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Tracing the Cambro-Ordovician ferrosilicic to calc-alkaline magmatic association in Iberia by in situ U–Pb SHRIMP zircon geochronology (Gredos massif, Spanish Central System batholith)

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ABSTRACT

U–Pb geochronological study of zircons from nodular granites and Qtz-diorites comprising part of Variscan high-grade metamorphic complexes in Gredos massif (Spanish Central System batholith) points out the significant presence of Cambro-Ordovician protoliths among the Variscan migmatitic rocks that host the Late Carboniferous intrusive granitoids. Indeed, the studied zone was affected by two contrasted tectono-magmatic episodes, Carboniferous (Variscan) and Cambro-Ordovician. Three main characteristics denote a close relation between the Cambro-Ordovician protholiths of the Prado de las Pozas high-grade metamorphic complex, strongly reworked during the Variscan Orogeny, and other Cambro-Ordovician igneous domains in the Central Iberian Zone of the Iberian Massif: (1) geochemical features show the ferrosilicic signature of nodular granites. They plot very close to the average analysis of the metavolcanic rocks of the Ollo de Sapo formation (Iberia). Qtz-diorites present typical calc-alkaline signatures and are geochemically similar to intermediate cordilleran granitoids. (2) Both Qtz-diorite and nodular granite samples yield a significant population of Cambro-Ordovician ages, ranging between 483 and 473 Ma and between 487 and 457 Ma, respectively. Besides, (3) the abundance of zircon inheritance observed on nodular granites matches the significant component of inheritance reported on Cambro-Ordovician metagranites and metavolcanic rocks of central and NW Iberia.

The spatial and temporal coincidence of both peraluminous and intermediate granitoids, and specifically in nodular granites and Qtz-diorite enclaves of the Prado de las Pozas high-grade complex, is conducive to a common petrogenetic context for the formation of both magmatic types.

Tectonic and geochemical characteristics describe the activity of a Cambro-Ordovician arc-back-arc tectonic setting associated with the subduction of the Iapetus–Tornquist Ocean and the birth of the Rheic Ocean. The extensional setting is favorable for the generation, emplacement, and fast rise of subduction-related cold diapirs, supported by the presence of typical calc-alkaline cordilleran granitoids contemporary with ferrosilicic volcanism.

1. Introduction

The European Variscan Chain resulted from the closure of the Rheic Ocean and the ensuing collision of Gondwana and Laurussia (Matte, 1991; Martínez Catalán et al., 2007; Nance et al., 2010). In NW Iberian Massif, several allochthonous complexes are thrust onto parautochthonous and autochthonous terranes (western part of the European Variscan Chain; e.g., Martínez Catalán et al., 2002). These terranes belong to the North-Gondwana margin (e.g., Martínez Catalán et al., 2002, 2007; Abati et al., 2007; Díez Fernández et al., 2010, 2012a). The pre-Variscan Paleozoic evolution of this tectonic realm includes the formation of a Cambro-Ordovician peri-Gondwanan magmatic arc presumably linked to the subduction of the Iapetus–Tornquist Ocean and the simultaneous opening of the Rheic Ocean triggered by back-arc extension and rifting (e.g., van Staal et al., 1998; Abati et al., 1999, 2007; Winchester et al., 2002; Stampfli and Borel, 2002; Fernández-Suárez et al., 2003; Fuenlabrada et al., 2010; Sánchez Martínez et al., 2012; Díez Fernández et al., 2012b). The analysis of the Cambro-Ordovician magmatism in the Iberian Massif is essential to properly understand the building of the arc and its bearing on the inception of the Rheic Ocean. This widespread magmatism along the northern Gondwana margin comprises rift-related mafic rocks: continental tholeiites (Murphy et al., 2008) and N-MORB, E-MORB, and OIB basalts

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