

Spectral exploration of LCT pegmatites in the Ajmer region of central Rajasthan, India

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The increasing challenges of the global energy transition have significantly intensified the demand for critical metals like lithium, driving advancements in exploration methods. While spectral analysis technique has been widely used to identify various deposit types, its application in exploring LCT pegmatites remains limited. This study employed VNIR-SWIR spectral analysis, supplemented by petrographic, XRD, XRF and EPMA techniques, to identify the mineral assemblages associated with LCT pegmatites and surrounding lithologies in the Ajmer region of central Rajasthan, India. The study area, situated within the Proterozoic Delhi Fold Belt, comprises metasedimentary, metavolcanic, and intrusive igneous rocks hosting widespread pegmatite intrusions. These pegmatites, extending for hundreds of meters, vary in thickness from a few meters to nearly 50 meters. A total of 10 pegmatite samples and 10 surrounding lithological samples were analysed. Spectral parameters including wavelength position, reflectance magnitude, absorption depths, shape and symmetry of diagnostic absorption features were used to determine the spectral mineralogy. The mineral assemblage associated with LCT pegmatites is distinct and includes beryl, schorl, elbaite, cleavelandite, orthoclase, lepidolite, garnet and muscovite. In contrast, chlorite and biotite minerals are identified in the remaining lithologies. This study successfully differentiates lepidolite from muscovite and the spectral analysis results aligning well with mineralogical results gained from petrographic and XRD studies. Additionally, geochemical analysis and mineral chemistry obtained from XRF and EPMA confirm the mineral assemblages of both LCT pegmatites and surrounding lithologies. These findings provide valuable insights for mapping LCT pegmatites using satellite data in the study area and in similar geological terranes elsewhere.