Transtensional tectonic controls on post-Variscan magmatism and related ore formation in the Eastern Erzgebirge, Germany

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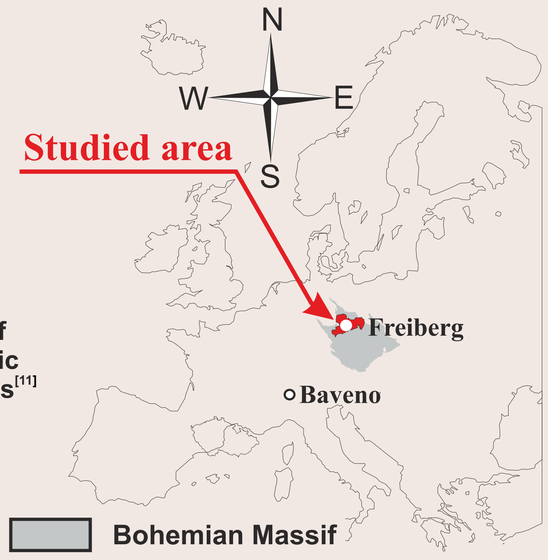
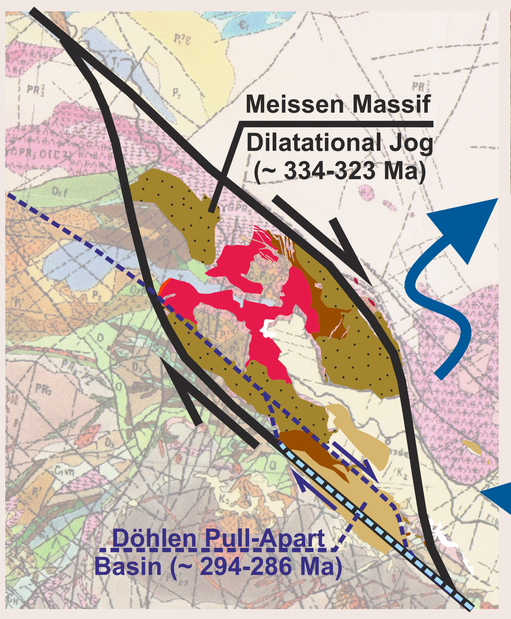
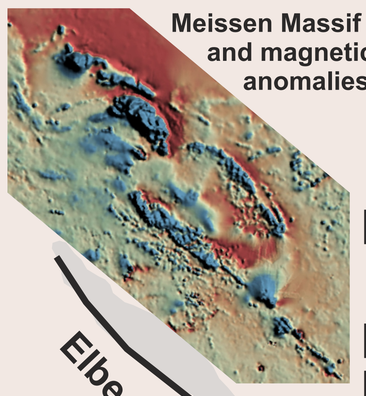
The Eastern Erzgebirge region is exceptionally well endowed in magmatic-hydrothermal ore deposits, which are related to granitic magmatism following the Paleozoic Variscan Orogeny. In this contribution, we explore possible links between this magmatism and the Elbe Shear Zone (ESZ), a major trans-crustal geological structure that separates the Erzgebirge from the significantly less endowed Lausitz Block. This raises the question about the possible role of the ESZ in the evolution of the Eastern Erzgebirge mineral systems.

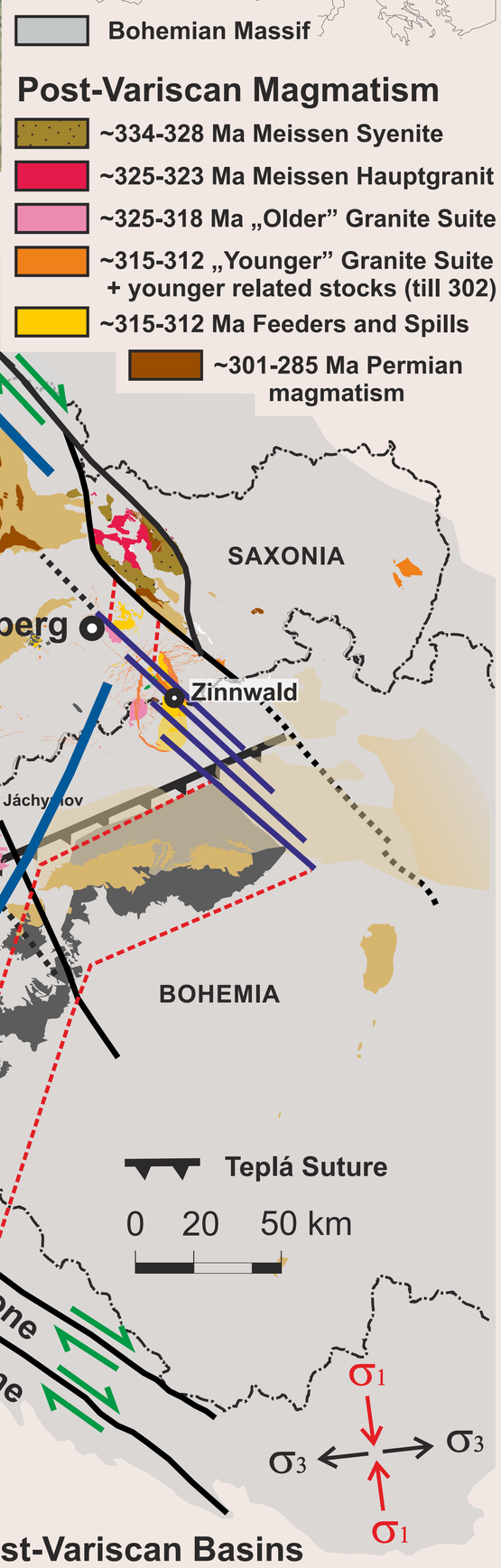


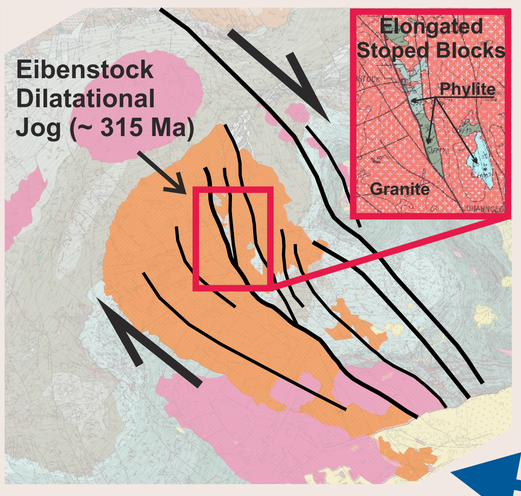
Meissen Massif & Döhlen Basin

The ESZ is well known to be a zone of long-lived (and still ongoing) tectonic activity, with mostly dextral kinematics and a total of ~40–50 km offset. It has been subject to a complex interplay of late to post-Variscan tectonic, magmatic, and sedimentary processes. At least two distinct trans-tensional events can be distinguished, and attributed to dextral strike-slip activity on the ESZ. These are recorded by (1) the Meissen Massif, a composite intrusion that was emplaced at 334–323 Ma[1] into a large dilatational jog[2], and (2) the Döhlen Basin, a pull-apart intramontane basin with abundant ignimbrite tuff units ranging in age from ~294–286 Ma[3].







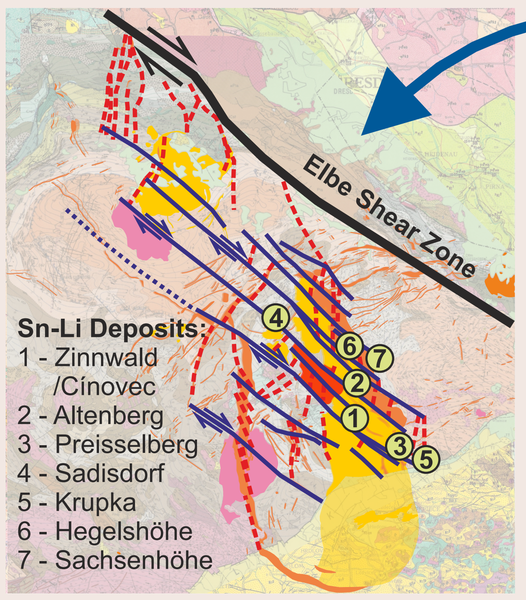


Eibenstock Dilatational Jog

Elongated stoped blocks along mapped faults in the Eibenstock massif indicate syntectonic emplacement at 315 Ma[4]. The geometry and overall shape of the Eibenstock are similar to the Meissen Massif and strongly suggest that the Eibenstock dilatational jog is a younger replica of the Meissen dilatational jog in the Western Erzgebirge along the Gera-Jáchymov Shear Zone (GJSZ).

Putting all together

The Meissen Massif, Eibenstock, and Döhlen basin ages bracket a potentially extensive period of transtensional dextral activity on the ESZ and GJSZ. This fits the overall accepted Post-Variscan stress field orientation in the Bohemian Massif[5]. The spatio-temporal link among the ESZ activity and formation of the Tharandt and Altenberg-Teplice Calderas (ATC) at ~315–310 Ma[6-8] seems to be more complicated and it´s clear that shearing affected at least the shape of the ATC[9]. This caldera is well known to host a number of small granitic stocks endowed with significant Sn-Li-(W-Cu) mineralization. We suggest that the transtensional tectonics associated with dextral strike-slip on the Elbe shear zone is an important control on this mineralization, providing the large-scale crustal architecture that supported these significant plutonic and caldera systems.



Conclusions

Specifically, we suggest that zones of strain-transfer between NW–SE striking dextral strike-slip / transform faults localize felsic magmatism by (1) establishing favorable pathways to the lower crust through which melts can ascend and (2) accommodating growing plutons in the upper crust. Considering the ~314 Ma infill in the Bohemian Basins[10], the Tharandt and Altenberg-Teplice calderas are part of a bigger Carboniferous pull-apart basin system. Related Sn-Li enriched stocks later used former transform fault system when penetrated older rocks.

Dextral transform fault

Normal / sinistral fault

Acknowledgement

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