Goldschmidt 2025 Abstract
https://doi.org/10.7185/gold2025.27751

Coevolution between crustal thickness and sulfur oxidation: evidence from apatite inclusions in Gangdese detrital zircons

XUYANG ZHENG[1] AND MING TANG[2]

[1]Peking University
[2]Research Institute of Extraterrestrial Material at Peking University (RIEMPKU)

Porphyry deposits, which are crucial reservoirs of metals such as copper, molybdenum and gold, are commonly associated with oxidized felsic magmas related to thickened continental crust. However, the exact mechanisms behind their formation, including the magma differentiation and oxidation processes, remain controversial. In southern Tibet, extensive Cu mineralization occurred in the Gangdese belt after the massive crustal thickening driven by India-Eurasia collision. To reconstruct the S oxidation state in the Gangdese batholith over the last ~100 Myr, we measured S contents in apatite inclusions hosted in detrital zircons separated from river sands. Zircon-hosted apatite inclusions are less affected by re-equilibrium and late-stage degassing and detrital zircons naturally sample large tracts of the crust. We observed a strong correlation between S content in apatite, the lattice of which tends to accommodate sulfate rather than sulfide, and crustal thickness derived from zircon Eu anomalies as well as whole rock proxies. Because crustal thickening stabilizes garnet in magmatic differentiation, this relationship links the valance state of sulfur in magma to garnet crystallization, which preferentially removes Fe^{2+} relative to Fe^{3+} from magma and oxidizes S. Our findings provide additional evidence for the petrological endogenous mechanism for the oxidation of felsic magmas in convergent margins