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Petrogenesis of S-type syntectonic granites from Santa Comba de Rossas, Northern Portugal

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At Santa Comba de Rossas a syntectonic granitic complex (G1-G2) was emplaced during syn-kinematic stages of the Variscan orogeny, between 319.4 ± 0.5 Ma (G1) and 319.9 ± 0.8 Ma (G2), as determined by ID-TIMS U-Pb on zircon and monazite. The complex intruded Silurian metasediments of the Parauthocthonous Domain of the Galicia–Trás-os-Montes Zone, in a NW-SE trending antiform. Structural and petrographic studies indicate that the medium-grained porphyritic biotite > muscovite granite G1 and the medium-grained slightly porphyritic biotite ≈ muscovite granite G2 yield evidences of ductile and brittle deformation, typical of late magmatic and solid states. Both granites consist of quartz, microperthitic microcline, plagioclase, biotite, muscovite, zircon, apatite, monazite and ilmenite. Tourmaline only occurs in granite G1. There are local alteration effects such as chloritization of biotite and sericitization of plagioclase. In granite G1, there is also evidence of microclinization of plagioclase. The plagioclase is albite-oligoclase, showing oscillatory patterns in granite G1 and normal zoning in granite G2. Granite G1 contains metasedimentary xenoliths that have either sharp or diffuse contacts, evidencing their progressive interaction and assimilation by the magma (schlieren).

Granite G1 shows an alkali-calcic/calc-alkalic character, whereas granite G2 is alkali-calcic. Both are peraluminous, with ASI ranging between 1.22 and 1.42 and with 2.32–4.32 % normative corundum. Variation diagrams, REE patterns, $\delta^{18}O$ of 10.73–10.88 ‰ and different mean values of $^{87}Sr/^{86}Sr_i$ and εNd_t for G1 (0.7123 ± 0.0005; -6.3) and G2 (0.7181 ± 0.0007; -7.4) show that they correspond to S-type magmas, resulting from partial melting of metasediments with a composition comparable to those of the northern Central Iberian Zone. However, the same data, together with $^{87}Sr/^{86}Sr_i$ and εNd_t values for a xenolith sample (0.7087; -6.2), suggest that the first magma batches promoted the assimilation of country rocks by melting the margins of the magma chamber, lowering the $^{87}Sr/^{86}Sr_i$ ratios and raising εNd_t values and thus producing granite G1. Its crystallization at the margins most likely isolated the interior from new wall rock inputs so that subsequent magma batches could preserve the original isotopic signature and crystallize granite G2.

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