

Detecting the Undetectable: Lithium by Portable XRF.

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The Lithium-Caesium-Tantalum Pegmatites represent approximately 12.5% of the estimates global lithium resources and due to their high grade (1 to 2% Li₂O) are of significant economic importance.

Lithium (Z3) is not directly detectable by a portable XRF instrument; at best a portable XRF instrument can, under helium purge, detect sodium (Z 11) but more commonly is limited to detecting magnesium (Z 12) using a low kev beam (eg 15 kev) and a fundamental parameter calibration.

While portable XRF cannot directly detect lithium a pXRF can detect pathfinder elements associated with LCT Pegmatites including Cs, Ga, Nb, Rb, Sn, Ta, Tl. This suite of elements is not typically included in any standard calibrations package when purchasing “off the shelf” instruments.

Thus a fundamental custom calibration was developed to include elements associated with LCT pegmatites and their host lithologies incorporating an algorithm that estimates the lithium content of a sample. This algorithm is not a single element correlation to the deposit but a multielement correlation that exists to predict Li and actually calculates a lithium proxy termed the Lithium Index.

To evaluate the Lithium Index Calibration blind field trials were undertaken following the implementation of the calibration onto a Bruker S1 Titan pXRF.

In Field Trial 1 rock chip samples from a pegmatite property were initially analysed by a four acid digest and the same samples pulps run on the pXRF. Results returned a strong statistical correlation ($r^2 = 0.99$) between laboratory assay results and the Lithium Index over a grade range of ~100 ppm to ~20000 ppm Li.

In Field Trial 2 fine grained soil samples (-250um) collected over an LCT Pegmatite prospect were initial analysed on the pXRF then sent to a laboratory for four acid digestion. Results returned a strong Lithium Index correlation ($r^2 = 0.84$) when compared the laboratory results over a grade range of ~10 ppm to ~180 ppm Li

Following the successful blind field trials the Lithium Index Calibration in use in mineral exploration campaigns for LCT Pegmatite in Western Australia.