

Spreading of the Paleothetys aulacogen behind the Variscan Orogen: Alkaline gabbros from the pelagic Devonian basin of Minorca Island

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The Variscan Orogen is characterized by several high-pressure metamorphic events and ophiolites of different ages. The Paleothetys Ocean, the main eastern Pangea Ocean, started to open during the Devonian somewhere in northeastern Gondwana. At c. 395 Ma, the opening of intra-Gondwana transitional-oceanic basins can be tracked by the presence of several supra-subduction zone ophiolites, preserved in Variscan Allochthonous Complexes. Within the Autochthonous domain under these complexes, made up of the pre-Silurian continental crust and Devonian basins, alkaline magmatism is recognized. Minorca is the only Balearic Island with Variscan basement outcrops, composed of a large Devonian to Carboniferous basin with pelagic sediments and mafic abyssal dykes. Its current position, together with the paleogeographic evolution of the Western Mediterranean, suggest that the Devonian Minorcan basin was located at the southernmost eastern branch of the Iberian block, close to southern Sardinia and the Alkapecas basements.

Intruded in the Devonian Minorcan series, the Tramuntana Gabbros represent a set of sills emplaced throughout a tectonic-driven extension registered by a pelagic Frasnian – Tournaisian sequence. Based on the abundance of incompatible HFSE and REE, these titanium-rich augite-bearing mafic rocks correspond to alkaline magmas equivalent to intra-plate types or oceanic-island basalts. Additionally, the $^{87}\text{Sr}/^{86}\text{Sr}=0.708573$ and $^{143}\text{Nd}/^{144}\text{Nd}=0.512669$ average isotope ratios reported for 10 gabbro samples indicate an enriched mantle source with an average $T_{\text{DM}}=c. 665$ Ma.

The radiometric and biostratigraphic age of the alkaline magmatism found in different peri-Gondwanan terranes varies between 385 and 360 Ma. During this time, protracted dextral convergence between Gondwana and Laurussia induced subduction of the northern Gondwana margin, and the strike-slip settings of the simultaneously opening Devonian basins located further south. Our interpretation is that the widespread Devonian alkaline magmatism is caused by an episode of rifting located to the south of the Variscan Orogen, which was related to the easternmost opening of the Paleothetys Ocean. This section of the ocean can be interpreted as a short-lived aulacogen. The broad melting of an enriched mantle beneath northern Gondwana aligns with the Cadomian (Ediacaran – lower Cambrian)