



The missing Rheic Ocean magmatic arcs: Provenance analysis of Late Paleozoic sedimentary clastic rocks of SW Iberia

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ABSTRACT

Early Carboniferous turbiditic sedimentary rocks in synorogenic basins located on both sides of the Rheic suture in SW Iberia were studied for provenance analysis. An enigmatic feature of this suture, which resulted from closure of the Rheic Ocean with the amalgamation of Pangea in the Late Carboniferous, is that there are no recognizable mid- to Late Devonian subduction-related magmatic rocks, which should have been generated during the process of subduction, on either side of it. U–Pb LA–ICP–MS geochronology of detrital zircons from Early Carboniferous turbidites in the vicinity of the Rheic suture in SW Iberia, where it separates the Ossa–Morena Zone (with Gondwana continental basement) to the north from the South Portuguese Zone (with unknown/Meguma? continental basement) to the south, reveals the abundance of mid- to Late Devonian (51–81%) and Early Carboniferous (13–25%) ages. The Cabrela and Mértola turbidites of the Ossa–Morena and South Portuguese zones, respectively, are largely devoid of older zircons, differing from the age spectra of detrital zircons in the oldest (Late Devonian) strata in the underlying South Portuguese Zone, which contain abundant Cambrian and Neoproterozoic ages. Mid- to Late Devonian zircons in the Cabrela Formation (age cluster at c. 391 Ma, Eifelian–Givetian transition) and Mértola Formation (age clusters at c. 369 Ma and at c. 387 Ma, Famennian and Givetian respectively) are attributable to a source terrane made up of magmatic rocks with a simple geological history lacking both multiple tectonic events and older continental basement. The terrane capable of sourcing sediments dispersed on both sides of the suture is interpreted to have been completely removed by erosion in SW Iberia. Given that closure of the Rheic Ocean required subduction of its oceanic lithosphere and the absence of significant arc magmatism on either side of the Rheic suture, we suggest: 1) the source of the zircons in the SW Iberia basins was a short-lived Rheic ocean magmatic arc, and 2) given the lack of older zircons in the SW Iberia basins, this short-lived arc was probably developed in an intra-oceanic environment.

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1. Introduction

Deciphering the processes responsible for the closure of the Rheic Ocean is crucial to understanding the late Paleozoic amalgamation of Pangea. The Rheic suture between the two main continental blocks that made up Pangea, Laurussia and Gondwana, can be traced along the Ouachita–Appalachian–Variscan orogenic system across North America and Western-Central Europe (e.g. [Matte, 2001](#); [Nance et al., 2010](#)) (Fig. 1).

In the northern Appalachians, terranes inferred to lie west of the Rheic suture include Avalonia and the more outboard Meguma. The Meguma terrane is exposed in southern Nova Scotia and is interpreted to extend seaward over a wide area from the Grand Banks to Cape Cod ([van Staal et al., 2009](#)). Mid–Late Devonian granitoid intrusions that have a collisional geochemical signature ([Tate and Clarke, 1997](#); [Moran et al., 2007](#)) characterize the Meguma terrane and are interpreted to record subduction of Rheic oceanic lithosphere to the northeast beneath Laurentia ([van Staal et al., 2009](#); and references therein). If correct, the Rheic suture is constrained to lie offshore of the North American Atlantic margin, east of the Meguma terrane ([van Staal and Barr, 2012](#)).

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