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Provenance study of Pliocene–Pleistocene sands based on ancient detrital zircons (Alvalade Basin, SW Iberian Atlantic coast)

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ABSTRACT

Pliocene–Pleistocene sand of the Alvalade basin was taken from the sea-cliffs of SW Iberia coast for a provenance study using radiometric dating. The U–Pb ages obtained revealed a wide interval ranging from Cretaceous to Archean, with predominance of Paleozoic, Neoproterozoic and Cretaceous zircon ages. Cretaceous ages interpreted to indicate a Sines Massif provenance are dominant in sands close to Cape Sines but are absent in sand sampled 12 km north. Carboniferous ages younger than ca. 315 Ma suggesting a possible contribution from the Central-Iberian Zone originally; however, these zircons may be multi-cyclic, having been reworked from Eocene–Miocene siliciclastic deposits related to transport from central Iberia (Lower Tagus basin drainage evolution). These signatures provide important constraints on the location and extent of the Pliocene–Pleistocene topography and drainage system that were probably controlled by: i) Miocene to Pleistocene landscape rejuvenation driven by Alpine movements along major faults; and ii) residual reliefs related to inherited Variscan structure. The U–Pb ages obtained also trace the pre-Cenozoic paleotectonic evolution of SW Iberia recorded in their sources: i) the North Gondwana accretion and breakup; ii) the Gondwana and Laurussia collision; and iii) the Pangea breakup and opening of the Atlantic Ocean.

1. Introduction

Exposed rocks are subject to external geodynamic processes that promote erosion, transportation and deposition of detritus into sedimentary basins. The mineralogical composition of detritus that eventually reach the sedimentary basins can vary their proportion depending on the climate which controls the weathering, sediment transport and the geological setting of their sources (von Eynatten and Dunkl, 2012). Commonly, detritic sedimentary rocks contain heavy minerals, such as zircon, which is derived from different source rocks (Davis et al., 2003; Fedo et al., 2003; Kinny and Maas, 2003; Gehrels et al., 2011). Provenance studies using the efficient and reliable technical capability of Laser Ablation-Inductively Coupled Plasma Mass Spectrometry (LA-ICPMS) in regard to detrital zircon U–Pb age determination are extremely useful in the process of recognizing potential sources and to better understand complex histories of changes in drainage basin evolution during epeirogenic uplift (Galloway et al., 2011).

Such provenance studies based on detrital zircon U–Pb geochronological analysis can lead to the identification of different episodes of detrital sediment deposition and to a better understanding of the Earth's evolution (Sircombe, 1999; Cawood et al., 2003; Campbell et al., 2005; Morton et al., 2005). In the present study a dataset of detrital zircon U–Pb LA-ICPMS geochronological results is presented from Pliocene–Pleistocene sands of the Alvalade basin sampled on the sea-cliffs of SW Iberian Atlantic coast (Figs. 1, 2). The obtained results are used to statistically compare the detrital zircon age distributions and to trace potential source areas based on existing knowledge of the zircon-forming events preserved in the pre-Cenozoic basement of SW Iberia. Despite intense investigation, the origin and transport history of the sediment within the Alvalade basin and the interplay with tectonism remain poorly understood. Field evidence suggests that much of the Pliocene–Pleistocene sand in the Alvalade basin was probably derived from nearby Paleozoic and Mesozoic sedimentary and igneous rocks, whereas early paleogeographic reconstructions imply that the sand transport was also connected to a large northeast-to-southwest drainage network of the Lower Tagus basin extending from central eastern Iberia to the Atlantic coast. Resolving these issues can help improve

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