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The nested Sierra Bermeja Pluton (SW Iberian Massif): likely sources and magma evolution

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The late Variscan Sierra Bermeja Pluton intruded close to one of the major suture zones of the SW Iberian Massif, in the transition domain between the Central Iberian Zone and the Ossa-Morena Zone. The pluton is NW–SE elongated ($\sim$55 km^2), normally zoned and built by three roughly concentrically arranged pulses of cordierite-bearing monzogranites. The first intrusion corresponded with the outermost Porphyritic Unit (PU), characterized by its K-feldspar phenocrysts and a biotite-rich granodioritic groundmass. Inward, coarse-grained equigranular biotite monzogranites of the second pulse (Monzogranitic Unit; MU) and the latter two-mica leucogranites of the Leucocratic Unit (LU) were emplaced nearly contemporaneously, as a mixing/mingling belt separates them.

All monzogranites display SiO_2 concentrations in the range of 67.90–74.44 wt. %, with mg# (molar Mg/(Mg + Fe^t)) values between 30.8 and 47.6. The peraluminosity increases towards the latest pulses, from subaluminous to strongly peraluminous compositions (A/CNK = 1.01–1.33 mol. %). Moreover, the three units are clearly distinguished by the decreasing maficity (expressed as B = Fe + Mg + Ti in millications; Debon and Le Fort, 1983). $^{87}Sr/^{86}Sr_{300}$ ratios of the studied samples vary from 0.7039 to 0.7112 and the initial εNd values fall in the range of –2.6 to –7.6.

Based on constrained least-squares modelling of major elements, each of the pulses could have formed by $\sim$ 20–27% fractionation of an assemblage dominated by K-feldspar (45–50 wt. %) and plagioclase (34–44 wt. %), with minor biotite (9–20 wt. %). These models are consistent with the observed variation in the log(Ba)–log(Sr) diagrams. In order to reproduce the REE, Th and Y data, minor amounts of monazite (0.03–0.08 wt. %), apatite (0.2–0.3 wt. %) and xenotime (0.0015–0.015 wt. %) had to be included in the fractionating assemblage. These accessory minerals are indeed present in the studied monzogranites.

Each of the facies originated from an independent magma batch, generated most likely from a periodically tapped, periodically replenished magma chamber. The overall trend, from the PU to the LU, is from purely psammitic (or granitic orthogneiss) sources to increasing involvement of metapelites.

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References

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