EVOLUTION OF ALKALI BASALTIC MAGMAS, NÓGRÁD–SELMEC VOLCANIC FIELD (SOUTHERN–CENTRAL SLOVAKIA)

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Introduction: Monogenetic alkaline basaltic (s.l.) volcanic activity of the Selmec–Nógrád Volcanic Field cover more than six million years. The petrological and geochemical investigations of these basaltic formations have a long history [1-6]. Some of the most fractionated alkali basalts in the CPR are in this area, although their fractionation processes have been barely studied in detail. The widely held view of the simplicity of monogenetic basaltic volcanism has been changed as they evolution could be more complex as it was thought before [7-11]. Revealing the fractionation and magma storage processes is useful to better understand the ascent history of magmas of monogenetic alkali basalt volcanoes and, in addition, it could be invoked to carry out an eruption forecast [12].

Four samples from two localities in the Selmec (Štiavnica) and eight samples from six localities in the Nógrád (Novohrad) area were chosen for investigation.

Order of crystallization and evolution of melts: Single mineral (amphibole), two minerals (ilmenite-magnetite) and mineral-melt (olivine, clinopyroxene, plagioclase, nepheline) thermobarometric calculations were carried out to reveal the ascent history of differently fractionated alkaline magmas.

Fractionation calculations: Taking the forsterite and Ni concentrations of olivine pheno- and microphenorists a new method of olivine and clinopyroxene fractionation calculation was developed. Based on that types of fractionation could be described:

1 – Olivine only.

2 – Olivine dominated with lesser amount of clinopyroxene.

3 – Olivine and clinopyroxene.

4 – Clinopyroxene dominated with lesser amount of olivine.

To check the validity of our method the primary magma calculator "PRIMELT2" [13] was used.

Differences in magma ascent: Based on the investigation of eight characteristic volcanic formations of the area three distinct categories were created:

1 – Fast magma ascent without any contamination.

2 – Magma ascent with a short or negligible stop at the depth of the MOHO, slight contamination by last stage highly evolved alkali basaltic melts/cumulates.

3 – Magma ascent with an unquestionable stop in deep magma reservoir below the MOHO, significant contamination by last stage highly evolved alkali basaltic melts/cumulates.

Spatial and temporal differences of melt evolution in the Nógrád area: Based on our research and former data from literature the volcanoes of the Nógrád area were divied into four categories by the degree of contamination caused by late stage, evolved alkaline basaltic melts and/or crystal cumulates:

1 – No contamination

2 – Slight contamination (maximum 6–8 %)

3 – Moderate contamination (~8–17 %)

4 – Strong contamination (17–24%)

Conclusions: The conspicuous difference of petrology and geochemistry of alkaline basaltic rocks of the Selmec–Nógrád area is related mostly to their ascent histories.

Types of magma fractionation and contamination have both spatial and temporal variability. Strong fractionation and/or subcrustal contamination is more likely by younger basalts and by those rocks which belong to the central updomed area of the Nógrád site. Underneath them – according to our research – a quite huge magmatic underplating at the depth of MOHO is presumable.

Our calculations on the depth of the MOHO (31–33 km) are in accordance with former geophysical data [14]. Additionally, a new method for olivine ± clinopyroxene fractionation calculation from alkaline basalts were developed.

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