Andesitic dyke swarms in the Araç-Boyalı foredeep basin, N Anatolia: Evidence for Eocene extension

R. EZGI CAKIROGLU[1]* M. CEMAL GÖNCÜOĞLU[1] MICHELE MARRONI[2] AND LUCA PANDOLFI[2]

[1]Department of Geological Eng., Middle East Technical University, Ankara-Turkey (*correspondance: ezgi.cakiroglu@metu.edu.tr)

[2]Dipartimento di Scienze della Terra, Università di Pisa, Italy

A number of dykes and sills have been investigated in the Araç-Boyalı Flysch Basin, a foreland basin formed on the platform of the Sakarya Composite Terrane following the closure of the Intra-Pontide Ocean during the Late Cretaceous – Late Paleocene. The andesitic dyke swarms, characterized by well-developed chilled margins, flow textures and elongated vesicles, intrude the basin sediments, among which massive and pillow lavas, as well as lava and pillow breccias are also found.

Major element data plotted on SiO_2 indicates plagioclase, pyroxene and biotite fractioation, as well Fe-Ti oxides in the samples, that are andesites and andesitic basalts of calc-alkaline character. Tectono-magmatic discrimination diagrams of lavas as well as the dykes are indicative for destructive plate margin volcanism. Lava and dyke samples display similar patterns in REE and Spider diagrams. A depletion of heavy REE, enrichment of LREE is observed, as well as a marked Nb-Ta trough, characteristic of arc magmas. Based on low Mg numbers, together with low compatible trace element concentrations and low Nb/La ratios, compositions of examined samples might have been modified by assimilation processes.

Geochemical characteristics of the volcanic rocks reveal that they are products of continental arc magmatism within the Sakarya Composite Terrane above the N-ward subducting Izmir-Ankara oceanic lithosphere of Neotethys.

Similarities in major, minor and trace element geochemistry are in favour of dykes being the feeders of the Eocene lava flows within the Eocene basins that formed as a result of post-collisional extention.

Environmental mineralogy: Bridging the gap from microscopic to macroscopic

G. CALAS, G. MORIN T.ALLARD L. GALOISY , F. JUILLOT G. ONA-NGUEMA[1] AND G.E. BROWN, JR.[2]

[1]Institut de Minéralogie et de Physique des Milieux Condensés, Université P&M Curie, Paris, France (georges.calas@upmc.fr)

[2]Dept. of Geological & Environmental Sciences, Stanford University, Stanford CA 94305, USA.

Minerals provide a large wealth of environmentally relevant information during their formation and further evolution, through their substituted trace/minor elements and structural -often radiation-induced- defects. A unified view of their behavior comes from the possibility to determine element speciation in fluids, minerals and mineral surfaces, atomic substitution processes in mineral lattices, using molecular-scale observations derived from structural, experimental and theoretical approaches.

The first focus will be on the structural evolution of nuclear glasses during aging (alteration, irradiation), showing the molecular-scale mechanisms that govern glass stability. Matrix stability relies on the synergy between glass/gel components, with a major role played by the competition for local charge compensation. Crystal chemistry considerations explain the differences observed in the leaching behavior during under-saturated and open conditions.

The second part is devoted to the mineralogical control of the distribution of heavy elements such as Zn, As, Pb or U in geochemical anomalies and sites contaminated through industrial/mining activities. Combining mineralogy and element speciation provides unique information on the behavior of heavy elements during low-T processes, showing the respective importance of low-solubility phases and sorbed species and illustrating the key mechanisms that inhibit short- and long-term contaminant dissemination. Trapping of heavy metals by Fe/Mn oxyhydroxides is an efficient natural attenuation process in acid mine drainage (AMD) waters. The dynamics of metal speciation and concentration in AMD systems provides an interesting picture of the complex interplay among source terms, geochemical conditions, hydrological fluxes, and bacterial activity

A last example will concern radiation-induced defects in minerals, used to trace short-lived uranium daughter elements. The high specific area of clays makes them sensitive to ground-level radiation doses, providing information on the past transfer of radionuclides in the geosphere, helping to model uranium-bearing fluid migration.

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