The deep ‘cool’ terrestrial biosphere-fracture waters and dissolved gases at >2.5 km in the Canadian Shield

B. SHERWOOD LOLLAR[1], S. TILLE[1] , J. MORAN[3],
K. VOGLESONGER[1], G. LACRAMPE-COULOUME[1],
T.C. ONSTOTT[2] AND G.F. SLATER[3]

[1]Dept. of Geology, University of Toronto, Ontario Canada M5S 3B1, bslollar@chem.utoronto.ca
[2]Dept. of Geosceinces, Princeton University, Princeton, N.J
[3]School of Geography and Earth Sciences,McMaster University, Hamilton Ontario Canada L8S 4K1

Investigations of the deep biosphere have, in most cases, focused on the deep marine subsurface, including deep sea sediments, hydrothermal vents and cold seeps. As exploration for gold, diamonds and base metals expand mine workings to depths of up to 3 km below the earth’s surface, not only in the gold fields of South Africa but also in the Canadian Shield, the incidence and volumes of gas encountered increase with the depth of exploration. Exploration of these systems may provide information about the limits of the deep terrestrial biosphere, and the geochemical factory that produces substrates on which microbiological communities at great depths survive.

While many sites are dominated by methane and higher alkane gases produced by microbial processes, H_2 and hydrocarbon gases in the deepest, most ancient fracture waters with residence times on the order of tens of millions of years have been suggested to be the product of abiotic hydrocarbon formation reactions. Sampling of fracture waters and dissolved gases in Precambrian Shield rock at these extreme depths seeks to delineate the interface between geologically dominated (abiotic) systems and those dominated by microbiological processing and cycling of carbon. Resolving the origin of methane, whether in the terrestrial subsurface, at hydrothermal fields such as Lost City, or in Mars’ atmosphere, requires a means of distinguishing abiogenic from biogenic hydrocarbons. As carbon isotope characterization of CH_4 alone is rarely conclusive, studies of both terrestrial and extraterrestrial hydrocarbon compounds require constraints from higher molecular weight hydrocarbons and associated trace gases as well as methane. Here we present an isotopic model that predicts carbon isotope values for higher hydrocarbons through to pentane produced by abiogenic polymerization from CH_4 and show that this model may account for the unusual carbon isotope signatures of deep subsurface hydrocarbons gases found in a variety of settings in Precambrian Shield rocks.

Re-Os age and geochemistry of the Zhongjia Tin polymetallic deposit and its geological significance in SW Fujian Province, China

JIANJI SHI[1,2], DA ZHANG[1]* AND GANGUO WU[1]

[1]State Key Laboratory of Geological Processes and Mineral Resources, China University of Geosciences, Beijing, 100083, China (*correspondence: zhangda@cugb.edu.cn)
[2]Fujian Bureau of Geology and Mineral Exploration and Exploitation 350003, Fuzhou, China

The mineralization age of ore deposit is one of the important subjects in the study of the genesis of ore deposits and it has long been obtained by means of indirect methods. The Re-Os dating technique is an effective means for the direct accurate determination of the ages of molybdenite and related mineralization. The alkali fusion combined with ICPMS was used in this study to determine the Re-Os ages of molybdenite in the Zhongjia tin polymetallic deposit, which is located on the eastern margin of southwestern Fujian late Paleozoic basin [1]. Meanwhile, we analyse the geochemistry characteristics of the intrusion which related to tin mineralization. The results indicate that the model age of mineralization of the Zhongjia tin polymetallic deposit is 193-196 Ma, which gave rise to early Mesozoic mineralization in the studying area. Geochemical data indicate that the tin mineralization is commonly related to biotite granite in this area, which was emplaced during the early Mesozoic. According to the geochemical results, this biotite granite is derived from the the interaction between the continental plate and the Plaeo-Pacific ocean plate. In brief, the transformation from the Tethys tectonic domain to the circum-Pacific tectonic domain in southeastern China might take place at early Jurassic. The tin polymetallic mineralization in the study area resulted from the transformation of the two tectonic domains. The determination of the early Mesozoic tin mineralization can provide direct chronological evidence for looking for new regional ore prospecting areas. (Grant Nos. 1212010813064, 1212010533105 and B07011).

[1] Gao Tianjun (1999), *Beijing: Geological Press*, 1-188.