

A unique blueschist facies metapelite with Mg-rich chloritoid from the Badajoz-Córdoba Unit (SW Iberian Massif): correlation of Late Devonian high-pressure belts along the Variscan Orogen

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ABSTRACT

The Badajoz-Córdoba Unit (BCU, SW Iberian Massif) is a Variscan high-P unit mainly constituted by metapelites, metagreywackes, orthogneisses, Grt-amphibolites, and retrogressed eclogites (high-P metamorphism at c. 377 Ma). Discovery of rare metapelites with well-preserved high-P mineral assemblages, including large garnets up to 1 cm in diameter with abundant inclusions, chloritoid (up to $X_{Mg} = 0.32$), kyanite, staurolite, chlorite, phengite (up to $Si = 3.16$ apfu), paragonite, margarite, and rutile, allows detailed determination of the tectonothermal evolution of the unit. Pseudosection modelling of representative samples indicates that this mineral assemblage formed in blueschist facies (near eclogite facies transition) at P conditions higher than 20 kbar at c. 525°C and that it underwent a subsequent severe exhumation and moderate heating. The lithological composition of the BCU, the age of high-P metamorphism and the characteristics of the high-P mineral assemblages are similar to those found in other high-P and low to intermediate-T units of the Variscan Orogen. All these units form part of a single blueschist-eclogite facies metamorphic belt formed during Late Devonian subduction of the external margin of Gondwana.

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1. Introduction

The Iberian Massif is the southwestern part of the Variscan Orogen, a section of the long mountain chain formed in Devonian and Carboniferous times during the assembly of Pangea (Matte 1991; Martínez Catalán *et al.* 2009). The final amalgamation of Pangea occurred during a complex interaction between Gondwana and Laurussia that generated several diachronic high-P belts and involved the opening and closure of different oceanic basins (Arenas *et al.* 2014a; Díez Fernández *et al.* 2016a). Remnants of these high-P belts and ophiolites are preserved in an Internal Variscan Zone defined along the orogen (Figure 1a).

In the Iberian Massif, a high-P (HP) metamorphic event characteristic of some crustal units distributed from NW to SW (Díez Fernández and Arenas 2015; Figure 1b) has been dated as Late Devonian (c. 377–370 Ma, U-Pb in zircon, Lu-Hf and Sm-Nd isochrons; Abati *et al.* 2010, 2018; Puellas *et al.* 2017). This high-P metamorphism has low to

intermediate temperature characteristics (HP-LT) and can be distinguished from another older metamorphic event with high-P and high-T conditions (HP-HT) dated at c. 410–400 Ma (U-Pb in zircon; Ordóñez Casado *et al.* 2001; Fernández-Suárez *et al.* 2007). This oldest high-P metamorphism is represented in the terranes of NW Iberian Massif. Both types of high-P metamorphism can be roughly followed all along the Variscan Orogen (Armorican Massif, Massif Central, and Bohemian Massif), but the distinction between them is not always evident, and greater local complexity exists (Figure 1a; Kroner and Romer 2013; Ballèvre *et al.* 2014; Arenas *et al.* 2016a; Díez Fernández *et al.* 2016a; Martínez Catalán *et al.* 2020). In the Iberian Massif, both types of high-P units form part of a thick pile of allochthonous terranes where they appear below (HP-LT) and above (HP-HT) of ophiolites. The units affected by the Late Devonian HP-LT metamorphism define a Basal Allochthonous Terrane (Figure 1b). They represent a large section of the Gondwana margin subducted below oceanic lithosphere represented by different Ophiolitic Units dated