Redox control on the water column distribution of Ra in a stratified lake - Lake Kinneret, Israel

G. SHARABI[1,2]*, Y. KOLODNY[1], L. HALICZ[1], A. NISHRI[3] AND B. LAZAR[1],

[1] Institute of Earth Sciences, The Hebrew University of Jerusalem, ISRAEL 91904
(*Correspondence: galit@gsi.gov.il)
[2]Gological Survey of Israel, Jerusalem, ISRAEL 95501
[3]Israel Oceanographic and Limnological Research Ltd., P.O. Box 447, Migdal, ISRAEL 14950

The vertical distribution of transition metals in holomictic lakes is controlled by the seasonal mixing/stratification regime that change the redox state in the water column. We studied the control of the Mn redox system on water column distribution of Ra, an element with invariant oxidation state. The study was conducted in Lake Kinneret (The Sea of Galilee), Israel, a warm monomictic lake in northern Jordan valley. Lake Kinneret fluctuates between periods of stratification (spring/summer) and mixing (fall/winter), with full depth mixing (~37 m) in February. The mixed layer (epilimnion) is always well oxygenated while below it (hypolimnion), anoxic conditions prevail.

Vertical profiles of Mn, ^{226}Ra ($T_{1/2}$=1,600 y) and ^{224}Ra ($T_{1/2}$=3.7 d) were measured during October 2012. Practically all the Mn in the well-oxygenated mixed layer (0-15 m) was particulate (10 $\mu g \cdot L^{-1}$). A large peak of dissolved Mn (500 $\mu g \cdot L^{-1}$), appeared at the oxycline ~17.5 m. The reducing hypolimnion, below 20 m, contained ~60 $\mu g \cdot L^{-1}$ of dissolved Mn and was virtually deficient of solid Mn-oxides. The water column profile of ^{226}Ra and ^{224}Ra were remarkably similar.

Mn speciation along the Kinneret water column is redox sensitive: it appears mainly as solid Mn-oxide in the oxygenated epilimnion, and as dissolved Mn(II) in the anoxic hypolimnion. Hence, the particles of Mn-oxide that sink through the water column, dissolve in the epilimnion-hypolimnion interface and form an extremely large and narrow peak of dissolved Mn(II). The Ra water column profile resembled that of Mn, despite being a redox-insensitive element. This is attributed to adsorption of dissolved Ra on solid Mn-oxides in the epilimnion and its desorption in the hypolimnion. We use the ^{224}Ra/^{226}Ra ratios and the large difference in their half-lives to obtain a field estimate of the reduction rate of Mn-oxide.

Magmatic systems of the Paleoproterozoic large igneous provinces: Evidence from the eastern Fennoscandian Shield

E.V. SHARKOV*, M.M. BOGINA AND A.V. CHISTYAKOV

IGEM RAS, Staromonetny per. 35, Moscow, Russia 119017 (sharkov@igem.ru)

It is known that large igneous provinces are usually formed by lava plateaus, dyke swarms and subvolcanic sills, which are united into volcano-plutonic associations. At the same time, rocks within lava plateau were subjected to crystallization differentiation and crustal assimilation, which caused wide variations in their composition. This leaves us with questions where and how this occurred?

For this aim we presented the results of our study of two Paleoproterozoic large igneous provinces in the eastern Fennoscandian Shield: (1) early Paleoproterozoic (2.5-2.35 Ga) province of siliceous high-Mg series, and (2) middle Paleoproterozoic (2.35-1.9 Ga) province composed by high- and low-Ti alkaline and tholeiite basalts. The peculiar feature of these provinces is the presence of layered mafic-ultramafic complexes: dunite-harzburgite-bronzitite-norite-gabbronorite-anorthosite (Monchegorsky, Fedorovo-Pansky, Burakovsky, etc.) and wehrlite-clinopyroxenite-gabbro-alkaline gabbro (Elet'ozero and Gremyakha-Vyrmes), respectively. The formation of these complexes was controlled by replenishment of fresh magmas in solidified intrusive chambers and impregnation of melts into already solidified rocks (multistage formation). Geochemical data indicate that all rocks of these centers are related in different degree, being often close in major and trace-element composition to volcanics in lava plateaus.

So, we suggest that these layered intrusive complexes represent deep-seated long-lived transitional magmatic chambers where melts, derived from magma-generation zones were accumulated and experienced crystallization differentiation, while evolved melts were mixed with fresh magma portions. Cumulates retained in the crust. Correspondingly, the primary magmas partially lost their components and derived evolved magmas continue their ascent to the surface. The evolved magmas arrived at the surface and formed lava piles of different composition. Thus, it is difficult for primary melts to reach surface; as a rule, they are subjected to transformations in such transitional chambers.

www.minersoc.org
DOI:10.1180/minmag.2013.077.5.19