Geophysical Research Abstracts
Vol. 20, EGU2018-3701, 2018
EGU General Assembly 2018

The plastic deformation of pyrite: Trapping gold in Fool's Gold

Renelle Dubosq (1), Anna Rogowitz (2), and David Schneider (1)

(1) University of Ottawa, Earth and Environmental Sciences, Ottawa, Canada , (2) Department of Sedimentology & Geodynamics, University of Vienna, Austria

As part of metallic ore paragenesis, pyrite is an important sulphide phase known to incorporate significant concentrations of lattice-bound and/or ultrafine inclusions of base- and precious-metals. Prevailing models suggest that the metamorphic transition of pyrite to pyrrhotite through de-sulphidation processes in addition to the plastic deformation of sulphides liberate these trace elements, which are then remobilized and concentrated into economically viable deposits. We conducted 2-D microstructural and geochemical mapping on pyrite subjected to mid-crustal conditions to evaluate the in[U+FB02]uence of sulphide plastic deformation on the release of trace elements during metamorphism. Orientation contrast (OC) forescatter imaging and electron backscatter diffraction (EBSD) mapping reveal that plastic deformation of pyrite under lower-amphibolite facies occurs as linear to complex misorientation patterns, low-angle grain boundary development through dislocation creep and recrystallization by subgrain rotation. EBSD data also show strain localization at microfractures and fracture development due to strain hardening in high strain areas suggesting coeval brittle and plastic deformation of pyrite at our targeted sampling areas. Results from 2-D laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS) trace element mapping of the same pyrite indicates base- and precious-metal enrichment at microstructures including fractures, low-angle grain boundaries and recrystallized grain boundaries. For example, pyrite incorporates <2 ppm Au in the crystal lattice and at low-angle grain boundaries Au concentrations were up to 350 ppm. The integrated results from the microstructural and geochemical analyses conclude that plastic deformation in pyrite creates diffusion pathways as low-angle grain boundaries that act as traps for base- and precious-metals. These results are in contrast to previously suggested models where high strain zones within the crystals should be depleted in trace elements, and allow us to re-evaluate our understanding of pyrite plastic deformation, which has significant implications for economic geology. Additional analyses using 3-D mapping techniques to interrogate the atomic structure of the deformed zones will help further advance our understanding of diffusion processes occurring during pyrite plastic deformation and metamorphism.