

Geochemistry and Petrology of the Timar basaltic volcanism in the northeast of Lake Van

VURAL OYAN^{1*} MEHMET KESKIN^{2A}
AND YAVUZ ÖZDEMİR³

¹Yüzüncü Yıl University, Faculty of Architecture and Engineering, Department of Mining Engineering Van, Turkey.

²Istanbul University, Faculty of Engineering, Department of Geological Engineering Istanbul, Turkey.

³Yüzüncü Yıl University, Faculty of Architecture and Engineering, Department of Geological Engineering Van, Turkey.

Timar Pliocene basaltic volcanism in the northeast of the Lake Van Basin erupted from local central eruption centers. Products of basaltic volcanism in the Timar region are covered by younger lavas of Late Pliocene Etrüsk volcanics and Quaternary basalts in age. Available K-Ar ages [1] indicate that basaltic volcanism observed in north and southeast of the Etrüsk volcano erupted in a period between 4.90 and 4.50 Ma corresponding to Zanclean (Pliocene). Alkaline-subalkaline basalts and hawaiites consist of olivine, augite, titanomagnetite and plagioclase phenocrysts and micro-phenocrystals. The groundmass of these lavas contains the microcrystals of the same mineral assemblages and volcanic glass. They display porphyritic, glomeroporphyritic, intersertal and hyalopilitic textures.

Results of our FC, AFC and EC-AFC modelings indicate that the Timar basaltic lavas were slightly influenced by crustal contamination and fractional crystallization. MORB patterns of corrected data to MgO 9% show that some HFS elements such as Nb and Ta are depleted relative to LIL and LREE (La-Ce). This findings imply that Timar basaltic volcanism could have been derived from a mantle source with a distinct subduction component.

Results of our melting models indicate that the Timar basaltic rocks were derived from both shallow and deep mantle sources with different melting degrees ranging between 0.8 - 5 %. The percentage of spinel seems to have increased in the lherzolitic mantle source of the basaltic lavas. Accordingly, chemical character of the lavas turned from alkaline to subalkaline in time. We argue that the temporal increase of spinel contribution and the melting degree in the mantle source region was responsible for transition from alkaline to subalkaline character in the lava chemistry in time.

[1] Lebedev, A.V., Sharkov, E.V., Keskin, M., Oyan, V., 2010. Doklady Earth Science, (433): 1031-1037.

Conditions for Proterozoic anoxic and non-sulfidic ocean: Constraints from a marine biogeochemical cycle model

K. OZAKI^{1*} AND E. TAJIKA²

¹Atmosphere and Ocean Research Institute, University of Tokyo, Chiba 277-8561, Japan

(*correspondence: ozaki@aori.u-tokyo.ac.jp)

²University of Tokyo, Chiba 277-8561, Japan
(tajika@k.u-tokyo.ac.jp)

Understanding the Earth's oceanic redox evolution in response to several environmental conditions is one of the fundamental topics in the Earth science. Accumulating geochemical records, such as iron speciation and molybdenum geochemistry, reveal large spatial heterogeneity of Proterozoic ocean redox chemistry; anoxic and non-sulfidic (i.e., ferruginous) conditions had been prevailed throughout the Proterozoic, and sulfidic conditions might have covered only a small portion of the seafloor. However, the atmospheric oxygen level (pO_2) in the Proterozoic has not been well constrained, and it remains unclear exactly what biogeochemical conditions are necessary to explain such redox structure in the Proterozoic ocean interior.

Here, we try to constrain the conditions for Proterozoic ocean redox structures by use of a marine biogeochemical cycle model in which C-N-P-O-S coupled biogeochemical cycles are taken into account. The results of systematic sensitivity experiments regarding pO_2 and chemical weathering rate on land demonstrate that the conditions for pervasive euxinia are very limited, and widespread ferruginous condition would be an inevitable consequence of low pO_2 and high pyrite burial efficiency during the Precambrian. Sulfidic waters would be restricted in near-shore regions where riverine sulfate flux is sufficient to stimulate the sulfate reduction. We also found that other environmental factors affecting long-term oceanic redox state (e.g. sea-level stand, settling rate of marine snow in water column) do not change above biogeochemical consequences.

These quantitative results would provide insight into further understanding of the Earth's redox history and its stabilization mechanism(s) from a perspective of the biogeochemical dynamics. We also propose that shelf euxinia still has a significant impact on the availability of redox-sensitive, bioessential trace metals, and therefore would provide a linkage between evolution of ocean oxidation state and biological innovation.