

TIMING OF THE NEOGENE— QUATERNARY ALKALI BASALT VOLCANISM IN CENTRAL AND SOUTHERN SLOVAKIA (WESTERN CARPATHIANS)

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Abstract: Alkali basalts occur as sporadic necks, lava flows and cinder cones post-dating andesite/rhyolite volcanism in the Central Slovakia Volcanic Field and as a basaltic field represented by numerous diatremes, maars, tuff cones, cinder cones and lava flows in southern Slovakia, extending into northern Hungary. K/Ar dating and results of paleomagnetic measurements imply, that volcanic activity took place in seven phases: 8.0 – 6.4 Ma, 5.43 – 3.74 Ma, 2.92 – 2.6 Ma, 2.25 – 1.6 Ma, 1.51 – 1.16 Ma, 0.8 – 0.5 Ma (close to the Günz/Mindel boundary), 0.22 – 0.13 Ma (Riss).

Key words: Slovakia, Neogene, Quaternary, alkali basalt, K/Ar dating, paleomagnetism

Introduction

Alkali basalts occur as sporadic necks, lava flows and cinder cones post-dating andesite/rhyolite volcanism in the Central Slovakia Volcanic Field (fig. 1) and as a basaltic field represented by numerous diatremes, maars, tuff cones, cinder cones and lava flows in southern Slovakia (Lučenec basin and Cerová vrchovina highland) (fig. 2), extending into Salgótarján area in northern Hungary (Konečný et al., 1995a). Results of K/Ar dating, degree of volcanic form destruction, relationship to morphology, and results of paleomagnetic measurements imply that volcanic activity took place in seven phases (fig. 3).

Timing of volcanic activity

The 1st volcanic phase (8.0 – 6.4 Ma) of the Pannonian - Pontian age includes basaltic relics in central Slovakia (necks close to Banská Štiavnica, lava complex Ostrá Lúka and lava flow Devíčie) and lava flows and maars of the Podrečany Formation in the NW part of the Lučenec Basin, formed in the limnic environment of the Poltár Formation. Biostratigraphic evidence points to the Pontian age of the Poltár Formation (Planderová, 1986).

Volcanic activity of **the 2nd volcanic phase** (5,43–3,74 Ma) during the Dacian stage of Pliocene occurred dominantly inside and subordinately at the margins of an updomed area

in the southern part of Cerová vrchovina highland. Lava necks Šomoška, Veľké Hradište, Steblová skala, relics of cinder cones and lava complexes Pohanský vrch, and lava flow Belinský vrch have been formed. Volcanic forms reveal an advanced degree of destruction.

Volcanic activity of **the 3rd volcanic phase** (2.92 – 2.60 Ma) during the Early Romanian stage of Pliocene, following a longer lasting break, occurred mostly close to margins of the updomed area (lava flows Mačacia - Tri chotáre, complex Ostrá Skala and diatremes Šurice, Hajnačka).

During **the 4th volcanic phase** (2.25 – 1.6 Ma, Late Romanian stage of Pliocene) volcanic activity expanded over margins of the updomed area (lava flows Ratka - Fil'akovské Kováče and Buda - Hodejov, a complex maar Bulhary). Within the updomed area it has created the lava plateau Medvedia výšina along with a related cinder cone. Within sedimentary filling of the maar to the south of Hajnáčka village skeletons of mammal fauna have been described by Fejfar, (1964). The assemblage of skeletons corresponds to the zone MN-16 (Nairn et al., 1975), representing roughly the time interval 1.8–2.0 Ma.

The 5th volcanic phase (1.51 – 1.16 Ma) of the Early Pleistocene age is dominantly concentrated to the NE of Fil'akovo within the Lučenec basin (group of cinder cones Veľký Bučeň with lava plateau at their foot). Lava flows directed to the North reached the lowest levels of paleovalleys (about 200 m above sea level) what is in good agreement with the radiometric age. Sporadic volcanic activity continued also within the updomed area (spatter cone Dunivá hora and related lava flow, scoria cone Roháč and related lava flow Borkút).

During **the 6th volcanic phase** (around the Günz/Mindel boundary or Early Mindel) maars Hodejov and two maars at Fil'akovo (castle hill and Červený kopec) were formed as inferred from their relationships to river terraces.

The 7th volcanic phase of the Late Pleistocene age is represented by the Púťikov vršok volcano in the Central Slovakia Volcanic Field, composed of a cinder cone and related lava flow (Šimon and Halouzka, 1996). The lava flow was dated to $0,53 \pm 0,16$ Ma. As it covers terrace accumulations of the Hron river assigned to the Riss stage of Pleistocene, the age of the volcano corresponds most probably to the time interval 0,13 – 0,22 Ma.

Evolution of the alkali basalt volcanic activity

Activity of alkali basalt volcanism started in the area of central Slovakia during the Pannonian time (1st phase). Subsequently it moved into the region of southern Slovakia.

Initial volcanic products of the Pontian age (Podrečany Formation) are located in the NW part of the region (1st phase). Lava flows, following the southeaster orientation of paleovalleys, finished in the fluvial/limnic sedimentary environment (Poltár Formation). In places, where ascending magma came into contact with water saturated sediments, maars were formed. At this time the Cerová vrchovina highland was already an area with the continental environment due to its initial uplift.

The following volcanic activity during the Pliocene to Early Pleistocene time was confined to the Cerová vrchovina highland area, which went through a contemporaneous uplift (Vass et al., 1986). Volcanic activity started in its southern part and/or in northern Hungary (2nd phase). Subsequently the eruptive centres migrated to the margins of the uplifted area (3rd phase). Afterwards the main volcanic activity expanded beyond the limits of uplift, but still it continued in a restricted extent also in its central part (4th and 5th phases). Volcanic activity in the Cerová vrchovina highland area was concluded during the Early Pleistocene by phreatomagmatic eruptions giving rise to several maars situated at the periphery of the uplifted area (6th phase).

The youngest alkali basalt volcanic activity of the Late Pleistocene age took place again in the region of central Slovakia. As the time that elapsed since the last eruptions is shorter than breaks between volcanic phases, we should not consider the alkali basalt volcanic activity in Slovakia as finished one. Future eruptions can not be excluded.

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Fig. 1. Relics of alkali basalt volcanism in Central Slovakia Neogene volcanic field

1 - lava flows and lava complexes of alkali basalts, 2 - a) cinder cone; b) supposed cinder cone/removed by erosion); 3 - lava necks; 4 - fluvial limnic sediments of depressions dammed by lava flows a) Riss/Würm, b) Late Miocene/Early Pliocene; 5 - margins of Central Slovakia Neogene volcanic field; 6 - state boundary

Fig. 2. Geological sketch map showing the distribution and forms of Late Miocene to Early Quaternary alkaline volcanics in southern Slovakia. Cerová Vrchovina formation (Middle Pliocene-Pleistocene): 1 - lava flow, 2 - scoria cone, 3 agglomerates, 4 - lapilli tuffs, 5 - maar, 6 - eruptive centres: 6a) diatreme, 6b) neck, 6c) extrusion, 6d) dyke, Podrečany formation (Early Pliocene); 7 - lava flow, 8 - maar, Belina beds (Romanian?), 9 - gravels, clays, sands, Poltár formation (Pliocene), 10 - clays, sands, gravels, rare lignite lenses, 11 Early Miocene sediments, other signs, 12 - updomed area, 13 - local scale elevation, 14 - direction of lava flows, 15 - state boundary, 16 - undivided basaltic rocks.

Fig.3. Radiometric ages (K/Ar) and magnetic polarity (RMP) of alkali basalts in Slovakia. Sources of data: Balogh et al. (1981), Kantor and Wiegerová (1981), Konečný et al. (1995b) and unpublished K/Ar data of Kadosa Balogh.





