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An investigation approach of the volcanic geomorphology in the Călimani – Gurghiu – Harghita volcanic chain, Romania

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In poorly-exposed forest-covered volcanic areas, the main challenge in classical geological and geomorphological studies is the interpretations of landforms and volcanic structures. The usage of 3D models provides modern opportunities in visualization of volcanic landforms in volcanological studies in areas with dense vegetation cover.

Geological mapping of the Neogene Călimani-Gurghiu-Harghita (CGH) volcanic chain is challenging due poor exposure of area. The Călimani-Gurghiu-Harghita volcanic chain exhibits ~10 My age range spanning from North (> 10 Ma) to South (< 0.03 Ma) linked to the evolution of the adjacent intra-mountain sedimentary basins (Bilbor, Borsec, Gheorgheni, Upper Ciuc, Lower Ciuc, Brașov and Baraolt basins). The geomorphological analysis of the CGH volcanic chain is currently performed using SRTM data. However, the SRTM data are affected by the vegetation cover. Instead, we used a digital elevation models (DEM) built from topographic maps in combinations with volcanological field observations.

Our method uses a DEM 3D spatial view with overlay standard geological maps, shaded relief complemented with terrain analysis and landform recognition. Then, the study integrates field-based observations and geomorphological mapping results in a new general overview of the complex volcanic topography of the CGH volcanic chain.

Using digital elevation models (DEM) allows the general identification of volcanic facies distribution (proximal, medial and distal) belonging to an individual volcanic structures as well as the regional assemblages of the whole volcanic chain. DEM studies also permit to reconstruct the erosion level of volcanic edifices in conjunctions with field-based volcanological studies. This approach may also help identifying volcanological formations and various types of volcanic facies resulting from both construction and destructions of the edifices in poorly exposed areas.

By using this methodology a broad range of volcanic morphological features have been observed along the CGH volcanic range including the Călimani caldera morphology, features of the old and young debris avalanche deposits of various volcanic edifices and the youngest lava-dome morphology of Ciomadul volcano. Our DEM approach provides better results than those obtained by previous studies pointing out, for instance, that the volcanic edifices are highly to moderately eroded in the north and progressively better preserved toward the south.

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