



A new look at the collision-related volcanism in Eastern Anatolia, Turkey: Volcanic history of the Northern-Van neovolcanic province

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The region including the Eastern Anatolian – Northern Iranian High Plateau and Greater and Lesser Caucasus mountain ranges is one of the best examples of an active continental collision zone in the world, which is thought to have been formed by the closure of the northern branch of the Neotethyan Ocean. It comprises one of the high plateaus of the Alpine-Himalaya mountain belt (i.e. the Eastern Anatolia High Plateau) with an average elevation of ~2 km above the sea level. The volcanic activity initiated immediately after the block uplift of the region (at around 15 Ma as our new isotope-geochronological database indicates) and produced great volumes of volcanic material in a number of countries including Turkey, Russia, Georgia, Azerbaijan, Armenia and Iran. At present, the volcanic province extends from Eastern Anatolia (Turkey) into Caucasus of Southern Russia, spanning a distance of some 1000 km. Perhaps the most striking aspect of the Eastern Anatolian – N Iranian High Plateau and Caucasus is the volume and compositional variability of collision-related volcanic products erupted in a time interval from Neogene to Quaternary. Only in E Turkey, the collision-related volcanic units cover over half of the region (i.e. ~43,000 km²). In order to better understand the spatial and temporal compositional variations in volcanic rocks and their implications on magma genesis and geodynamic evolution of the region, we conducted joint research on this spectacular volcanic province.

One of the largest Cenozoic volcanic areas on the EAHP is located in the north of Lake Van as we named “the Northern-Van neovolcanic province”. It covers an area of about 6000 km² starting from the northern cost of Lake Van. It is composed of a series of volcanic edifices (e.g. Girekol, Meydandag and Etrusk volcanoes). Remarkably, these volcanoes sit almost on the culmination of a regional domal structure called “Lake Van dome” in the vertex of the eastern Turkish high plateau. We intentionally started working from the southern part of the Turkish side because little is known about the initiation dates of volcanism there, as good dates on these rocks are quite limited. Collision-related volcanism in the Northern-Van neovolcanic province lasted around 15 My and followed four stages of intense activity, each lasted 1-2 My but divided by long pose periods. (1) During the Middle Miocene (15.0-13.5 Ma) period, andesitic lavas and pyroclastics with a distinct subduction signature erupted along a zone extending from S of the Tendurek volcano to Zilan Valley and Deliçay in the N and NE of the town of Ercis, basically around Mt Aladag. These are the oldest lavas in the E Anatolian volcanic province. (2) During Late Miocene (10-9 Ma) volcanism restarted along the same belt, producing lavas ranging in composition from basalts, trachybasalts to dacites. These lavas overly the volcanic units of the Middle Miocene period. (3) After a 3.2 My time break, volcanism restarted in the region during Pliocene (5.8-3.9 Ma) with the eruption of basalts, trachydacites and trachytes in the NW, N and NE of the town of Ercis. Early-Pliocene basaltic flows formed a vast plateau in the north from Etrusk volcano. The final phase of the Pliocene magmatic activity was marked by the eruptions of trachytic, trachyandesitic, trachydacitic and rhyolitic lavas from the Etrusk volcano (4.3 to 3.9 Ma), whose final stage was marked by a caldera collapse at around 3.7 Ma. (4) Volcanism restarted in Quaternary (1.0-0.4 Ma) with the eruption of basalts and trachybasalts. The diverse character of the volcanism in the region can be explained by variations in magma genesis, magma chamber processes and geodynamic reasons, e.g. detachment by means of slab breakoff and/or delamination.