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Permian volcanism vs. Alpine nappe stacking: petrographic and geochemical observations for regional correlation of the Permian felsic volcanic rocks, Tisza Mega-unit (Hungary and Romania)

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The Tisza Mega-unit forms the basement of the Pannonian basin south of the Mid-Hungarian Lineament. It includes a Permian (∼265 Ma) felsic volcanic assemblage known in the Mecsek and Villány region (S Transdanubia, Hungary) and in the basement of the Great Hungarian Plain. Additionally, it is well exposed in the central-western part of the Apuseni Mountains (Romania) where features of bimodal volcanic processes were documented. In this study felsic volcanic rocks from the Hungarian part of the Tisza Mega-unit and from the Apuseni Mts. were used for regional correlation.

During the Alpine orogeny, facies zones were differentiated in the Jurassic and nappe-systems were formed in the Cretaceous. Consequently, three main zones are distinguished within the Hungarian part of the Tisza Mega-unit: the Mecsek Unit, the Villány–Bihor Unit and the Békés–Codru Unit. The Permian volcanic and volcano-sedimentary rocks are represented by rhyodacitic/dacitic ignimbrites (Mecsek Unit), rhyodacitic/dacitic pyroclastic and lava rocks (Villány–Bihor Unit) and rhyolitic pyroclastic and lava rocks (Békés–Codru Unit). In the Apuseni Mts. several Alpine tectonic units were also recognized such as the Bihor Autochtone Unit, the Codru Nappe System (NS) and the Biharia NS. The Permian deposits are unevenly distributed in the Biharia NS, more abundant in the Codru NS and sporadic in the Bihor Autochtone Unit. The studied rocks from the Apuseni Mts. are dominantly rhyolitic ignimbrites (Biharia NS: Arieşeni and Gârda Units; Codru NS: Moma, Dieva and Finiş Units).

Petrographically, the ignimbrites are similar in all the studied areas, they are rich in flattened, devitrified pumices and have 30–40% feldspar, quartz and hematitized biotite phenocrysts. In Transdanubia, strongly altered pyroxenes also occur. Interestingly, in the Villány–Bihor Unit and in the Finiş Unit garnet is also present. Lava rocks are porphyric with the same main mineral assemblage as ignimbrites and have various recrystallized textures. All samples are enriched in Rb, Th and U and depleted in Ba, Nb, Sr and Ti. The chondrite normalized REE patterns show higher enrichment in LREEs and a strong negative Eu anomaly. Most of the rocks, however, are affected by post-magmatic alterations (K-metasomatism, hydrothermal alteration, Alpine low-grade metamorphism) causing significant changes in their major and sometimes in immobile trace element compositions. Samples affected by low grade metamorphism are present in the area of Kelebia (Békés–Codru Unit) and in the Biharia NS.

Based on the Alpine evolution the following traditional correlations are accepted within the Tisza Mega-unit: the Hungarian Villány and Békés Units correlate with the Bihor Autochtone Unit and the Codru NS, respectively. Regarding the Permian volcanic rocks, however, the Villány Unit shows greater similarity to the Codru NS than to the Bihor Unit, and at least one part of the Békés Unit (Kelebia area) can be in a close relationship with the Biharia NS. The abovementioned features demonstrate that the differentiation of the Alpine facies zones could be more complex than previously thought. This project (K108375; PD 121048) was financed by the NRDIF (Hungary).