Geophysical Research Abstracts
Vol. 20, EGU2018-1073-3, 2018
EGU General Assembly 2018

Alkaline magmas in collision zone settings: Age and petrogenesis of the Tezhsar Alkaline Complex, Armenia

Krzysztof Sokół (1,2), Ralf Halama (2), Khachatur Meliksetian (3), Ivan P. Savov (4), and Masafumi Sudo (5)

(1) School of Earth & Environmental Sciences, University of St Andrews, St Andrews, KY16 9AL, UK (ks275@st-andrews.ac.uk), (2) School of Geography, Geology and the Environment, Keele University, Keele, ST5 5BG, UK (r.halama@keele.ac.uk), (3) Institute of Geological Sciences, National Academy of Sciences, 24a Marshal Baghramian Avenue, 0019, Yerevan, Armenia (km@geology.am), (4) School of Earth & Environment, University of Leeds, LS2 9JT, UK (I.Savov@leeds.ac.uk), (5) Institute of Earth and Environmental Science, University of Potsdam, Karl-Liebknecht-Str. 24-25, 14476 Potsdam, Germany (Masafumi.Sudo@geo.uni-potsdam.de)

The occurrence of alkaline igneous rocks in collision zones is a topic of intense discussion with respect to their petrogenesis and prospectivity of rare earth elements (REE) in ore exploration, due to their importance in developing modern technologies. Despite that, alkaline complexes within collisional environments are rarely studied. In this work, we present new petrological and geochemical whole-rock data for the Eocene Tezhsar Alkaline Complex (TAC) in central Armenia, and we provide a new date for the complex of 41.0 $\pm$ 0.5 Ma obtained by ^{40}Ar/^{39}Ar geochronology. Two major events of the South Armenian Block and Arabia colliding with the Eurasian Plate in the Late Cretaceous and Oligocene respectively are highlighted in the Lesser Caucasian geo-tectonic history. The aim is to improve our understanding of the formation of alkaline rocks in collisional settings and to integrate the study into a wider context of alkaline magma genesis amid regional Eurasian-Arabian continental convergence along the major Sevan-Akera suture.

TAC is a concentric volcano-plutonic complex $\sim$10km in diameter, representing a remnant of a large stratovolcano located just a few kilometres southward of the suture zone. Meliksetian (1989) accounted for >50 different mineral species within Tezhsar including allanite, monazite, xenotime and rare REE-bearing species like loparite, euxenite and britholite. For the purpose of this work, the TAC rocks are subdivided into three major units: An outer volcanic unit (OVU), an inner plutonic unit (SYU) and a central volcanic unit (CVU), that have been subsequently juxtaposed by ring faulting. The volcanic units are dominated by trachytic-phonolitic rocks, with rare pseudoleucite phonolite. The pluton comprises syenites and nepheline syenites with subordinate pegmatites containing large (up to 3cm) melanite garnets. Further petrographic study has shown apatite zoning with an enrichment of LREE in the rims and reaction replacement of clinopyroxene by amphibole.

Whole-rock data show a highly fractionated, metaluminous, alkalic and silica-undersaturated composition of the TAC. The general trace element enrichment and strong fractionation of REEs (La_N/Yb_N $\sim$70>) point to a relatively enriched magma source and low degrees of partial melting. Negative Nb-Ta in mantle-normalised diagrams for all TAC units show typical subduction signatures. Other trace element indices also point to variable effects of subduction-related metasomatism. Mantle-like initial ^{87}Sr/^{86}Sr ratios (0.704-0.705) and positive εNd values (+3 to +5) indicate an isotopically depleted mantle source and no crustal influence.

In summary, the new data suggest an influence of ancient subduction of the Tethyan oceanic plate beneath the Eurasian continental margin. TAC's formation is broadly contemporaneous with Lesser Caucasian extension and crustal thinning due to rollback of the Neotethyan slab. Its alkalinity however sets it apart from other calc-alkaline centres in the region indicating further metasomatic enrichment just prior to the magma genesis. Furthermore, the presence of pseudoleucites, amphibolitisation reactions and the remobilisation of LREEs suggest late-stage fluid circulation in the complex's evolutionary story.

References:

Meliksetian B.M. (1989): Petrology, geochemistry and ore genesis of Palaeogene-Neogene volcano-intrusive formations of Lesser Caucasus (magmatism of collision zones). Thesis of Doc. Sci. dissertation, Tbilisi, Georgian SSR (in Russian).