Biogeochemistry and stable isotope investigation of acid mine drainage associated with abandoned Pb-Zn mine in Balya, Turkey

NURGUL BALCI[1]*, NEVIN KARAGULER[2], M. SEREF SONMEZ[3] AND EROL SARI[4]

[1]Department of Geological Engineering, ITU, Turkey (*correspondence:ncelik@itu.edu.tr)
[2]Department of Molecular Biology and Genetics, ITU, Turkey (karaguler@itu.edu.tr)
[3]Department of Metallurgy and Materials Engineering, ITU, Turkey (ssonmez@itu.edu.tr)
[4]Institute of Marine Science and Management, Istanbul University, Turkey (erolsari@istanbul.edu.tr)

The abandoned Pb-Zn mine in Balya Region contains mainly galena, sphalerite, pyrite, chalcopyrite, and arsenopyrite. The mine tailings and smelting waste rocks produce significant amount of acidity and heavy metals. We used laboratory and field approaches to elucidate oxidation mechanisms of galena, sphalerite and pyrite in the region. The biological and abiotic oxidation experiments with galena, sphalerite and pyrite under various conditions (pH (2-4), (4-25 ºC) conditions were carried for the laboratory studies. Sediment and water samples were collected from the mine sites. Areas of the mine flooded by water have acidic pH (3) and high concentrations of metals (Pb, Zn, Cu, Fe, Co, Cd and As). In acidic, Fe-rich waters, oxidation of Fe^{2+} after exposure to air is microbially catalyzed and follows zero-order kinetics (range of 0.92 to 1.5 mmol L^{-1} h^{-1}). Biological oxidation experiments with galena and sphalerite at 25 ºC showed high oxidation rate compared to chemical –control and suboptimal temperature (4, 10ºC) experiments. *A. thioxidans* was still active even under 4ºC although the oxidation rate of galena and sphalerite were significantly lower compared to 25ºC. Oxidation of pyrite with or without bacteria did not show significant reaction rate. The S isotopic composition of dissolved sulfate collected from the mine areas closely reflect sphalerite and galena values rather than pyrite. The $\varepsilon^{18}O_{SO4\text{-}H2O}$ values of 8.0 ± 0.2 ‰ and 7.8 ± 0.1 ‰ obtained from the field measurements is consistent with the values calculated from biological oxidation of galena and sphalerite experiments relative to pyrite experiments ($\varepsilon^{18}O_{SO4\text{-}H2O}$ values of 0.0 to 4.0 ‰) [1] . A clear distinction exits among the $\varepsilon^{18}O_{SO4\text{-}H2O}$ values produced during pyrite and sphalerite experiments may help to determine the source of acidity.

[1].Balci *et al*. (2007) *Geochimica Cosmochim. Acta* **71**, 3796-3811

Cosmogenic ^{21}Ne production systematics in quartz inferred from a 25-meter sandstone core

G. BALCO[1]*, D.L. SHUSTER[1], P-H. BLARD[2], L. ZIMMERMANN[2] AND J.O.H. STONE[3]

[1]Berkeley Geochronology Center, 2455 Ridge Rd., Berkeley CA 94550 USA (*correspondence: balcs@bgc.org)
[2]CRPG-CNRS-Université de Lorraine, 15 rue Notre Dame des Pauvres, 54501 Vandoeuvre-lès-Nancy, France
[3]Earth and Space Sciences, University of Washington, Seattle WA 98195-1310 USA

We measured ^{20}Ne, ^{21}Ne, and ^{22}Ne concentrations in quartz in a 25-meter sandstone core collected at Beacon Heights, Antarctic Dry Valleys, as part of the CRONUS-Earth project. ^{21}Ne concentrations computed as excess over atmospheric Ne are shown below. We intercalibrated measurements at BGC and CRPG by exchanging standards. A systematic difference between the two labs, most likely due to the effect of different sample preparation schemes on ^{21}Ne produced from alpha implantation at grain edges, is evident in deep samples. These data, with corresponding U and Th concentrations, permit resolution of the ^{21}Ne inventory into trapped, cosmogenic, and nucleogenic components, and thus estimates of ^{21}Ne production rates due to spallation and muon interactions.