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Assessing Lithium Potential in Granitic Pegmatites from the Borborema and Araçuaí Pegmatite Provinces (brazil) Using Quartz chemistry

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Quartz from pegmatites of the Borborema (n = 25) and Araçuaí (n = 4) provinces was analyzed by LA-ICP-MS at the Isotopic Geology Laboratory (LAGIS), University of Campinas, Brazil. This study presents the first results from a newly implemented protocol for trace-element analysis in quartz at LAGIS. Borborema pegmatites belong to the LCT (Lithium-Cesium-Tantalum) family, whereas those from Araçuaí are spodumene-rich (SRP) and LCT pegmatites, both formed during the neoproterozoic Brasiliano orogeny. Trace elements analyzed include Al, Ti, Li, Ge, B, Be, Rb, and Ga. Mn, Zn, U, Sb, and Sr were excluded due to unstable signals or concentrations below detection limits. Lithium ranges from 0.1 to 295 ppm, Be from 0.05 to 6.4 ppm, B from 0.6 to 137 ppm, Ga from 0.03 to 1.4 ppm, Rb from 0.04 to 5.4 ppm, and Ge from 0.15 to 14.6 ppm, all positively correlated with Al (73–5558 ppm). Quartz from Araçuaí pegmatites contains up to 133 ppm Li and 803 ppm Al. In Borborema, quartz shows variable but locally high Li and Al contents, reaching 163 ppm Li and 824 ppm Al (Alto Serra Branca), with elevated values also in Alto do Giz, Alto do Patrimônio, and Alto Boqueirão. These concentrations exceed thresholds for spodumene mineralization (>30 ppm Li; >100 ppm Al), supporting quartz as an indicator of Li-enriched pegmatites. Quartz from Borborema pegmatites such as Alto Feio, Alto da Onça, Alto Tanquinhos, and Alto do Patrimônio exhibits the lowest total trace-element contents, suggesting suitability for high-technology applications. B concentrations above 5 ppm—associated with gem-quality tourmaline mineralization—occur in several pegmatites, including Alto Feio (60 ppm), Alto Serra Branca (115 ppm), Alto Tanquinhos (66 ppm), Alto Cortume (35 ppm), and Alto da Quixaba (18 ppm). Quartz trace-element signatures, recording magmatic differentiation and late-stage fluid interaction, provide a proxy for evaluating pegmatite fertility, including lithium enrichment, gemstone potential, and quartz purity. Distinct geochemical patterns between the Borborema and Araçuaí provinces further highlight the value of quartz chemistry for regional metallogenic assessments. [The first author acknowledges financial support from UNICAMP (PIND 03/2023; Grant 2460/23) and CNPq (Research Fellowships 309325/2023-4; 306382/2020-2).]