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Variability over time in the sources of South Portuguese Zone turbidites: evidence of denudation of different crustal blocks during the assembly of Pangaea

Abstract

This study combines geochemical and geochronological data in order to decipher the provenance of Carboniferous turbidites from the South Portuguese Zone (SW Iberia). Major and trace elements of 25 samples of graywackes and mudstones from the Mértola (Visean), Mira (Serpukhovian), and Brejeira (Moscovian) Formations were analyzed, and 363 U-Pb ages were obtained on detrital zircons from five samples of graywackes from the Mira and Brejeira Formations using LA-ICPMS. The results indicate that turbiditic sedimentation during the Carboniferous was marked by variability in the sources, involving the denudation of different crustal blocks and a break in synorogenic volcanism. The Visean is characterized by the accumulation of immature turbidites (Mértola Formation and the base of the Mira Formation) inherited from a terrane with intermediate to mafic source rocks. These source rocks were probably formed in relation to Devonian magmatic arcs poorly influenced by sedimentary recycling, as indicated by the almost total absence of pre-Devonian zircons typical of the Gondwana and/or Laurussia basements. The presence of Carboniferous grains in Visean turbidites indicates that volcanism was active at this time. Later, Serpukhovian to Moscovian turbiditic sedimentation (Mira and Brejeira Formations) included sedimentary detritus derived from felsic mature source rocks situated far from active magmatism. The abundance of Precambrian and Paleozoic zircons reveals strong recycling of the Gondwana and/or Laurussia basements. A peri-Gondwanan provenance is indicated by zircon populations with Neoproterozoic (Cadomian-Avalonian and Pan-African zircon-forming events), Paleoproterozoic, and Archean ages. The presence of late Ordovician and Silurian detrital zircons in Brejeira turbidites, which have no correspondence in the Gondwana basement of SW Iberia, indicates Laurussia as their most probable source.

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