Matrix dependance for the quantification of sulphur in sulphide minerals by LA-ICP-MS

S.E. GILBERT*, L.V. DANYUSHEVSKY AND S. MEFFRE

CODES, Univarsity of Tamania, Hobart, Tasmania, Australia, 7000 (*correspondence: sgilbert@utas.edu.au)

Matrix effects due to differencs in ablation characteristics can be significant between minerals during LA-ICP-MS analyses [1, 2]. In this study we investigate the degree of matrix dependance on the quantification of sulphur between a range of sulphide minerals including pyrite, phrrhotite, bornite, chalcopyrite, sphalerite and pentlandite.

The major element yeilds (sensitivity per ppm) for these sulphide minerals were compared on three laser ablation systems: a 213 nm and 193 nm Nd:YAG lasers and a 193 nm Excimer laser. Sulphur fractionation was significant for some minerals. For example, for both pyrrhotite ($Fe_{1-x}S$) and bornite (Cu_5FeS_4) S yields relative to Fe are consistently high on all laser systems, by up to 12 and 40 % respectively, compared to pyrite (FeS_2). In comparison no fractionation is seen between Cu and Fe [3].

These observation can in part be explained by examining the amount of melt within, and adjacent to, the laser ablation crater. The degree of melting is mineral specific and dependant on the physical properties of the mineral (ie heat capacity), as melting occurs even at low energy close to the ablation threshhold. The degree of melting in each sulphide mineral was assessed with SEM imaging, by inspecting the morphology of the crater rim and deposited material adjacent to the ablation site. Very little melting occurs during pyrite ablation in contrast to pyrrhotite and bornite, which show evidence of liquid melt within and around the ablation crater.

We propose that the high yileds of S relative to Fe and Cu in these minerals is due to the high volatility of S. The implications for the quantification of S in sulphide minerals, and the factors that influence the liberation of S, such as melting during ablation, are discussed.

[1] Jackson & Gunther (2003) JAAS, **18**, 205-212. [2]Sylvester (2008) in Laser-Ablation-ICPMS in the Earth Sciences: Current Practices and Outstanding Issues. [3] Danyushevsky *et al* (2011) *Geochemistry: Exploration, Environment, Analysis,* **11**, 51-60.

Evolution of AFM mineral assemblages in the Jálama granitic pluton

GIL-CRESPO P.P.[1], TORRES-RUIZ J.[2], PESQUERA A.[1] AND RODA-ROBLES E[1].

[1]Departamento de Mineralogía-Petrología, Universidad del País Vasco, PO Box 644, E-48080 Bilbao, Spain
[2]Departamento de Mineralogía-Petrología, Universidad de Granada, Campus Fuentenueva, E-18002 Granada, Spain

The Jálama pluton crops out in the Central Iberian Zone (Spain). It intrudes into low-grade metasedimentary rocks from the Schist-Greywacke Complex, and includes two main units: (1) the central unit, which consists of an inhomogeneous sillimanite-bearing monzogranite with hypidiomorphic seriate texture containing mainly quartz, alkali feldspar, plagioclase, muscovite and biotite. (2) the external unit, which comprises (i) a coarse-grained monzogranite with hypidiomorphic seriate to porphyritic texture including quartz, K-feldspar, plagioclase, biotite, muscovite ± tourmaline, the tourmaline being relatively abundant in places, (ii) an equigranular granite with a mineral association similar to the monzogranite, but muscovite being more abundant than biotite, and (iii) a fine- to medium-grained leucogranite containing quartz, alkali feldspar, plagioclase, muscovite and tourmaline as essential components. Based on textural relationships, mineral compositions, and AFM liquidus topologies, the sequence of AFM mineral reactions in the Jálama pluton may have evolved from $L_1 = Bt + Ms + L_2$, through $L_2 = Bt + Ms + Tur + L_3$ to $L_4 = Ms + Tur$. Biotite would react with a B-bearing melt (L_3) to produce further tourmaline during crystallization to lower temperatures, and subsequent crystallization of the residual melt (L_4) gave rise to the muscovite + tourmaline facies. The $FeMg_{-1}$ exchange operator involving the crystallization of biotite and tourmaline, with an average K_D value ((Mg/Fe)tur/(Mg/Fe)bt) ~ 2.0, covers a wide range of Fe/(Fe+Mg) in the AFM topology. The restricted accesibility to the three-phase Tur-Bt-Mus field of most granitic melts, nevertheless, would account for the separation of biotite + muscovite assemblages from tourmaline-bearing assemblages. The three-phase assemblage displaces toward higher Fe/(Fe+Mg) values with decreasing temperature based on the AFM liquidus topology. This suggests a solidus temperature for the biotite-muscovite assemblage higher than for the tourmaline-muscovite assemblage. This is consistent with the emplacement of the pluton under epizonal conditions (~200-300 MPa) at temperatures in the range of 650-800ºC using the zircon saturation thermometry.

DOI:10.1180/minmag.2013.077.5.7