# Ecological impact of submarine groundwater discharge in a Mediterranean lagoon: Correlations between radon, radium and nitrate in the Mar Menor, Murcia, Spain

CHRISTELLE CLAUDE[1], PAUL BAUDRON*[23], ADRIANO MAYER[1], JAVIER GILABERT [4], DAVID MARTINEZ VICENTE[2] , OLIVIER RADAKOVITCH[1], CHRISTIAN LEDUC[3], JOSE LUIS GARCIA AROSTEGUI[5], AND FRANCICO CABEZAS CALVO-RUBIO[2]

[1]CEREGE, Europôle de l'Arbois, 13545 Aix-en-Provence, France, (claude@cerege.fr)
[2]F-IEA, Complejo de Espinardo, C\ Nacional 301, 30100 Murcia, Spain, (paul.baudron@baudron.com)
[3]G-EAU, BP 5095, 34196 Montpellier cedex 5, France, (Christian.Leduc@ird.fr)
[4]Department of Chemical & Environmental Engineering, Technical University of Cartagena (UPCT), Alfonso XIII, 52, E30203, Cartagena, Spain, (javier.gilabert@upct.es)
[5]IGME, Avenida Miguel de Cervantes, 45, 30009 Murcia, Spain, (j.arostegui@igme.es)

Since 15 years numerous works have shown the influence of submarine groundwater discharge (SGD) on the water budget of lagoons, bays or open coastal areas [1]. In particular the high concentrations in nutrients of discharging groundwater may result in very productive ecosystems [2]. A radon-radium study was coupled with nutrients in semi-arid South-Eastern Spain. Mar Menor lagoon (135 $km^2$) is bordered by a Quaternary sedimentary aquifer extending over 1200 $km^2$. $^{222}Rn$ and $^{224}Ra$ activities in groundwaters along the coast range between 2200 to 17500 and 16 to 120 $Bq/m^3$ respectively. In the lagoon, $^{222}Rn$ and $^{224}Ra$ activities varied from 10 to 100 and 4 to 8 $Bq/m^3$ respectively. The increase of both nuclides is localized and synchronous with a peak in $NO_3^-$ and chlorophyll, revealing groundwater input. In the same area, changes observed in coastal vegetation could be related. Further measurements will refine the SGD flux to Mar Menor and its ecological impact.

[1] Moore W. S. (1996), *Nature* **380**, 612-614. [2] Laroche, J., Nuzzi, R., Waters, R., Wyman, K., Falkowski, P.G., and Wallace, D.W.R. (1997), *Global Change Biology* **3**, 397-410.

# Uranium-series mobility during spheroidal weathering of 300 kyrs old basalt (La Réunion Island)

CHRISTELLE CLAUDE[1], JEAN-DOMINIQUE MEUNIER*[1], DAOUDA TRAORE[2], FRANÇOIS CHABAUX[3], BRUNO HAMELIN[1] AND FABRICE COLIN[2]

[1]CEREGE, Europôle de l'Arbois, 13545 Aix-en-Provence, France, (claude@cerege.fr)
[2]IRD, Anse Vata, BP A5, 98848 Nouméa Cedex, New Calédonia, (fcolin.noumea@gmail.com)
[3]Laboratoire d'Hydrologie et de Géochimie de Strasbourg EOST, 1 rue Blessig , 67084 Strasbourg cedex, (fchabaux@unistra.fr)

Spheroidal weathering (also named corestone-shell systems hereafter called CSS) is a common form of chemical weathering affecting many types of rocks [1]. The spheroidal structures are good models for studying weathering budget because the volume of shell rocks during weathering is conservative [2]. The CSS constitute therefore an open system for mobile elements such the major cations and silica that are leached out of the units. Conversely, they also can be seen as a closed system relative to poorly mobile elements such as Ti, Al or Fe which are only displaced from the core to the outer shell. During chemical weathering processes, natural radionuclides from the uranium series are either mobile or refractory and this differentiated behavior disturbs the status of radioactive secular equilibrium characterizing geological formations. Consequent radioactive $^{234}U$-$^{238}U$-$^{230}Th$ disequilibria can be used as a tool to estimate rate of soil formation on a time scale of circa 1 Ma. Here we combine mineralogical observations, geochemistry of major and trace elements to Sr isotopes and U-series as an attempt to constraint the rate of spheroidal weathering of a basaltic flow dated at 292 ±10 ka from la Reunion Island. U-transport model shows a remobilization process occurring on a time-scale of ca 250 ka. $^{87}Sr/^{86}Sr$ variations are small (0.7042 - 0.7050). Highly mobile Sr is leached out in 1500 yrs only. Sr fluxes are 1 order of magnitude higher than steady state conditions [3] suggesting that weathering rates could be higher during the first stages of alteration.

[1] Ollier, C.D., (1971), *Earth Sci. Rev.* **7**, 127-141. [2] Patino, L.C., Velbel, M.A., Price, J.R., Wade, J.A., (2003). *Chem. Geol.* **202**, 343-364. [3] Rad, S.D., Allègre, C.J., Louvat, P., (2007), *Earth Planet Sci. Lett.* **262**, 109-124.