Transtensional Tectonics Control Emplacement of Lithium-Tin Granites in the Eastern Erzgebirge (Germany/Czech Republic)

Jan Cerny[1], Sam Thiele[1], Marie Guilcher[1], Matthias Burisch[2], Uwe Lehmann[3], Henrik Kaufmann[3], Lutz Sonnabend[3], Jens Gutzmer[1]
1. Helmholtz-Zentrum Dresden-Rossendorf, Helmholtz Institute Freiberg for Resource Technology, Freiberg, Germany, 2. Mineral Systems Analysis Group, Department of Geology and Geological Engineering, Colorado School of Mines, Golden, CO, USA, 3. Landesamt für Umwelt, Landwirtschaft und Geologie (LfULG), Freiberg, Germany

The eastern Erzgebirge region contains several significant granite-related Li-mica deposits (e.g., Zinnwald-Cinovec). More than 90% of the known Li-mica occurrences of the Erzgebirge are related to late-stage intrusions (˜313-310 Ma) within the Altenberg-Teplice caldera system. In this contribution, we explore the role of transtensional tectonics and associated crustal-scale faults as the controlling factors for the emplacement and spatial distribution of small stock-like granitic intrusions within the Altenberg-Teplice Caldera. Examination of fault architectures within the wider region of the Altenberg-Teplice and Tharandt calderas and within the broadly contemporaneous western Bohemian Pennsylvanian basin (~314-312 Ma) reveals a large-scale composite pull-apart structure. This includes three pull-apart basins cleaved by a network of transform faults providing trans-crustal connectivity, which are preferentially hosting intrusive stocks and related mineralization. We propose a simplified mechanical model that invokes several second- and third-order dilatant and transfer structures linking the first-order Elbe shear zone in the northeast to the Pfahl or Danube shear zones in the southwest that have allowed the opening of this pull-apart system.

Our analysis provides insight into the intricate tectonic framework that controls the distribution and localization of Li-rich peraluminous granites and associated Li-Sn greisen systems in the Erzgebirge region, with possible applications elsewhere in the world. This approach brings a new exploration tool for identifying favorable locations for undiscovered Li-endowed granite stocks in the Eastern Erzgebirge and provides useful criteria for the exploration of Li-Sn granites in collapsed collisional orogens.