# Enrichments of trace elements in settling particulate matter from the Alfonso Basin, La Paz Bay, south-western Gulf of California in 2002–2005 time-series data set

E. SHUMILIN[1], N. SILVERBERG[1], A.P. RODRÍGUEZ-CASTAÑEDA[1], O. MORTON-BERMEA[2], E. HERNÁNDEZ-ALVAREZ[2] AND F. BAHENA-AGUIRRE[1]

[1]Centro Interdisciplinario de Ciencias Marinas-IPN, Av. IPN s/N, La Paz, Baja California Sur, 23096, Mexico (*correspondence: eshumili@ipn.mx)

[2]Instituto de Geofísica, Universidad Nacional Autonoma de México, Delegación Coyoacan, México D.F., 04510, Mexico

Some micronutrients and chalcophylic elements are enriched in settling particulate matter of a time series (January 2002 - December 2005), especially in some periods. The average enrichment factors (EFs) of elements, calculated using Sc as normalizer (Salomons and Förstner, 1984), display the next sequence in a decreasing order:

Normal years (2003-2005)

Se (117-927) > Sb (10-53) > Cd (17-41) > As (14-19) > Pb (3-36) > Sr (3-10) > U (2-6) > Cs (5-5.6) > Ca (3-5) = Zn (3-5) > Cu (1.3-5.4) > Ba(1.8-4.3) > Mo (2-2.8) > Co (1.0-3.6) > Mn (1.4-2.1) > Ni (1-2) > Rb(1-1.2) > Fe (1) >Al (0.8-0.9) > Cr (0.9-1) > V (0.6-1)

Anomalous year (2002)

Se (1488) > Sb (470) > As (239) > U (61) > Cd (35) > Sr (31) > Mo (26) > Zn (15) = Pb (15) > Ca (11) > Cs (9) > Rb (6,.5) > Co (4.8) > Ba (4) = Cu (4) > Ni (3) > Cr (2.4) > Al (1.4)= Mn (1.4) >Fe (1.2) > V (1)

The highest values of EFs of As, Cd, Mo and U were observed mainly in late spring – early summer of the year 2002, when the waters from the Pacific Ocean presumably enter into the La Paz Bay, carrying less oxygen, less terrigenous particles and bringing tropical and subtropical plankton species. During that time, the winds become of SE direction, decreasing the continental aerosol input.

The Oxygen Minimum Zone can make slower the remineralization rate of sedimenting biogenic particles, also favouring the formation of insoluble Cd, Cu and Zn sulphides, as well as the reduction of Mo and U which can be easily scavenged by particles in a lower oxidation state (+4).

# What is $^4He/^3He$ thermochronometry telling us about the (U-Th)/He system in apatite?

DAVID L. SHUSTER[1] AND KEN A. FARLEY[2]

[1]Berkeley Geochronology Center, 2455 Ridge Road. Berkeley, CA, 94709 (dshuster@bgc.org)

[2]Division of Geological and Planetary Science, Caltech, 1200 E. California Blvd., Pasadena, CA 91125 (farley@bgc.caltech.edu)

$^4He/^3He$ thermochronometry has allowed us to make observations of the spatial distributions and diffusive behavior of $^4He$ in apatite that were previously inaccessible. In many applications of the technique, the $^4He/^3He$ data are consistent with (a) the basic assumptions of thermochronometry, and (b) assumptions that are specific to the (U-Th)/He system involving the direct emission of alpha particles, diffusion domain geometry, and radiation damage accumulation. However, in other instances, the observed spatial distributions are apparently *inconsistent* with these assumptions. We will present data from plutonic rocks in (i) SE Brazil, (ii) Baffin Island, Canada, and (iii) the Sierra Nevada, USA, that apparently demand additional complexity in the way we model the behavior of helium in apatite over millions of years. We will discuss possible implications, including alpha particle implantation from neighboring minerals, inner-crystalline U and Th zonation, mineral inclusions, the calibration of radiation damage as a control on effective diffusivity, the geometry of alpha ejection + diffusion, diffusive anisotropy, and sub-grain diffusion domains.