Understanding water sources, age and flow paths in hydrochemical exploration: Constraints from stable and radiogenic isotopes in the hyper-arid Atacama Desert, Chile

M.I. LEYBOURNE[1], E.M. CAMERON[2], C.F.W. RISSMANN[3] AND N. R. MILLER[4]

[1]GNS Science, Avalon, New Zealand (m.leybourne@gns.cri.nz)
[2]Eion Cameron Geochemical Inc., Carp, Ontario, Canada (eioncam@gmail.com)
[3]Department of Geological Sciences, University of Canterbury, New Zealand (clintonrissmann@yahoo.com)
[4]Department of Geological Sciences, University of Texas at Austin, Austin, TX, USA (millernr@mst.edu)

Groundwater is an important medium for geochemical exploration of many different styles of mineralization, including porphyry copper, volcanogenic massive sulfide (VMS), sandstone uranium, and gold. Groundwater recharges to depth, resulting in greater likelihood of interacting with buried mineralization compared to surface geochemical methods, and thus providing a three dimensional perspective. However, to optimize groundwater exploration strategies, knowledge of potential water sources, ages and flow paths is required. Incorporation of isotopic analyses greatly enhances interpretations of groundwater provenance. This paper describes the use of stable (O, H, C, S) and radiogenic (Sr) isotopes in groundwaters collected over known mineralization (the Spence deposit) and in two basins without known mineralization (Monturaqui and Salr de Punta Negra) and shows how these isotope systems are critical in developing conceptual models for development of geochemical anomalies in groundwaters and in soils overlying mineralization. At Spence, stable isotopes clearly demonstrate mixing of fresh and sline groundwaters within the deposit area, with a clear imprint of interaction with porphyry Cu mineralization. In contrast, stable and Sr isotopes in the Monturaqui Basin suggest no sources of Cu mineralization, but do suggest influence from magmatic sources associated with Volcano Socompa. New advances in analytical methods are providing new isotopic systems and improving the cost and speed of traditional isotopic techniques. This paper will also discuss how these advances in analytical methods will impact hydrogeochemical exploration in the future.

Mid-Holocene East Asian Winter Monsoon evolution: Evidence from the mud wedge record in the East China Sea inner shelf

ANCHUN LI[1]* AND FANGJIAN XU[1,2]

[1]Key Laboratory of Marine Geology and Environment, Institute of Oceanology, Chinese Academy of Sciences, Qingdao 266071, China (*correspondence: acli@ms.qdio.ac.cn)
[2]Graduate University of Chinese Academy of Sciences, Beijing 100049, China

A mud wedge is distributed in the East China Sea inner shelf, the source of which is dominantly derived from Changjiang (Yangtze River) and delivered by alongshore current off Fujian and Zhejiang coast, which is driven by East Asian Winter Monsoon (EAWM). Good relationship between grain sizes and strength of EAWM has been revealed lately in two short gravity cores. Their implication to paleoclimate change and solar irradiance has been discussed.

A 60.2m long core EC2005 was drilled near the Holocene depocenter that was lately reveaded by seismic profiles off the southern Zhenjiang coast. Sediment grainsizes are coarser below 2806 cm than up section. Sediment is homogenous and consists mainly of clayey silt from 2806 cm to o cm. Sedimentation rate varies from 117 to 1986 cm•ka^{-1} in this section. The highest sedimentation rate occurred during mid-Holocene (5.2- ~5.9kaBP). Time resolution for 2 cm-interval is from 1.0 a to 1.5 a. This study only focuses on this period.

A 700-year EAWM record between 5.9~5.2ka BP were compared with the GRIP $\delta^{18}O$ records, the good correlation suggested that inner relationship existed between the EAWM and the climatic changes. The EAWM weakened during the mid-Holocene, and greatly fluctuated at about 5.5 ka BP, which was well in accord with the regional climatic changes and the archaeological studies. There is close relationship between the East Asian winter monsoon (EAWM) and solar activity, based on sensitive grain-size data and AMS^{14}C dating. The significant periodicities disclosed by power spectral analysis (PSA) are corresponding to the solar activity such as the 278a,62a,11a periodicities.