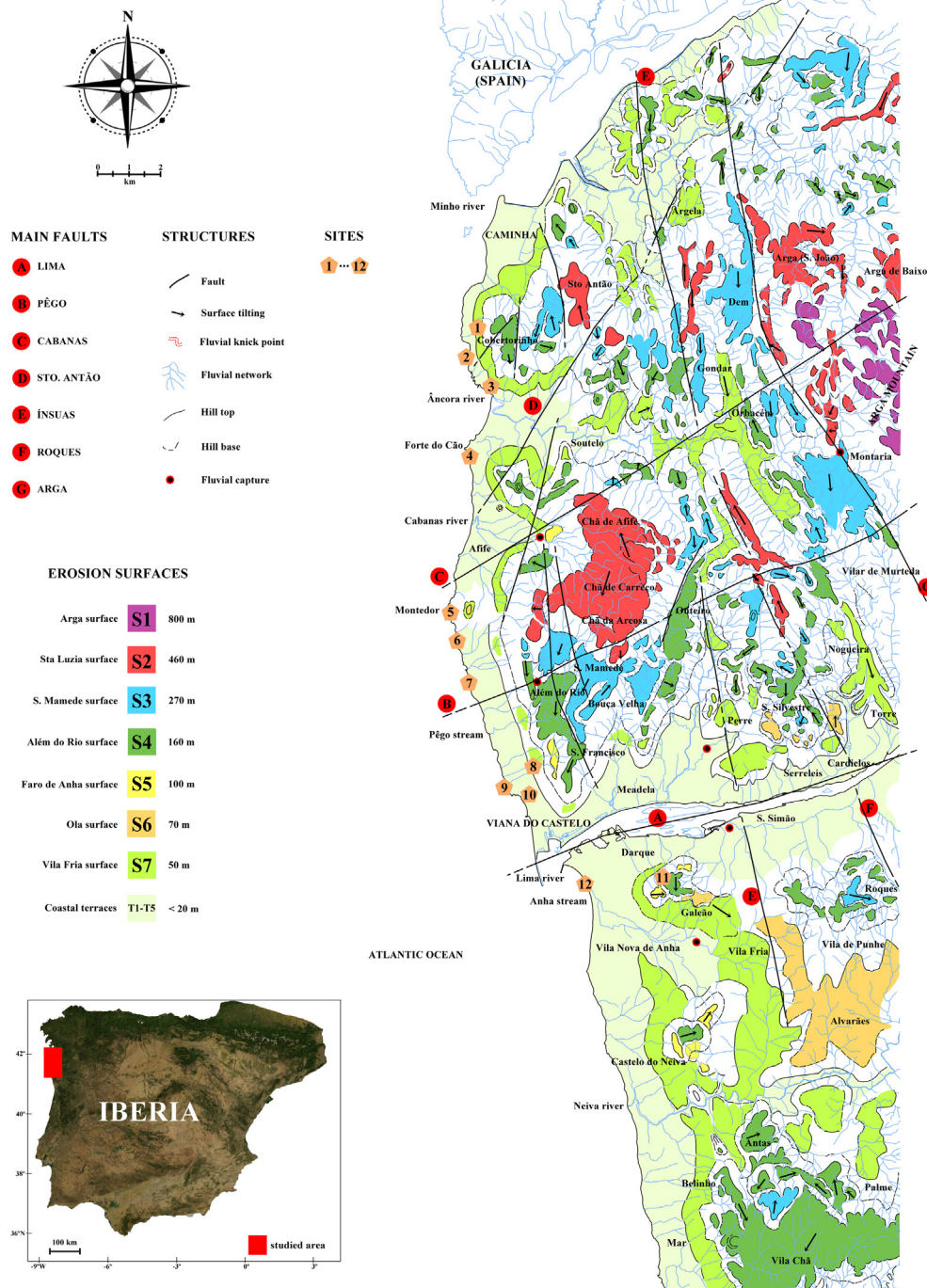


Fig. 1. Geomorphological map of NW Portugal coast, with location of the studied sites (adapted from Carvalho, 2012). Sites: 1) Estrada Real; 2) S. Domingos – Moledo; 3) St. Isidoro – Âncora; 4) Forte do Cão/Gelfa; 5) Alcantilado de Montedor; 6) Cambôa do Marinheiro – Montedor; 7) Canto Marinho; 8) S. Sebastião – Areosa; 9) Rego de Fontes; 10) Ribeira de Portela – Areosa; 11) Galeão; 12) Ribeira de Anha – Cabedelo.

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