Indium Mineralization Related to Thermal Convection and Deformation: Insights from 3D Numerical Modelling

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The Dachang ore district in South China has several world-class stratiform sediment-hosted tin-polymetallic deposits, of which, the Changpo-Tongkeng, the Dafulou, and Baotan deposits are also enriched in indium [1].

In the complicated shallow-level ore-forming systems of the Dachang ore district, factors including temperature, pressure, pH, salinity and fluid chemistry can significantly influence the hydrothermal processes resulting in indium mineralization. Understanding the In mineralization in the area requires consideration of a fully coupled system involving medium deformation, pore-fluid flow, heat transfer, mass transport and multiple-components chemical reactions with time and in three-dimensional space. Taking more realistic geochemical environments into account, a 3-dimension numerical modelling was conducted to investigate the indium enrichment mechanism in the study area. Fluid flow and heat-transfer processes are described using medium-continuity, fluid-continuity, and heat conservation equations. The migration of basinal brines into basement material has been proposed as an important mechanism of scavenging or leaching metals for subsequent ore deposition.

Our computation results reveal that medium thermoelasticity has considerable influence on the flow patterns of pore fluid and localization of mineralization in a deformable porous medium [2]. Indium mineralization is often developed in transitional zones between the Sn-bearing and epithermal zones. The geochemical features of this transitional zones have potential to become vectors for exploring In-rich orebodies [3]. Our results also suggest that dilation, reduction deformation, and thermal convection are crucial for concentrating fluid wthin the dilation and reduction zones of the Upper Devonian sediment sequence, which resulted in In mineralization in these horizons.

[1] Li *et al.* (2001) *World Nonferrous Metals* **10**, 33–36. [2] Schaubs *et al.* (2006*) Journal of Geochemical Exploration* **89**, 351–354. [3] Zhao *et al. (2002) Engineering Computations* **19***,* 364–387.