

Illumination of vein quartz textures in a porphyry copper ore deposit using scanned cathodoluminescence: Grasberg Igneous Complex, Irian Jaya, Indonesia

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ABSTRACT

Vein quartz from the Grasberg Igneous Complex in Irian Jaya, Indonesia, displays a wide range of features when observed using scanned cathodoluminescence imaging on the electron microscope. Examination of seventeen samples revealed concentric growth zoning, quartz-filled microfractures, dark luminescence near sulfides, changes in crystal size and orientation from vein edges to vein centers, turbid growth zoning, and the truncation of concentric growth zoning. Individual features observed along two large photomosaic traverses from vein margins to vein centers coupled with trace element analyses from the electron microprobe allow determination of a detailed history of fracture infilling. The two traverses indicate a simple, two-stage history of crystal growth into an open fracture followed by mechanical closing of the fracture with resulting microfractures. Electron microprobe trace-element analyses show that the Fe content of quartz reaches values of up to 4900 ppm in dark-luminescent regions near sulfide crystals and decreases smoothly to ~200 ppm along traverses away from the sulfides. The solution to the diffusion equation coupled with existing experimental data about Fe diffusion in SiO₂ indicate the duration of the diffusion was perhaps on the order of thousands of years.