Paper Number: 2067

The 2650 Ma to 2600 Ma Magmatic Event and its Economic Importance for the Archean LCT Pegmatite Budget

Dittrich, T.[1], Seifert, T.[1], Pfänder, J.A.[2], Gerdes, A.[3], Schulz, B.[1] and Hagemann, S.[4]

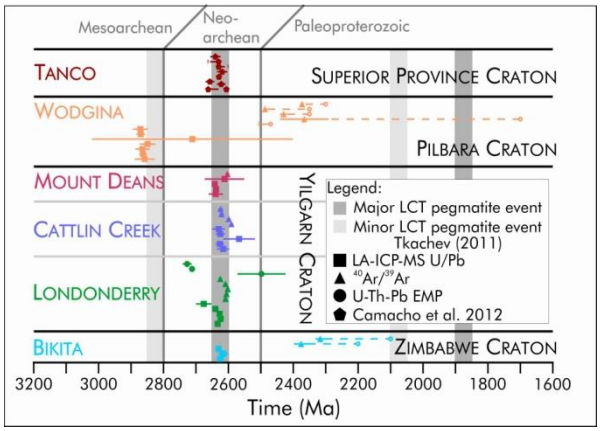
[1]Division of Economic Geology and Petrology, TU Bergakademie Freiberg/Germany (Thomas.Dittrich@mineral.tu-freiberg.de, Thomas.Seifert@mineral.tu-freiberg.de)
[2]ArgonLab Freiberg, Department of Geology, TU Bergakademie Freiberg/Germany
[3]Institute for Geosciences, Goethe University, Frankfurt am Main/Germany
[4]University of Western Australia, Centre for Exploration Targeting, Crawley/Australia

---

Steadily growing markets for high technology applications (e.g., electronics, renewable energies) lead to an increasing demand for rare metals like Li, Ta, Nb and REE. Beside saline brines, lithium-cesium-tantalum (LCT) pegmatite deposits are a significant source for Li and other rare metals (Cs, Ta, Nb, Sn, Rb, and Be) and became a major exploration target during the past years [1].

The present work compares different Mesoarchean to Paleoproterozoic LCT pegmatite systems of the Pilbara, Yilgarn and Zimbabwe Cratons with respect to their geotectonic setting and temporal evolution, and attempts their integration into the complex framework of the Archean Cratons.

Mineral ages were determined using the $^{40}Ar/^{39}Ar$ method on micas, LA-ICP-MS U/Pb dating on Ta-Nb-Sn-oxide minerals and Th-U-Pb electron microprobe (EMP) dating on monazites. Determined ages cover a large age spectrum from the Mesoarchean (ca. 2890Ma) to Paleoproterozoic (ca. 1700 Ma). Ta-Nb-Sn oxide minerals from the Wodgina pegmatite (Pilbara Craton) yield oldest ages of 2890 Ma and are interpreted as major period of crystallisation. This age is supported by LA-ICP-MS U/Pb dating of apatite. In contrast, $^{40}Ar/^{39}Ar$ dating of micas provided cooling ages covering the period from 2500 Ma to 1700 Ma and indicates that the pegmatites at Wodgina were subjected to mineralogical changes a long time after the initial emplacement of the pegmatites. These changes are interpreted to be caused by an extremely long period of cooling or due to a thermal event, which resets the Ar isotopic system of the micas. A similar observation is made for the Bikita LCT pegmatite deposits (Zimbabwe Craton). The U/Pb ages of Ta-Nb-Sn oxide minerals provided Neoarchean ages of 2620 Ma, interpreted as crystallisation age of the pegmatite. As for the Pilbara, $^{40}Ar/^{39}Ar$ mica ages indicate cooling or resetting between 2400 Ma to 2100 Ma, suggesting that the Bikita LCT pegmatite was subjected to later (thermal) events. Age determinations of several LCT pegmatite systems from the Yilgarn Craton all yield comparable Neoarchean ages of 2650 Ma to 2600 Ma. Only some monazites from the Londonderry pegmatite field yield an older age of 2700 Ma. The determined ages of the Yilgarn and Zimbabwe Craton are comparable to the ages determined for the Tanco pegmatite located on the Superior Province Craton [2]. Furthermore, the ages are in good aggreement with the first major LCT pegmatite event of Tkachev [3] indicating that at this time particular geological processes (i.e., high heat flow) and geotectonical settings (i.e., super-continent assembly) were active that favours the global formation of LCT pegmatite deposits.



Acknowledgement: We thank Rockwood Lithium GmbH (Frankfurt am Main, Germany) for friendly support, which allowed us to realise this project.

References:

[1] Dittrich, T et al. (2015) Final project report: 536p.
[2] Camacho, A et al. (2012) Canadian Mineralogist 50(6): 1775-1792
[3] Tkachev, A (2011) Geological Society, Special Publications 350: 7-23