



Megavolcano in the Late Cenozoic Samtckhe-Javakheti Volcanic Province? Lesser Caucasus, Georgia-Turkish Border

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REGIONAL GEOLOGY

The Caucasus represents a Phanerozoic collisional orogen formed along the Eurasian North continental margin and stretched on 1200 km, from the Caspian to Black sea. Currently, it is an expression of continental collision between the Arabian and Eurasian plates (Fig. 1). Three major units are distinguished in the Caucasus: the Greater and Lesser Caucasian mobile belts and Transcaucasus microplate (Okrostsavridze & Tormay, 2013).

Samtskhe-Javakheti volcanic highland (1300-2800 m asl) was formed at Late Cenozoic in the central part of the Lesser Caucasus mobile belt and it has an area more than 4500 km², however its large part is located in the South in Turkey and Armenia territories (Fig. 2). In the formation of the highland three big magmatic activity should be marked: 1. Early Pliocene – when dacite-andesitic volcanic tuffs of 700-1100 m thickness (s.c. Goderdzi suite) were formed; 2. Late Pliocene-Early Pleistocene – when continental flood basalts of 100-250 m thickness were formed and 3. Mid Pleistocene-Holocene volcanic activity, when Abul-Samsari linear volcanic ridge was formed to the south of continental flood basalts.

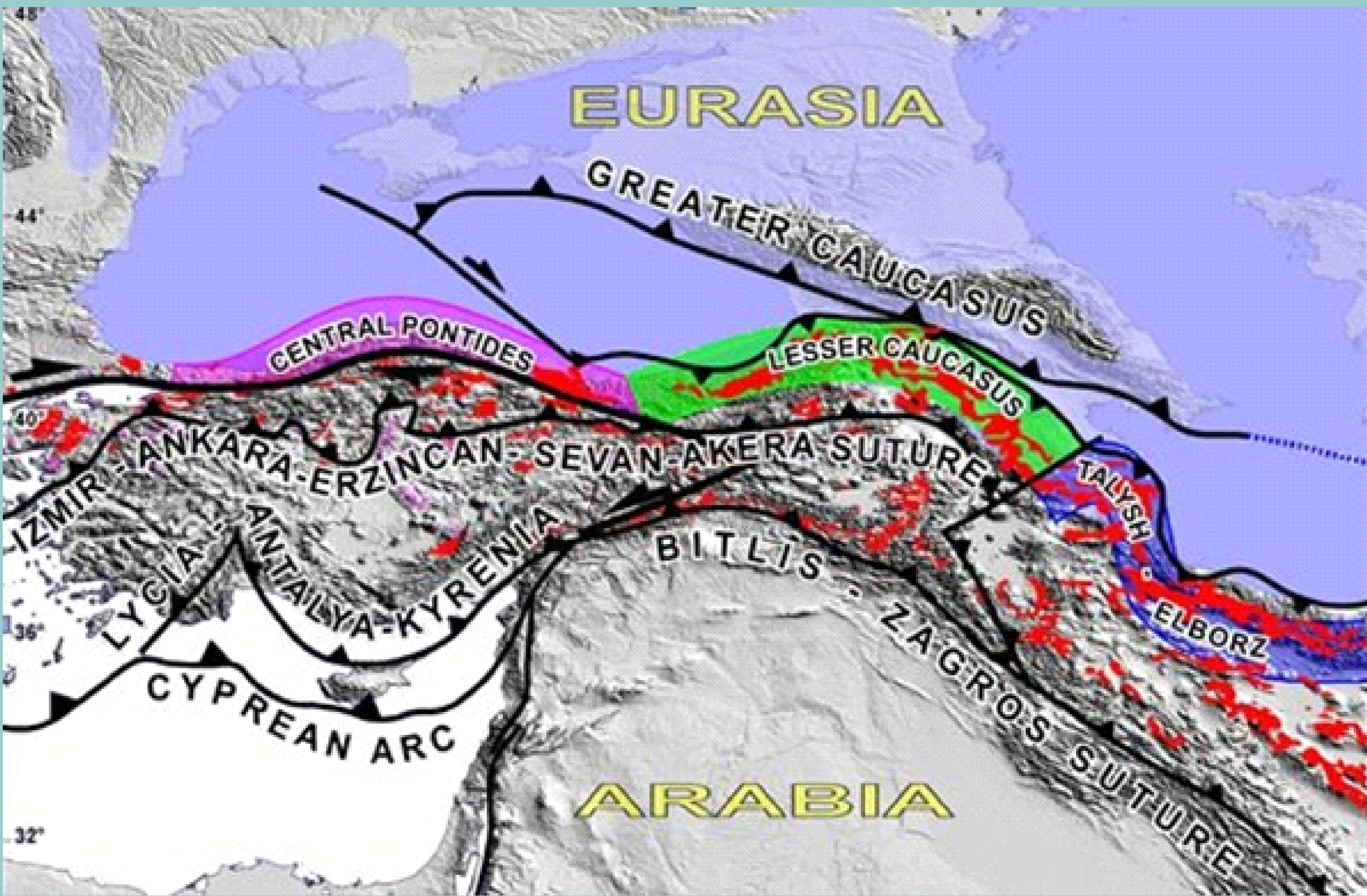


Fig.1. Schematic tectonic map of the Eastern Mediterranean



Fig.2. Physical map of the Caucasus, with megavolcano area

PHYSICAL VOLCANOLOGY, ZIRCON DATING RESULTS

A large part of the highland is built by the Pliocene s.c. Goderzi suite (Skhirtladze, 1958), with a thickness of 700-1100 m. The series are represented by volcanic lava-breccias, pyroclastic rocks, tuffs and ash fall deposits of andesitic-dacitic composition. Formation of the series was conditioned by several cycles of volcanic eruption in the range of 5.19-3.51 million years (zircons dating results) with a mantle source of magma chamber (¹⁴³Nd/¹⁴⁴Nd = +0.51703 - +0.52304; ⁸⁷Sr/⁸⁸Sr = 0.7036 - 0.7042) (Chang et al., 2013).

The question about magmatic center of the Goderzi suite is still debated, but it is clear, that it was a huge formation. Based on physical volcanology, the analogy of such structure is considered as super/megavolcanos. (Bryan, 2010). The evidences of such structure are the following: a large volume of volcanic material (> 1500 km²); (s.c. Goderzi suite –area more than 1500 km² in Georgia territory, thicknesses 700-1100 m in average), big size of volcanic breccias (Goderzi suite volcanic breccias, in some areas, diameter >1 m), large scales of lava flows (Vardzia ignimbrites flow - length 35 km, width 2-3 km, thickness 30-80 m) and big thickness of volcanic ash horizons (3 m at some places - Vani kettles). In general, the explosive index (Newhall, Self, 1982) of this volcano is very large.



Post-volcanic andesitic domes of Niala caldera. The back side Gumbati mountain (2996 m asl). It should be noted that, Georgian word "Gumbati" in English translates as the "Dome"



Fragment of the Niala Caldera N-E edge. The Mtkvari River valley



Fragment of Niala Valley caldera, Easter part

CONCLUSION

Our detailed investigations in field work, based on physical volcanology, allow us to conclude, that the magmatic center of the Goderzi suite is a huge volcano, which is located in Georgia and territory of Turkey also. One of the caldera structure of this megavolcano is located on Niala Valley (territory of Georgia) (15x 22 km, 2800-2200 m asl.), western part of which is injected by post-volcanic andesitic domes and known as Gumbati mountain (2996 m asl). At present, the Niala Valley caldera partly is covered with quaternary sediments, bounded with andesitic lava flows and open to the eastern. In spite of the fact, that this areal undergoes erosion for about 5 million years, the identification of large caldera circle structures is still possible here. The Vardzia tuffs and ignimbrites flow represents the products of Niala Caldera, flows out and extended more than 35 km, width 2-3 km, to the different directions of the volcano and its thickness varies within of 30-80 m. It should be noted, that Vardzia Cave City, a unique monument of the 12th century of Georgia, is hewn into this flow. Finally, the information above mentioned volcano is quite new, which needs future detailed investigation.



Panoramic view of the Mtkvari river canyon, Vardzia region. In white color – ignimbrite flow (Vardzia Horizonte). At the top of the flow–an upper part of the Goderdzi suit. In right – the Vardzia cave city.



Fragment of Vardzia ignimbrite flow South of Vardzia Cave City.



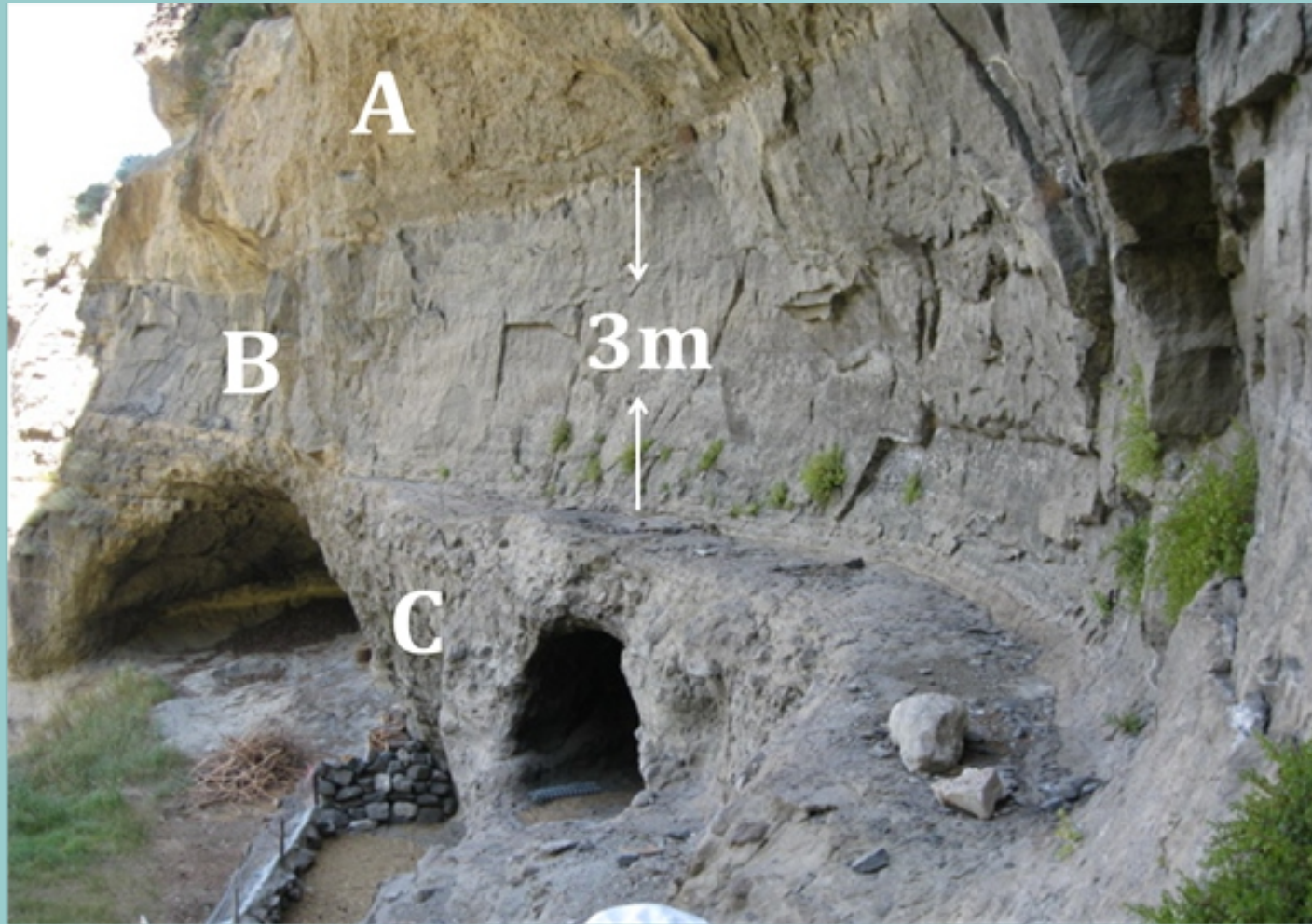
Vardzia Cave City, a unique monument of the 12th century Georgia, is hewn into the welded Vardzia ignimbrite flow.



Goderdzi suite volcanic breccias, near the Chachkari village.



Fragments of the Vardzia ignimbrite flow at the end Niala Caldera, in the Mtkvari river canyon



The exposure of thick layer of volcanic ash of Vani kettles, Vardzia suite. A – medium-grained tuffs, B – grey volcanic ash, C – coarse-grained volcanic tuffs.



Fragment of the Niala Caldera S-E edge.

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