



## **Mineralogical and geochemical characteristics of the Archaean LCT pegmatite deposit Cattlin Creek, Ravensthorpe, Western Australia**

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The LCT (lithium-cesium-tantalum) pegmatite Cattlin Creek is located about 550 km ESE of Perth, Western Australia. The complex-type, rare-element pegmatite is hosted in metamorphic rocks of the Archaean Ravensthorpe greenstone belt, which constitutes of the southern edge of the Southern Cross Terranes of the Yilgarn Craton. The deposit is currently mined for both lithium and tantalum by Galaxy Resources Limited since 2010.

The pegmatitic melt intruded in a weak structural zone of crossing thrust faults and formed several pegmatite sills, of which the surface nearest mineralized pegmatite body is up to 21 m thick. The Cattlin Creek pegmatite is characterized by an extreme fractionation that resulted in the enrichment of rare elements like Li, Cs, Rb, Sn and Ta, as well as the formation of a vertical zonation expressed by distinct mineral assemblages. The border zone comprises a fine-grained mineral assemblage consisting of albite, quartz, muscovite that merges into a medium-grained wall zone and pegmatitic-textured intermediate zones. Those zones are manifested by the occurrence of megacrystic spodumene crystals with grain sizes ranging from a couple of centimeters up to several metres. The core zone represents the most fractionated part of the pegmatite and consists of lepidolite, cleavelandite, and quartz. It also exhibits the highest concentrations of Cs (0.5 wt.%), Li (0.4 wt.%), Rb (3 wt.%), Ta (0.3 wt.%) and F (4 wt.%). This zone was probably formed in the very last crystallization stage of the pegmatite and its minerals replaced earlier crystallized mineral assemblages. Moreover, the core zone hosts subordinate extremely Cs-enriched (up to 13 wt.% Cs<sub>2</sub>O) mineral species of beryl. The chemical composition of this beryl resamples that of the extreme rare beryl-variety pezzotaite. Other observed subordinate, minor and accessory minerals comprise tourmaline, garnet, cassiterite, apatite, (mangano-) columbite, tantalite, microlite (Bi-bearing), gahnite, fluorite, sphalerite, zircon, and uraninite. The mineral composition of micas and the Nb-Ta minerals columbite and tantalite were also used to determine the degree of fractionation within the different zones of the Cattlin Creek pegmatite. The mineral composition of white micas clearly points out a fractionation trend from lithian muscovite composition within the border zone via mixed composition in the intermediate zone towards lepidolite and polyolithionite composition within the core zone. A similar trend is shown by the Nb-Ta mineral compositions, the border and intermediate zone is dominated by ferrocolumbite and manganocolumbite, whereas in the core zone only manganotantalite is present. Further geochronological and isotopical investigations studies will help to understand the regional geological framework and provenance history of the Cattlin Creek pegmatite in more detail.