Mineralization potential and trace element whole rock signatures of Archean greenstone belt-hosted LCT-pegmatite deposits

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Archean Lithium-Cesium-Tantalum (LCT) pegmatites are an important source for rare metals like Li, Cs, Rb, Ta, Nb, Sn and Be, commodities that due to their rapid increasing demand in high technology applications are now considered as critical. Major deposits (e.g. Tanco/Canada, Bikita/ Zimbabwe) are of Meso- to Neoarchean age, exclusivelly hosted in greenstone belts and are interpreted to represent deriviates of recycled pre-existing continental crust, caused by a major change in the tectonic structure of the Earth. LCT-pegmatites are an characteristic feature of the geology of the Archaean Yilgarn and Pilbara Craton [1]. Despite their abundant occurence in Western Australia, only the Greenbushes, Cattlin Creek and Wodgina deposits are currently exploited for Li and Ta. Therefore, Western Australia still possesses a great potential of additional resources of rare metals. The present study compares the whole rock trace element signatures of the Londonderry, Mount Deans, Cattlin Creek and Wodgina pegamtites with that of the Bikita pegmatite (Zimbabwe Craton). The pegmatite dikes are mainly composed of quartz, feldspar and mica as well as subordinate to minor components of spodumene, petalite, and Nb-Ta-Sn oxide minerals. Geochemically these pegmatites are metaluminous (ACNK=0.96) to peraluminous (ACNK>1.27) in composition and show typical LCT-pegmatite enrichments in Li (up to 2.25 wt.%), Cs (up to 0.72 wt.%), Ta (up to 0.35 wt.%), Nb (up to 0.1 wt.%) and Sn (up to 0.46 wt.%). The application of element ratios like Nb/Ta (0.03-5.2), Ce/Pb (0.01-9.86), Zr/Hf (1.11-33.33), or Rb/Cs (1.98-72.99) are used as fractionation indicators and allow the definition of specific zones within the single pegmatites that have a high potential to host a rare metal mineralization. Further investigations will focus on the determination of the provenance of the melt that formed the pegmatites and their relation to specific tectonothermal events that were involved during the assembley of the Archean cratons.

[1] Jacobson, M-I., Calderwood, M-A. & Grguric, B-J. (2007) Hesperian Press, Carlilsle/Australia. 356p.