Advances in LA-ICPMS analysis of sulphide minerals

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Analysis of sulphide mineral by LA-ICPMS presents challenges in two main aspects: 1) sulphur fractionation relative to the major metals varies between different sulphide minerals [1], affecting quantification of complex solid solutions and fine mineral intergrowths, where the use of electron-beam based techniques for independent analysis of sulphur is not practical due to significantly different volumes of the analysed material (larger in LA-ICPMS) leading to incomparable results; and 2) rapid signal drop-off during spot ablation as recorded on ICPMS, particularly for Cu-rich sulphides, when using small beam sizes (< 25 um). This behaviour is common for a number of laser ablation microprobes.

Our results demonstrate that the amount of signal drop-off during ablation is related to the melting point of the mineral, rather than to the composition of the mineral. Minerals with the lowest melting points, such as chalcopyrite, pentlandite and bornite are subject to the strongest signal drop-off compared to sphaleritee and Fe-sulphides. Signal drop-off is also dependent on the optical configuration and the wavelength and pulse width of the laser beam. We present here the performance of RESOlution S-155 microprobes equipped with 3 different lasers (Coherent 193 nm excimer laser, ~ 20ns pulse width; ATL 193 excimer laser, ~ 4ns pulse width; ATL 248 nm excimer laser, ~ 4 ns pulse width). We also investigate the effect of the geometry and rate of He flow around the ablation cell on fractionation of sulphur from base metals.

[1] Gilbert et al. J. Anal. At. Spectrom. 29, 1024–1033 (2014)