The influence of synorogenic extension on the crustal architecture of North Gondwana during the assembly of Pangaea (Ossa–Morena Zone, SW Iberia)

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Abstract: We present a new structural study of a D_2–M_2 tectono-thermal structure in SW Iberia (Ponte de Sor–Seda gneiss dome) characterized by a spatial distribution of telescoping isograds providing a record of Buchan-type metamorphic conditions. The gneiss dome comprises an infrastructure made up of a lower gneiss unit (LGU) and an intermediate schist unit (ISU), separated by early D_2 ductile extensional shear zones. The LGU and the ISU are composed of Ediacaran–Cambrian rocks that experienced the highest-grade M_2 metamorphic conditions (amphibolite facies). Late Ediacaran–Early Terreneuvian and Late Miaolingian–Early Furongian protolith ages for LGU (496 ± 3 Ma) and ISU (539 ± 2 Ma) orthogneisses are reported. A superstructure made of Cambrian–Devonian rocks (Upper Slate Unit, USU) deformed under M_2 greenschist facies conditions, tectonically overlies the ISU across a D_2 extensional shear zone. Kinematic criteria associated with D_2–M_2 fabrics indicate top-to-ESE–SE sense of shear. A late-D_2 brittle-ductile high-angle extensional shear zone (Seda shear zone) crosscuts the gneiss dome. D_3 upright folds, thrusts and transpressive shear zones caused the steepening of D_2 structures and the local crenulation of S_2 foliation. The Mississippian D_2–M_2 event recorded in the Ossa–Morena Zone may be regarded as a regional-scale phenomenon that markedly influenced the crustal architecture of North Gondwana during the assembly of Pangaea.

Supplementary material: Thin section and geochronology sample location and U-Pb data table of SHRIMP analysis of zircon grains (samples CHA-2.1 and VAL-4.1) are available at https://doi.org/10.6084/m9.figshare.c.6828875

Partial melting of the continental crust has a profound impact on orogenic evolution as it causes weakening of the orogenic root and favours gravity-driven lateral flow and/or the development of gravitational instabilities (Vanderhaeghe 2009). Partial melting occurs as a result of tectonic crustal thickening involving terranes with high radioactive heat production and under specific kinematic regimes (Collins 2002; Vanderhaeghe 2012). The formation of tectono-thermal structures typically composed of a core of gneisses and migmatites, structurally overlain by metamorphic rocks of much lower metamorphic grade, can be classified as gneiss domes (Teyssier and Whitney 2002; Whitney *et al.* 2004; Yin 2004) or metamorphic core complexes (Coney 1980; Dewey 1988). The exchange of arguments on the classification of dome-like tectono-thermal structures, including consideration of the relationship between metamorphic core complexes and gneiss domes, is useful for a better understanding of the extensional exhumation processes (e.g. Whitney *et al.* 2013; Platt *et al.* 2015), but is beyond the scope of this study. Some metamorphic core complexes may include gneiss domes in their lower unit (e.g. Vanderhaeghe *et al.* 1999*a*; Vanderhaeghe 2004) complicating structure definition. Dome structures are flanked by flat-lying ductile extensional shear zones developed at mid-lower crustal levels along with migmatites and gneisses, which are exhumed and juxtaposed with upper crustal units

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