

CUMULATE XENOLITHS IN THE ALKALINE BASALTS OF NÓGRÁD-GÖMÖR VOLCANIC FIELD (N-HUNGARY/S-SLOVAKIA): A MELT INCLUSION STUDY

ZAJACZ, Z.¹, KOVÁCS, I.¹, FALUS, GY.¹, HIDAS, K.¹, SZABÓ, CS.¹, NTAFLÓS, T.²

¹Eötvös University, Pázmány Péter sétány 1/c., Budapest, Hungary, H-1117.

²Institute of Geological Sciences, University of Vienna, Althan str. 14, A-1090, Vienna, Austria.

E-mail: zajacz@freemail.hu

The Nógrád-Gömör Volcanic Field (NGVF), built up by Plio-Pleistocene post-extensional alkali basalts and minor Badenien calc-alkaline andesites, is located at northern edge of the Pannonian Basin. The Pannonian Basin is an extensional back arc basin formed by two evolutionary stages in the Neogene times related to the southward and later westward subduction of an thinned lithosphere beneath the Carpathian orogen belt. Most of the recent studies showed that the extension was related to roll-back effect of subducting lithosphere and followed by subsequent small scale upwelling of asthenosphere during the second stage of rifting (Huisman, 2001).

Three different types of upper mantle and lower crustal xenoliths can be found in the alkaline basalts of the NGVF sampling different domains of deep lithosphere. 1) Peridotites (mostly spinel lherzolites), 2) Cumulates (pyroxenites in composition), and 3) granulites.

The cumulate xenoliths represent underplated mafic melts (Kovács and Szabó, 2003) crystallized at the mantle-crust boundary. These xenoliths are composed mostly of clinopyroxene, olivine and minor spinel. The ratio of olivine and clinopyroxene varies in a wide range. A noticeable part of these xenoliths show metasomatic alteration, which resulted in the presence of amphiboles. Both the cumulating process and the metasomatic alteration prevents assessing the initial parent melt composition of the cumulate bodies using their bulk chemical composition.

Four cumulate xenoliths selected contain large amount of primary partially crystallized silicate melt inclusions. These inclusions occur in mostly olivines and subordinately in clinopyroxenes. Two different type of melt inclusions can be distinguished: 1) Type A., and 2) Type B. The type A silicate melt inclusions are mostly isometric and rounded in shape. They

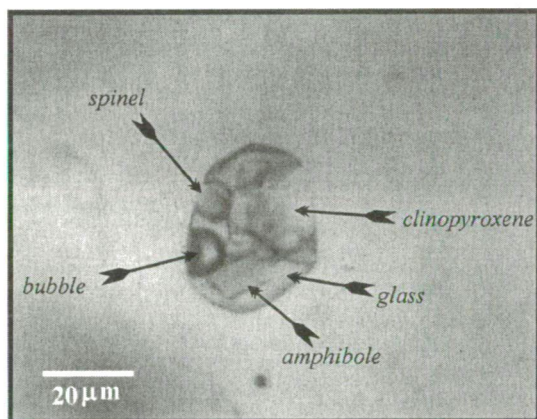


Figure 1: Multiphase type A inclusion in olivine.

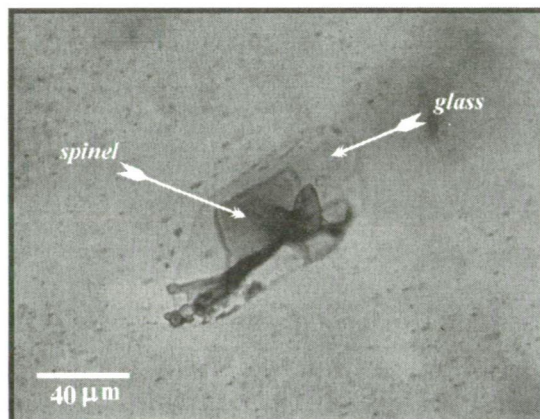


Figure 2: Type B inclusion in olivine.

occur both in olivine and clinopyroxene showing similar phase ratios and composition (Fig. 1). Size of these inclusions ranges from 5 μm to 70 μm . The main daughter phase is clinopyroxene, however rhonite and spinel are also common constituents. Amphibole might occur in a portion of the silicate melt inclusions. In addition, in some inclusions sulfide blebs and apatite can also be recognized.

All the type A silicate melt inclusions studied contain gas bubbles about one fifth in diameter of the host inclusion. The volume ratios of solid phases are in the range 25-35 vol% of clinopyroxene, 15-25 vol% of rhonite, 3-7 vol% of spinel, 20-50 vol% of glass, and 5-10 vol% of amphibole (if any), and other phases.

The type B silicate melt inclusions occur only in olivine of one particular olivine clinopyroxenite xenolith (Fig. 2). These inclusions consist of Cr-spinel and glass. The ratio of these phases varies in a very wide range confirming the contemporaneous enclosure. Gas bubbles are not typical (or absent) in this type of inclusions. The shape and size of these inclusions are also very diverse, showing from isometric to elongated shapes, and sizes in the range of 10-500 μm .

The chemical compositions of phases in silicate melt inclusions are similar to the composition observed in common silicate melt inclusions enclosed in olivine phenocrysts of alkali basalts. The clinopyroxene has high Ca content (Wo_{54} Fig. 3) and Ti content (up to 5.7 wt%); the mg# ranges from 68 to 84. The spinel compositions vary along the spinel-hercynite line and are

close to the $MgAl_2O_4$ end member (Fig. 4), however, in some silicate melt inclusions hosted in clinopyroxene titanomagnetite also occurs, whereas the cr# is very low: from 0.1 to 6. Rhonite shows low silica content ($SiO_2 \sim 27$ wt%), low Na and high Ti content (cation number of Na ranges from 0.3 to 0.6 and of Ti ranges from 0.6 to 1.2, respectively). This composition is similar to those observed in the melt inclusions of olivine phenocrysts of alkaline basalts (Sharygin et al., 2003). The amphibole has pargasitic and kaersutitic compositions with cation numbers $5.7 < Si < 6.4$, $0.13 < Ti < 0.91$, respectively, and the mg# ranges from 68 to 76.

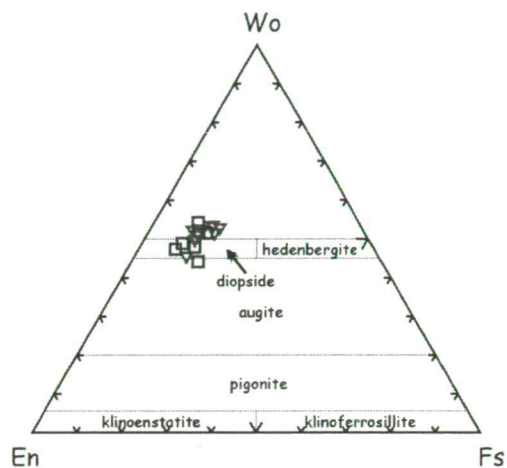


Figure 3: Composition of clinopyroxenes plotted on Enstatite-Ferrosillite-Wollastonite diagram.

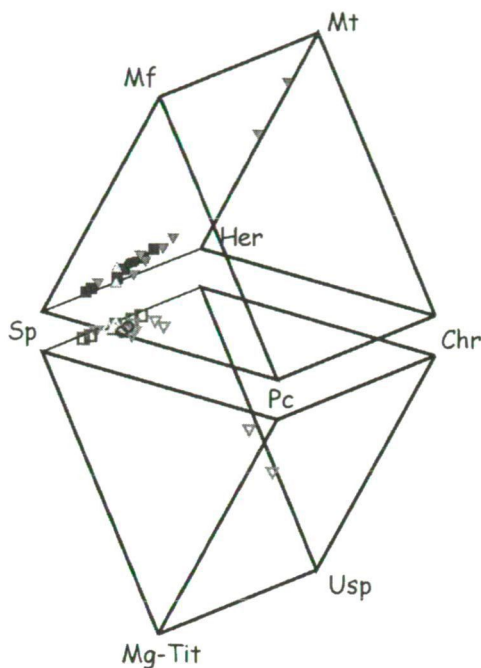


Figure 4: Composition of spinel in Type A inclusions.

High temperature microthermometric data observed using Linkam-stage indicate melting temperature ranges for different phases of the silicate melt inclusions: glass: 1090-1190 °C, clinopyroxene: 1190-1240 °C, rhonite: 1220-1265 °C, spinel: 1260-1320 °C. Homogenization has been reached by the total melting of spinel, however gas phase in most cases does not disappear even during heating up to 1350 °C. Occurrence of amphiboles suggests relatively high volatile content (in this case OH-) for initial silicate mel.

References:

HUISMANS, R. S. (2001): Dynamic modeling of the transition from passive to active rifting, application to the Pannonian basin. *Tectonics*, 20, No. 6: 1021-1039.
 KOVÁCS, I. & SZABÓ, Cs. (2003): History of the lithosphere beneath the Nógrad-Gömör Volcanic Field, Carpathian Pannonian Region (N-Hungary/S-Slovakia) submitted to *Tectonophysics*
 KUNZMANN, T. (1999): The aenigmatite-rhonite mineral group. *Eur. J. Mineral.*, 11: 743-756.