

# On spodumene-rich pegmatites: Eastern Brazilian Pegmatite Province

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Spodumene-rich pegmatites (SRP) are an important source of lithium, a prominent critical raw material and the main driver for the green energy transition. In Brazil, the main lithium deposits are the swarms of SRP of the Araçuaí Pegmatite District. These pegmatites are especially important due to their high modal contents (up to 30%) of coarse-grained spodumene crystals disseminated in a quartz-feldspar matrix of rather homogeneous ore bodies. In the Araçuaí Pegmatite District, the SRP pegmatites have been interpreted as residual magmas from post-collisional plutons mostly composed of Cambrian two-mica granites with pegmatoid cupolas formed under a low-P/high-T metamorphic regime in the late tectonic stage of the Araçuaí Orogen. Former isotopic studies yielded K-Ar ages of 470–490 Ma for SRP mica samples from the Araçuaí District. However, the timing and mechanism of formation of SRP in the area are open to debate based on more precise data. A key limitation for reconstructing their genesis and evolution is the difficulty of obtaining reliable geochronological information, due to: i) their complex and exotic mineralogy, often lacking the most common phases used in geochronology; ii) a general higher uranium content in accessory minerals, especially zircon, causing diffuse metamictization and consequent re-opening of the U-Pb isotopic system; iii) the late H<sub>2</sub>O-rich fluids activity promoting hydrothermal alteration and resetting of isotopic systems. Our study is focused on samples from drill cores and well-preserved outcrops of an SRP found 3 km from an intrusive pluton exposing two-mica and pegmatoid granites. The studied SRP (~ 800 m long and 40 m thick) shows a thin (<1 m thick) marginal zone rich in albite and quartz, discontinuously enveloping a thick internal zone rich in coarse-grained spodumene crystals (20–30 vol%) associated with perthitic K-feldspar, quartz, white mica and albite. The common accessory minerals are Li-phosphates, Nb-Sn-Ta oxides, and zabuyelite. The two mineralogically different zones were sampled and cassiterite grains were separated and imaged in cathodoluminescence. Cassiterite U-Pb analyses were performed by LA-MC-ICP-MS. Data were corrected for the presence of Pb<sub>c</sub> using a linear regression on a Tera-Wasserburg diagram calculating two lower intercept ages at  $512.39 \pm 6.38$  Ma ( $n = 18$ , MSWD = 2.2) and  $506.68 \pm 7.30$  Ma ( $n = 19$ , MSWD = 3.1) for the pegmatite core and border zones, respectively. These ages support formation of the pegmatites during the post-collisional stage of evolution of the Araçuaí magmatic belt.