Challenge to Electron Microprobe Analysis by Nano-features in Geo-materials

Identifier V51A-0323

Authors
Ma, C*, California Institute of Technology, Division of Geological and Planetary Sciences, Pasadena, CA 91125, United States
Rossman, G R, California Institute of Technology, Division of Geological and Planetary Sciences, Pasadena, CA 91125, United States

Abstract

With current high-resolution analytical scanning electron microscope and transmission electron microscope technology, nano-features (i.e., inclusions, exsolutions, pores) are being discovered in many common geo- materials routinely analyzed by EPMA. Most EPMA instruments have a thermionic electron gun with a tungsten "hairpin" type filament and operate at such high probe currents that they do not produce the high resolution imaging that field emission SEMs do. Such nano-features present difficulties to electron microprobe analysis of the host materials. It is an accuracy issue. Presented here are a few examples. Nano-inclusions like magnetite or pyroxene are common in volcanic glass. Massive rose quartz contains nano-fibers of a dumortierite-related phase that is pink, which is the cause of rose color and optical star effects. Blue quartz has nano-inclusions of ilmenite. Nano-exsolutions and nano-inclusions occur in some feldspars (moonstone and sunstone). Nano- pores in corundum and opals are observed. Thin coatings of nanocrystals on grains of hematite bring Al and P (or As) into the analytical picture. In each of these cases, electron microprobe analyses of host materials were contaminated or affected by the nano-features. For a complete analytical description of a geo-material it is necessary to first examine probe samples under an optical microscope (400× minimum) and a FE-SEM. If the sample contains nano-features, it would then be necessary to combine FIB and TEM-EDS-EELS to comprehensively analyze the host composition.

Cite as: Author(s) (2007), Title, *Eos Trans. AGU, 88*(52), Fall Meet. Suppl., Abstract V51A-0323