Distal tephra layers of the Ciomadul volcano

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In the present study I show the results of the volcanological examination, including physical volcanology, petrography and geochemistry of the tephra layers from the Ciucului and Braşovului Basins located in the SE edge of the Carpathian-Pannonian Region. Three localities were studied in details called here as locality 1 (Northeast from Târgu Secuiesc) and locality 2 (East from Turia) in the Braşovului (Háromszéki) Basin; locality 3 (Northeast from Sânmartin) in the Ciucului (Csíki) Basin.

Locality 1 (lc1) hosts a pumiceous lapilli layer embedded in quaternary sediments of the Turia brook terrace. The medium-well sorted tephra layer has a constant (~25 cm) thickness, suggesting that this layer is related to the tephra fallout, as suggested by Vinkler *et al.* (2007). Locality 2 (lc2) can be found only 9 km far from lc1. It hosts a pumiceous layer that probably represents the same layer as found in lc1. This layer is ~10 cm thick and consists of medium-well sorted lapilli. Below this, a series of coarse and fine grained ash layers was found. The pumice and ash layer series is separated by siliciclastic sediments. Locality 3 (lc3) hosts a ~35 cm thick coarse grained ash layer in siliciclastic sediments. The tephra layer is medium-well sorted and contains mainly micropumice. This ash layer is underline by a paleosoil layer. According to the ^{14}C chronology of the paleosoil, the ash layer is 33.6±0.8 ka old or younger. The sedimentological features of the ash layers suggest that they are fallout tephras.

The component analyses of the tephra layers revealed that they consist of predominantly volcanic fragments (>90%) supporting that their primary origin is related to volcanic eruptions and the role of reworking is negligible. The pumice layers (lc1 and lc2) consist of dacitic pumice lapilli (~85 vol%) and mainly lithic clasts of volcanic origin (~15 vol%). Two type of pumice can be distinguished: dense, grey (density > 1 g/cm^3) and light, white pumice (density < 1 g/cm^3). They show differences also in the vesicularity and microlite content. The ash layer of locality 3 also contains a high amount of juvenile pyroclasts in form of micropumice (~70 vol%) and crystals (~20 vol%).

On the other hand, the ash layers of locality 2 contain much less amount of juvenile pyroclasts (micropumice and crystals) (~30°vol%) and higher percentage of lithic clasts (~70 vol%). The lower amount of juvenile pyroclasts in these ash layers can be explained by the different eruption type. Pumice and ash layers with high amount of juvenile pyroclasts are likely products of a subplinian-plinian eruption, while the series of ash layers at lc2, may be the product of a series of phreatic-phreatomagmatic explosions.

The juvenile pyroclasts in all tephra layers have glassy vesicular matrix and are made of euhedral or subhedral phenocrysts of plagioclase > amphibole > biotite and accessory apatite; remnants of orthopyroxene is rarely found in the core of amphiboles. Outstanding result is that Cr-spinel inclusions were detected in the orthopyroxene. The lithic clasts are mainly accessory comagmatic dacitic lava rocks, altered volcanic fragments but accidental fragments (fine grained siliclastic rocks) probably from the basal basement were also found.

The composition of the matrix glass in the juvenile fragments is high K rhyolit (SiO_2 is between 71 and 78 wt%; K_2O is between 2.2 and 6.5 wt%). According to the composition of the matrix glass and An content of the plagioclase phenocrysts, tephras can be divided into two groups. The pumices in lapilli rich tephra layers (lc1 and lc2) are characterized by lower SiO_2 and higher CaO, Al_2O_3, FeO in the glass and andesine type plagioclase. In contrast the ash layer of lc3 has higher SiO_2 and lower CaO, Al_2O_3, FeO in the matrix and oligoclase type plagioclase. Small differences in the MgO, FeO and K_2O characterize the matrix glass of the micropumice in the ash layers of locality 2 and locality 3.

The young age of the tephra at lc3 and the petrographical and geochemical characteristics of the tephra layers clearly indicate that they are the products of the late explosive phase of the nearby Ciomadul volcano. These tephra layers support that the Ciomadul volcano was characterized by different type of explosive eruptions as it was suggested by former authors (e.g.: Vinkler *et al*., 2007). However, this study detected three different explosive events, indicating that tephra layers in the intermountain basins around the Ciomadul provide a good basis for characterising the explosive eruptions of the volcano.

Preliminary petrogenetic studies on the pumices, including analyses of zoning, texture and geochemistry of plagioclase phenocrysts suggest disequilibrium conditions in the magma chamber before the eruptions. Arrival of fresh magma into the magma chamber might have reheated the system and triggered the eruption related to the pumiceous tephra layers. The arriving magma might have been basaltic, according to the orthopyroxene and Cr-spinel inclusions found in the core of amphiboles.

Vinkler, A. P., Harangi, Sz., Ntaflos, T., Szakács, A. (2007): Földt Közl, 137/1: 103-128.