The lower Paleozoic magmatic flare-up in the Iberian Massif: the Fundão Pluton case-study (Castelo Branco, Portugal)

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The formation of oceans along north Gondwana in lower Paleozoic times is usually ascribed to an inheritance of the Cadomian orogen back-arc system followed by the generation of epicontinental seas during the initial lithospheric breakup. In the Iberian Massif, evidence of a ca. 30 Ma magmatic flare-up – from the Furongian to the Middle Ordovician – involving crustal- and lithospheric mantle-derived partial melts, with different grades of magmatic differentiation and magma mixing/mingling, are described in the different tectonic domains. Extensive anatexis have been recently described in the south-central Central Iberian Zone (CIZ), documenting partial melting of the continental crust, with inputs of lithospheric mantle-derived melts, related to fast crustal thinning during the formation of a passive margin that overprints the Cadomian Orogen in north Gondwana. Along this CIZ-segment, we describe new evidence that supports the presence of this Cambrian-Ordovician magmatic flare-up, represented by the Fundão Pluton. Among other contemporaneous plutonic bodies exposed in this sector, the Fundão Pluton is a composite-zoned system comprising different granitoid facies which compositional attributes document interaction between basal crustal and metaigneous-derived melts produced from ca. 499Ma to 465Ma. The available dataset confirms the importance of this CIZ-segment to unravel the magmatic phenomena and the paleogeographic meaning of the preexisting continental margin during the lower Paleozoic, to form the Rheic Ocean and the drifted continental masses. We propose a geodynamic and paleogeographic model that incorporates field, geochemical and geochronological datasets. In this model, an inherited NE to ENE pre-Variscan structure, following the continental margin configuration of Gondwana in the lower Paleozoic, might have assisted the mid-to-upper crustal emplacement of successive tonalitic-granitic melts with calc-alkaline affinities. This structure could be rooted in flat-lying extensional shear zones that enabled the fast crustal thinning and triggered the exhumation of the lithospheric mantle towards shallow conditions, favoring the formation of adiabatic melts further intruded the mid-to-upper crust along major upright discontinuities. This model impacts the current understanding of events preceding the Variscan Orogeny in Iberia, with direct influence in the definition and distribution of a large-scale magmatic flare-up in this sector in northern Gondwana hyperextended margin. Also, this crustal architecture had a major impact on the distribution and nucleation of the Variscan structures responsible for the orogenic thickening during the accretionary and collisional processes that formed the Pangea supercontinent in the Devonian and Carboniferous periods.

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