



## **Preliminary results of the analysis of earthquake swarms in Gegham volcanic ridge (Armenia)**

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Formation of Anatolian-Armenian-Iranian tectonically and volcanically active orogenic plateau is related to collision of the Arabian plate with the Eurasian margin occurred in early Miocene. Continental collision was followed by slab-breakoff processes resulted in orogenic uplift associated with long lasted widespread volcanism (Keskin et al., 2003, Skolbeltsyn, 2014; Neill et al., 2015, Meliksetian et al., 2015). GPS data determines, that Arabian plate moves northward with rates around 17 mm/year (Reilinger et al., 2006; Vernant et al., 2004), while internal deformations within orogenic plateau take place along regional strike-slip fault systems usually at rates  $\leq 2$  mm/yr.

Gegham monogenetic volcanic ridge in central Armenia is characterized by NNW-SSE oriented linear clusters of a total 127 volcanoes (Karakhanyan et al., 2002; Avagyan et al., 2005) that are indicative of extensional tectonics, evident also by GPS data ( $2.4 \pm 1$  mm/yr (Davtyan, 2007)).

Period of activity of Gegham volcanic ridge is ranging from Late Miocene (Baghdasaryan&Ghukasyan, 1985) up to Holocene, with indication of volcanic activity dated 4500-4400 years B.P., (Karakhanyan et al., 2002). Geological evidence as well as recurrence rate estimations shows, that future volcanic eruptions from Gegham volcanic system cannot be ruled out. In such a case the city of Yerevan, Sevan basin and surrounding areas will be at significant risk from a diverse volcanic phenomena and accompanying seismic activity.

In this contribution, we are analysing two seismic swarms occurred within Gegham ridge in April 2015 (180 events,  $M=0.5-3.4$ ) and in March 2016 (85 events,  $M=0.2-1.7$ ) located near to monogenetic volcano clusters and fault locations. It is noteworthy, that there are no 'main shocks' identified. These swarms occurred in a relatively short time span, i.e. are characterized by a high frequency of appearance. The aim of this work is to analyze the possible link between these seismic swarms and magmatic or geothermal processes.

The swarm in April 2015 is located in southern part of Gegham ridge near the graben-like structure associated with Gavaraget fault, in 1.6-5 km far from Sahakasar and Mesropasar volcanoes. The nearest station registered more than 200 events during 15 days. Most of the earthquake waveforms have clear P- and S-wave onsets and relatively low frequency content. It was possible to locate the highest magnitude earthquakes by using a regional seismic network. The sources are very superficial, between 1 and 8 km deep.

During March 2016 another swarm was identified in axial part of Gegham volcanic ridge, near to Lchayin, Lodochnikov and Sevkatar volcanic centers involving more than 85 events with magnitude  $M=0.2-1.7$ . In this case, the hypocentral depths are in range of 12-16 km.

Concluding from seismic observations, as well as from the geologic and tectonic settings, we assume, that recent seismic swarms identified within axial part of Gegham volcanic ridge may indicate or active magmatic processes such as dyke propagation at depths up to 15 km beneath Gegham volcanic ridge or active tectonic processing such as fractions of exiting active faults systems.