

Petrogenesis of early syn-D₃ S-type granites from Mondim de Basto, northern Portugal

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In the Mondim de Basto area, in northern Portugal, three granites (Senhora da Graça – SG, Vilar de Viando – VV and Paradaña – PD) intruded parautochthonous successions of the Galicia – Trás-os-Montes Zone, namely those from the Canadelo and Mouquim Units of upper Silurian to Lower Devonian age, and also from the Vila Nune Unit of lower Silurian age. These units are overthrust on the autochthonous metasediments of the Central Iberian Zone. The VV granite is a small body with interpenetrating and diffuse contacts to the PD granite. The latter is muscovite-dominant and is frequently cut by aplite and quartz veins. The SG and VV granites have higher amounts of muscovite than biotite. The three granites correspond to distinct pulses of S-type magmas, yielding $ASI \geq 1.28$, REE patterns enriched in LREE negative Eu anomalies and mean values of $(^{87}\text{Sr}/^{86}\text{Sr})_i = 0.7087 - 0.7149$, $\epsilon\text{Nd}_t = -9.1 - -8.1$ and $\delta^{18}\text{O} = 11.82 \text{‰} - 12.81 \text{‰}$. The $(^{87}\text{Sr}/^{86}\text{Sr})_i$ and ϵNd_t values show that SG and PD granites resulted from partial melting of heterogeneous / different metasedimentary rocks, with signatures that overlap those from the northern Central Iberian Zone. The average zircon saturation temperature is 740 °C for SG, 766 °C for VV, 739 °C for PD granite and 726 °C for PD aplite. These granites show a ductile and brittle deformation, mainly affecting plagioclase crystals, indicating emplacement during the early stages of the Variscan D₃ deformation phase. ID-TIMS U-Pb ages on zircon and monazite show that these stages occurred between 321.5 ± 0.80 Ma (SG granite) and 319 ± 8.7 Ma (PD granite). Geochemical fractionation trends recorded by whole-rocks and minerals enable to distinguish and model fractional crystallization series for SG and PD granites. This subdivision is supported by two Rb-Sr isochrons and relatively uniform $(^{87}\text{Sr}/^{86}\text{Sr})_i$ and ϵNd_t data among each granite. The same data indicate that PD aplite cannot be related to its PD host granite, nor to the SG and VV granites, and probably corresponds to a differentiation of late-D₃ granites that crop out in the surrounding area.