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P74 - Trace element mapping of pyrite from gold deposits –A comparison between PIXE and EPMA

Friday, 11 July 2014 13:00 (1 hour)

The chemical zoning of pyrite can record the evolution of mineralising fluids at widely varying P-T conditions ranging from diagenesis to medium-grade metamorphism [1,2]. If preserved, zoning can reveal growth textures, brecciation and veining, resorption and recrystallisation events, thus shedding light on the processes that contributed to ore formation [3]. Chemical zoning of sulfides is invisible in optical microscopy, but can be studied by chemical etching, high-contrast back-scattering electron images, and compositional maps (e.g. [4]). In this study, we present proton-induced X-ray emission (PIXE) and electron probe micro analysis (EPMA) data on the chemical zoning of pyrite in mineralised veins from the Sheba and Fairview gold mines, South Africa, and compare the two techniques. The compositional maps show complex distribution of trace elements, which suggest multiple events of pyrite crystallisation and gold deposition. EPMA maps show fine-scale variations reflecting growth and recrystallisation textures marked, in particular, by variations of As, Ni, and Co. Up to three events of pyrite formation have been distinguished. In PIXE maps, gold occurs both as finely-distributed and as discrete inclusions, suggesting incorporation in the pyrite structure as solid solution, and deposition as electrum inclusions, respectively. This study shows that trace element mapping of pyrite by PIXE and EPMA can provide complementary information, so that the two techniques can be used in conjunction as a powerful tool to obtain information of chemical zoning of pyrite in ore deposits.

[1] Craig, J.R. et al., 1998. Mineralium Deposita 34, 82-101.
[2] Deditius, A.P. et al., 2009. Geology 37, 707-710.
[3] Fleet, M.E. et al., 1989. In: R.R. Keays, W.R.H., Ramsay and D.I., Groves (Editors). Economic Geology Publishing Company, El Paso, Texas.
[4] Przybyłowicz, W.J. et al., 2001. X-Ray Spectrometry 30, 156-163.

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