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Sulfur cycling within subduction zones: Insights from exhumed mafic and ultramafic slab

Esther Schwarzenbach (1), Jilei Li (2), Timm John (1), Mark Caddick (3), Matthew Petroff (3), and Benjamin Gill (3)

(1) Institut für Geologische Wissenschaften, Freie Universität Berlin, Berlin, Germany (esther.schwarzenbach@fu-berlin.de), (2) Institute of Geology and Geophysics, Chinese Academy of Sciences, Beijing, China, (3) Department of Geosciences, Virginia Tech, Blacksburg, USA

Subduction zones significantly control the geochemical cycling and elemental transfer between the surficial and internal reservoirs of the Earth. Amongst the most hydrophile elements sulfur is the fifth most abundant element on Earth. Subduction of oceanic lithosphere transports sulfur together with numerous other elements into Earth's mantle and releases sulfur-bearing fluids modifying the redox state and the chemical budget of the mantle. Here, we present bulk rock sulfur geochemical data of exhumed mafic and ultramafic slab material to provide new insights into the sulfur cycle within subduction zones. Our data shows that small bodies of detached slab material are subject to metasomatic processes during exhumation (e.g., within a subduction zone channel), where fluids that are circulating along the plate interface cause sulfur mobilization. Sulfur mobilization is thereby more pronounced within serpentinites compared to mafic rocks. In contrast, large sequences of obducted ophiolitic sections can retain their seafloor alteration signatures, particularly at moderate peak P-T conditions. Furthermore, dehydration-related vein systems in blueschists provide evidence for sulfur transfer within the subducted oceanic crust. These vein systems carry distinct sulfur isotopic signatures that reflect dehydration processes of underlying sequences suggesting a negative sulfur isotope signature of the dehydrating subducting slab. Our data provides new insights into the sulfur transfer between the slab and the mantle wedge, which may eventually control the formation of arc-related melts and porphyry deposits.