MAGMA CHAMBER PROCESSES IN THE MIOCENE SILICIC PYROCLASTIC SUITES OF THE BÜKKALJA VOLCANIC FIELD (NORTHERN HUNGARY) REVEALED BY SILICATE MELT INCLUSIONS IN LITHIC CLASTS

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The Bükkalja Volcanic Field (BVF) exposes the volcanic products of the extensive Miocene silicic volcanic activities in the Pannonian Basin. This volcanism partly predates the main - Mid-Miocene - extensional period of the Pannonian Basin, but most of the volcanic eruptions occurred contemporaneously with the thinning of the lithosphere beneath the region. These volcanic rocks were formed between 21 Ma and 13.5 Ma (Márton, Pécskay, 1998) and consist only of pyroclastic rocks. The volcanic succession is divided into three main units based on palaeomagnetic data (Lower, Middle and Upper Units; Márton, Pécskay, 1998, Szakács et al., 1998). The petrogenetic and geodynamic processes during this period are not clearly understood. Most researchers suggested that these magmas were originated by anatexis of the lower continental crust either due to the delamination of the whole mantle lithosphere (Downes, 1996) or due to the intrusion of mantle-derived magmas into the crust-mantle boundary zone (Lexa, Konecny, 1999). In addition, Póka et al. (1998) proposed that most of the silicic magmas generated by melting of the upper crust. In contrast, Harangi et al. (2000) and Harangi (2001) emphasized the important role of mantle-derived magmas in the genesis of the silicic volcanic rocks and invoked variable amount of lower crustal contamination.

In this study we are focusing on the ignimbrites cropping out at Szomolya, (western part of the BVF), which belongs to the Lower Unit. The Szomolya locality exposes an unwelded rhyolitic ignimbrite sequence, which contains relatively large amount of lithic clasts, sized up to 20 cm. The lithic clasts have dominantly magmatic origin and are mainly andesites-dacites and minor amount of rhyolites. The andesite-dacite lithoclasts contain variable amount of plagioclase, biotite, orthopyroxene and amphibole. The phenocrysts (up to 70vol%) are embedded in a slightly heterogeneous rhyolitic-dacitic glassy groundmass. The main mineral phases in the host ignimbrite are quartz, plagioclase and biotite. The andesitic-dacitic lithic clasts could be cognate with the rhyolitic pumices of the host ignimbrite indicated by the similar initial $^{87}Sr/^{86}Sr$ and $^{143}Nd/^{144}Nd$ isotopic ratios (Harangi, unpublished data).

The plagioclase (An_{65-80}) and orthopyroxene (En_{62-70}) crystals in the lithic clasts host large amount of silicate melt inclusions. Plagioclases show often spongy texture due to the abundances of silicate melt inclusions. The silicate melt inclusions are glassy and they contain occasionally bubbles. Daughter minerals are very rare. The glass of the inclusions is usually fresh, colourless or brown. Size of the melt inclusions is up to 100 μm.

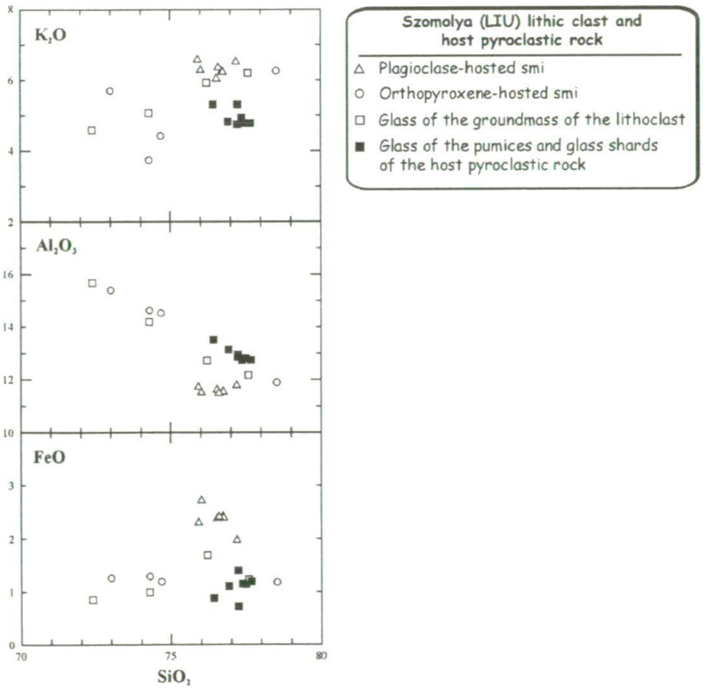

Fig. 1. Compositional variations of silicate melt inclusions (smi) and groundmass and juvenile glasses from an andesitic lithic clast and the host ignimbrite from Szomolya, BVF

Composition of melt inclusions shows relatively large variation (Fig. 1). The SiO_2 content is between 73.0 and 78.5 wt%, whereas the K_2O/Na_2O ratio is between 1.05-6.17. The LOI of the melt inclusions (estimated from the difference between the total and 100wt%) show a range between 1.63-5.33 wt%. The orthopyroxene-hosted melt inclusions have geochemical trend similar to the glassy groundmass of the lithic clast indicating genetic relationships between them (Fig.1). In contrast, composition of the plagioclase-hosted melt inclusions is more silicic than those in orthopyroxenes. They have SiO_2 content similar to the most silicic glasses of the groundmass in the lithic clast and to the glass shards in the host ignimbrite, but show differences in other major elements such as K_2O, Al_2O_3 and FeO.

The silicate melt inclusions embedded in the phenocrysts are dominantly glassy which suggests quenching shortly before the plinian eruption of the silicic magma. Thus, these glasses could represent the composition of the melts in the magma chamber. However, our data show a heterogeneous glass composition in a single lithic clast and even in one phenocryst type. Therefore, we suggest that this lithic clast may represent a fragment from the marginal facies of magma chamber comprising crystal mush and interstitial silica-rich melt. Our data imply that the interstitial melt could have been fairly heterogeneous in this zone and cannot clearly represent the geochemistry of the host magma.

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