Volcanoes morphology of the North Harghita (Romania) Volcanic chain segment: similarities and differences

Viorel Mirea and Ioan Seghedi
Institute of Geodynamics - Romanian Academy, Endogenous Processes, Romania (vmirea@geodin.ro)

Using numerical reconstructions of the morphology of the volcanoes in correlation with petrography, paleomagnetic and K-Ar age data we are showing the differences in eruptive activity between volcanoes in a post-collisional setting. North Harghita is a chain segment of the Șișetu-Maramureș-Ungureni (Romania) volcanic range, consisting of a row of volcanoes of partial overlapping edifices. It is formed from north to south by the following volcanic edifices: Răchițiș (small monogenetic aphanitic dacitic shield volcano) and the Ostoroș, Ivo-Cocoizaș, Vârghiș (including Harghita Băi) andesitic (dacitic) composite volcanoes.

The Miocene-Pliocene calc-alkaline volcanism developed in the North Harghita Mts. for ca. 2.4 Ma (6.3-3.9 Ma). The Răchițiș monogenetic volcano has been generated at ~5.8 Ma. The volcanic edifices of Ostoroș and Ivo-Cocoizaș were built up in the same time interval (6.3-5.0 Ma), lasting ~1.5 Ma each; Vârghiș main edifice indicate a <1 Ma-long activity (5.5-4.8 Ma), however dated debris avalanche suggest longer duration.

The Ostoroș and Ivo-Cocoizaș volcanic edifices after the build-up stage were followed by destructive east-oriented debris avalanches events (~synchronous) and eruption activity stopped. The Vârghiș edifice complex (including Harghita Băi volcano), experienced an intense build up stage followed by a south-west-oriented debris avalanche failure event. The southernmost Rupea basaltic andesite mega-block is 6.8 Ma old and can be attributed to the Vârghiș volcano suggesting a much longer duration for the volcano lifespan; later at 3.9 Ma a small effusive event was generated in the failure crater.

DEM volume calculations include present exposed edifices and debris avalanches. Răchițiș is only of 0.8 km$^3$; Ostoroș volcano edifice have 16 km$^3$ and a debris avalanche deposits of 6.1 km$^3$ suggesting a total volumes of 22.1 km$^3$; Ivo-Cocoizaș volcano has 18.6 km$^3$ and its debris avalanche deposits is of 12.6 km$^3$, suggesting a total volume of 31.2 km$^3$; Vârghiș volcano, the southernmost, has the largest volume of 84.9 km$^3$ (111.7 km$^3$ including Harghita Băi associated edifice) with a total debris avalanche deposits of 8.7 km$^3$ with a total volume of 120.4 km$^3$.

East-oriented debris avalanches of Ostoroș and Ivo-Cocoizaș travelled up to 20km where has been blocked by a higher morphology. South-west-oriented Vârghiș debris avalanche traveled up to 55km on a lower morphology, and it is much thinner.
The North-South-directed spatio-temporal evolution of North Harghita volcanic edifices reflect the southward propagation of strike-slip and normal faulting, following the post-collisional events in the East Carpathians.

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