Pyrite trace element compositions for ore deposits from Western Australia

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Trace element contents in pyrite is an important source of information on the nature and composition of the ore forming fluids. Detailed information on trace element contents of individual growth zones across different generations of pyrite, combined with Pb isotopic composition provides constraints on the sources and timing of mineralisation [1].

In this study, over 800 LA-ICPMS analyses of pyrite [2] have been performed in mineralised and barren samples from, and in the vicinity of 30 different ore deposits in Western Australia as well as background rocks. In each sample, element deportment within pyrite was assessed, distinguishing between elements present within pyrite structure or in micro-inclusions. Micro-inclusion populations were determined by determining the associations of Au and Ag with other elements (As, Pb, Bi, Te, Hg, Se, Tl).

The Apache K-Means cluster analysis (in the ioGas software) was used to investigate differences in pyrite composition from volcanic hosted massive sulfide deposits (VHMS) and orogenic Au deposits. VHMS deposits commonly contain pyrite with higher Pb, Bi, Co, Se and Sn contents and typically Co>Ni, whereas only a small proportion of analyses orogenic gold deposits had Co>10Ni. Some compositional differences between geographical locations and host rock compositions were also observed.

The data allows for:

- determination of Au and Ag deportment for various types of deposits
- discrimination of prospects according to the various genetic models
- assesment of the Au solubility in pyrite [3] for a wide range of different deposits.

Pyrite trace element and Pb isotopic data has the potential to becoming a useful tool for mineral exploration.

[1] Large *et al* 2011. *Econ.Geol*., v.**106**, pp.331-358 [2] Danyushevsky *et al* 2001. *GEEA*, v.**11**, pp 51-60 [3] Reich *et al*. 2005. *GCA*, v.**69** (11), pp.2781-2796