Geophysical Research Abstracts, Vol. 8, 01959, 2006
SRef-ID: 1607-7962/gra/EGU06-A-01959

Oxygen and carbon isotope compositions of bivalve shells from cold seeps environments

C. Lietard, C. Pierre

LOCEAN, Laboratoire d'océanographie et du Climat, University of Paris IV, Paris.

(lietard@lodyc.jussieu.fr / Phone: 0144278479)

Cold seeps from deep sea environments are characterized by venting of hydrogen sulfide, methane and other hydrocarbon-rich fluids which temperatures and compositions depend on the depth and on the sediments from which they originate. Communities living in cold seeps rely on a symbiotic relationship with chemoautotrophic bacteria (*archaea* and *eubacteria*). In these systems invertebrate organisms (vestimentiferan tubeworms, bivalves...) use energy release from sulfide and methane oxidation by chemosynthetic bacteria to power their own life process.

Methane from cold seeps is characterized by low δ^{13}C values in the range between -100 ‰ and -40 ‰ (PDB) depending if methane's origine is biogenic or thermogenic. Since organisms assimilate partly the isotopic composition of what they eat, the carbon isotopic composition of bivalve shells may be used to identify methane-rich seeps. Oxygen isotopic variabilities in bivalve shells are largely explained by temperature variations and oxygen isotopic composition of the ambient water.

This study focuses on various families of bivalves (Vesicomyidae, Mytilidae and Lucinidae) from three different areas of active cold seeps, Gulf of Mexico, Eastern Mediterranean and Barbados accretionary prism. The isotope compositions vary according to site location : in Gulf of Mexico: 2.6 $<$ δ^{18}O ‰ PDB $<$ 3.9 and -7.3 $<$ δ^{13}C ‰ PDB $<$ 3 ; Eastern Mediterranean : 1.7 $<$ δ^{18}O ‰ PDB $<$ 3.4 and -10.23 $<$ δ^{13}C ‰ PDB $<$ 2.2 and in Barbados accretionary prism : 3.5 $<$ δ^{18}O ‰ PDB $<$ 4.6 and -9.4 $<$ δ^{13}C ‰ PDB $<$ 3.9.

Bivalve shells from cold seeps are exposed to venting fluids containing methane of variable δ^{13}C values. Moreover, the living habitats of bivalves differ for each species, some of them living within the sediment while others live at the seafloor. The stable isotope compositions display a large dispersion for shells from a same location : δ^{18}O vary by about 1 ‰ whereas δ^{13}C vary up to 5 ‰. The dispersion of δ^{13}C and δ^{18}O values in the different shells can be explained by the variability of physico-chemical parameters, as methane flux and temperature and by the living habitat of bivalves. In one site of Barbados, Vesicomyidae species appear to have higher δ^{13}C values and lower δ^{18}O values than Mytilidae species. The δ^{13}C values of Vesicomyidae range between 0 ‰ and 4 ‰ whereas δ^{13}C of Mytilidae range between -10 ‰ and -3 ‰. The δ^{13}C depletion in Mytilidae shells could be explained by the living position of Mytilidae which are buried compared to Vesicomyidae which live partly buried in the sediments. The buried species seem to be the most appropriate species to study the variability of methane venting systems.

High resolution studies on sections of bivalve shells (as proposed by Schöne *et al*. in 2005) would provide useful informations on changes of these environmental parameters during the growth of the animals.

Reference:

Schöne B. R. and Giere O. 2005. Deep-Sea Res. 52: 1896-1910.