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PETROGENETIC SIGNIFICANCE OF SULFIDE INCLUSIONS IN ULTRAMAFIC CUMULATE XENOLITHS FROM NOGRAD-GÖMÖR VOLCANIC FIELD, PANNONIAN BASIN

by

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In this paper we provide new information about the evolution of the lithosphere beneath the Nógrád-Gömör Volcanic Field (northern Pannonian Basin) studying sulfide inclusions in cumulate-origin ultramafic xenoliths. These clinopyroxene rich xenoliths, representing the lower crust and upper mantle of the region studied, went through metasomatic alteration which resulted in formation of amphiboles.

We have carried out a detailed petrographic observation of sulfide inclusions using reflected light microscope and analyzed numerous back scattered electron images of the most typical sulfide inclusions. Based on these petrographic studies, only rounded or elongated or negative crystal shaped single inclusions occurring randomly in clinopyroxenes and amphiboles, and rarely in olivines and spinels have been selected for detailed electron microprobe analysis. Textural fabrics listed above are typical of primary inclusions. The sulfide blebs consist mostly of pyrrhotite and minor chalcopyrite, cubanite and pyrite, based on optical properties (Figure 1 and 2).

Chemical compositions of the sulfide phases show that pyrrhotite, which is the major phase in all inclusions, is sulfur rich (up to 40.2 - 41.4 m/m%) and nickel poor (max 6.1 m/m%). Chalcopyrite is also sulfur rich (up to 36.7 m/m%) and deficient in Cu content (down to 27.7 m/m%). Pyrite and cubanite show regular compositions and were identified only in one xenolith.

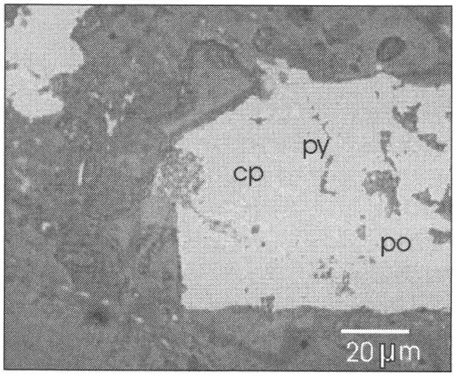

Figure 1
Elongated sulfide inclusion containing spherical chalcopyrite surrounded by thin pyrite rind in clinopyroxene. The rest of the inclusion consists of pyrrhotite.

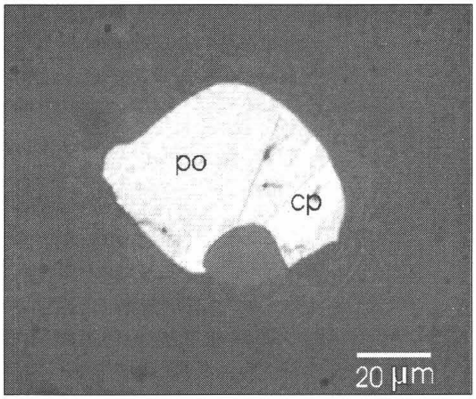

Figure 2
Spool-shaped sulfide inclusion containing pyrrhotite and minor exsolved chalcopyrite lamellas in clinopyroxene.

The bulk compositions of sulfide blebs calculated by mass balance calculation form a tight compositional range and are enriched in Fe compared to those in Type-I peridotite xenoliths from the same volcanic field (Figure 3) (SZABO & BODNAR, 1995). This indicates a distinct evolution history (FALUS et al., 2000).

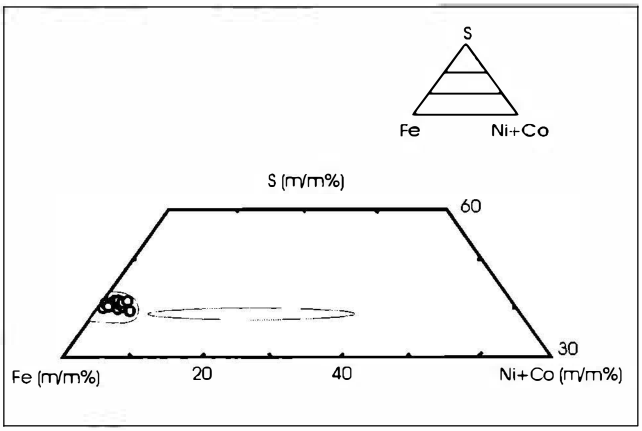

Figure 3
Calculated bulk composition of sulfide blebs in cumulate xenoliths (black circles) in comparison to those of Type-I peridotitic xenoliths (grey field) (SZABO & BODNAR, 1995) from the Nógrád-Gömör Volcanic Field.

Based on our study, it can be concluded that the sulfide blebs studied could have formed from sulfide melt which coexisted with silicate melt which was the source of host clinopyroxene rich cumulates. The sulfide blebs (mineralogically pyrrhotite) went through a high and low temperature evolution producing the other sulfide phases (chalcopyrite, cubanite, pyrite) present in the blebs. Chalcopyrite exsolved from pyrrhotite at relatively low temperature. Pyrite is a product of low temperature alteration process of pyrrhotite.

Study of the sulfide blebs also provides significant information to the origin of amphiboles in the host cumulate xenoliths. Textural features of the amphiboles (e.g., presence of amphibole lamellas in clinopyroxenes along their cleavages) refer to their metasomatic origin. However, sulfide blebs occurring either in clinopyroxenes or amphiboles show no differences in textural features and chemical compositions. The metasomatic process produced amphiboles did not affect the sulfide inclusions. If amphiboles have igneous origin, their sulfide inclusions should be different in compositions and fabrics from those in clinopyroxenes.

References

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