

## Hydrogeochemical and isotopic signatures of Carboneras-Palomares Fault Area aquifers (SE Spain)

P. HERNANDEZ-PUENTES<sup>1</sup>, R. JIMENEZ-ESPINOSA<sup>1\*</sup> AND J. JIMENEZ-MILLAN<sup>1</sup>

<sup>1</sup>Department of Geology and CEACTierra, Associated Unit IACT (CSIC-UGR), Faculty of Experimental Science, University of Jaén, Campus Las Lagunillas s/n, 23071 Jaén, Spain (ppuentes@ujaen.es; \*correspondence: respino@ujaen.es; jmillan@ujaen.es)

Groundwater from Palomares-Carboneras Active Fault Area has been studied using geochemical (major ions) and isotopic (data  $\delta^{18}\text{O}$  and  $\delta^2\text{H}$ ). The study area is located in the eastern of Betic Cordillera (SE Spain). Hydrological changes that follow major earthquakes has been investigated and found to be dependent on the style of faulting [1]. We try to establish a circulation model of groundwater and to identify the sources of fluids from aquifers and the influence of water flow on the nucleation of new earthquakes.

Chemical composition of the waters reflects different types and degrees of water-rock interaction and several geochemical families have been found:

(i) Na-Ca-Mg-SO<sub>4</sub>-Cl and Na-Mg-Cl-SO<sub>4</sub> waters: extreme EC (4000-14000  $\mu\text{S}/\text{cm}$ ): related to Pliocene marine marls in Vera Depression and Pulpí Corridor. ii) Na-Ca-Mg-SO<sub>4</sub>-Cl and Na-Mg-HCO<sub>3</sub>-Cl-SO<sub>4</sub> waters: high EC (2000-3500  $\mu\text{S}/\text{cm}$ ): related to dissolution of evaporites and carbonates along deep faults. (iii) Ca-Mg-Na-HCO<sub>3</sub>-SO<sub>4</sub> waters: low EC (300-1000  $\mu\text{S}/\text{cm}$ ): in relation to dissolution of carbonates from Sierra Cabrera, Sierra de Filabres and Sierra de Almenara.

The  $\delta^{18}\text{O} / \delta^2\text{H}$  diagram indicates that the distribution of the samples define a local meteoric line less steep than the World Online rainwater. The samples are better suited to the meteoric water line of the Mediterranean, indicating that precipitation of Mediterranean origin must contribute significantly to the recharge area. However, a mixed origin, Mediterranean and Atlantic rainfalls, could be taken into account. Samples from Sierra Cabrera and Fuente Alamo springs are more isotopically depleted. While Cuatro Caños and La Zanjilla springs appear more isotopically enriched. The prevalence of more negative values of  $^{18}\text{O}$  is associated with a greater height in recharge, regarding the two groundwater samples from the northern area.

[1] Muir-Wood and King, 1993. *J. Geophysical Research* 98-B12 (22035-22068)

## Effect of trace metals and light intensity on biomarker isotopic fractionation

M.T. HERNÁNDEZ-SÁNCHEZ<sup>1,2\*</sup>, H. STOLL<sup>1</sup>, A. PIOTROWSKI<sup>3</sup>, A. MILNE<sup>4</sup>, M. LOHAN<sup>4</sup> AND R. PANCOST<sup>2</sup>

<sup>1</sup>Geology Department, Univ. Oviedo, Oviedo, Spain. (\*correspondance: maitehs@geol.uniovi.es)

<sup>2</sup>Organic Geochemistry Unit, Univ. Bristol, Bristol, UK.

<sup>3</sup>Department of Earth Sciences, Univ. Cambridge, Cambridge, UK

<sup>4</sup>School of Geography, Univ. Plymouth, Plymouth, UK.

Photosynthetic carbon isotope fractionation ( $\epsilon_p$ ) is mainly controlled by CO<sub>2</sub> concentrations, but also other factors such as nutrient availability, carbon uptake or cell size; thus, it can provide insights into the marine carbon cycle. Most relevant for paleoclimate and despite its high dependence on algal growth rates, alkenone  $\epsilon_p$  has been invoked as a robust proxy for reconstructing ancient pCO<sub>2</sub> [1]. pCO<sub>2</sub> reconstructions rely on measured  $\epsilon_p$  and a b coefficient (which integrates physiological factors affecting isotope fractionation) which is generally assumed to be constant (or corrected for cell size) over time at a given location. Previously, the wide variations in b coefficient of suspended particulate matter alkenone  $\epsilon_p$  in the modern ocean was shown to correlate with seawater phosphate concentrations but in fact hypothesized to arise due to trace metal regulation of growth rate [2].

We further explore the effect of trace metal and light intensities on  $\epsilon_p$  of different phytoplankton biomarkers (including alkenones) for a smaller dataset in the modern ocean.  $\epsilon_p$  is positively correlated with light intensities that vary with collection depth, a trend which cannot be explained by lower growth rates at lower light but is consistent with prediction of light limitation of carbon concentrating mechanisms.  $\epsilon_p$  is inversely correlated with trace metals (Co and Co+Zn), a correlation that is stronger than that bore with CO<sub>2</sub> concentrations. Although further research is needed, our observations suggest that trace metals and light intensity affect the b coefficient, and that variations in the b coefficient at a given site must be accounted for in calibrations to reconstruct ancient pCO<sub>2</sub> accurately.

[1] Pagani *et al* (2002). *Paleoceanogr.* 17, 1069. [2] Bidigare *et al* (1997). *Global Biogeochem. Cycles* 11, 279-292.