Radiocarbon as a paleohydrological tracer in the Dead Sea

B. LAZAR [1], R. KEN-TOR[1,2], G.S. BURR[3], Y. ENZEL[1], AND M. STEIN[2]

[1]Institute of Earth Science, The Hebrew University, Campus Edmond Safra, Jerusalem, Israel 91904
[2]Geological Survey of Israel, 30 Malkhe Yisrael St, Jerusalem, Israel 95501
[3]University of Arizona, NSF-Arizona AMS Laboratory, Tucson, AZ/USA

This study focuses on the application of radiocarbon as paleo-hydrological tracer in the Holocene and modern Dead Sea. For this, we examined samples of authigenic aragonitic laminae, aragonitic crusts and modern runoff waters from the Dead Sea drainage area. We consider three cases of precipitation of aragonite crust and laminae: (1) aragonite encrusting a modern driftwood from the shore of Ein Gedi spa yielded ^{14}C and U-Th ages of 3,900 and 322±8 y, respectively, while the wood yielded ^{14}C age of 386±65 y, indicating a reservoir effect of ca. 3,500 y; (2) continuous sequence of aragonite crusts within the late Holocene (~ 800 y on organic carbon) section of the Ze'elim valley yielded radiocarbon ages of ca. 1800 to 2200 y; and (3) continuous sequence of aragonite laminae within the modern Dead Sea sedimentary section (~ 93 y on organic carbon), yielded between 2000 to 2500 radiocarbon years.

The deviation of the radiocarbon from calendar ages may reflect reservoir effect (radiocarbon composition of the Dead Sea water), addition of dissolved carbon entering in runoff waters, radiocarbon in saline groundwater or combination of all. Runoff waters from the Dead Sea drainage area are characterized by high radiocarbon content (~100 pMC), while springs that percolate throughout Cretaceous carbonate aquifers (saline and fresh) are ^{14}C depleted (~50 pMC).

Considering the geological setting of the samples we suggest that: (1) the aragonite encrusting the driftwood precipitated from old saline groundwater; (2) the sequence of aragonite crusts was deposited during an episode of lake level rise (the enhanced fresh water input caused the radiocarbon age deviation to decrease), and (3) the sequence of aragonite laminae unveiled several episodes of freshwater flooding.

The low pMC values of the aragonite crust at ~ 800 y BP suggests a minor contribution of runoff to the ancient lake, which is consistent with the independent evidence of low lake stand during that time. Reconstructing the pMC values of Dead Sea at 800 y BP yields ca. 80 pMC similar to the present Dead Sea. Thus, it appears the during most of the past 800 years the Dead Sea system preserved steady state conditions in respect to radiocarbon.

High precision W and Mo isotopic compositions for iron meteorites

DER-CHUEN LEE [1] AND ALEX N. HALLIDAY [2]

[1]Institute of Earth Sciences, Academia Sinica, Nankang, Taipei 115, Taiwan, ROC (dclee@earth.sinica.edu.tw)
[2]Institute for Isotope Geology and Mineral Resources, ETH-Zentrum, CH-8092 Zürich, Switzerland (halliday@erdw.ethz.ch)

A suite of iron meteorites of various petrographic types were analyzed for both the ^{182}Hf-^{182}W ($t_{1/2}$ ~ 9 myrs) and the ^{97}Tc-^{97}Mo ($t_{1/2}$ ~ 2.6 myrs) short-lived chronometers in order to better constrain the accretion and differentiation history of asteroids and to test the possibility of a heterogeneous distribution of Mo isotopes throughout the accretion disk.

All the iron meteorites measured show a distinct ^{182}W deficit relative to the terrestrial W standard as well as the chondritic W, and this is consistent with an early differentiation in the parent body of these iron meteorites while ^{182}Hf was present. Since virtually all the Hf remained in the silicates during metal-silicate differentiation, the amount of the ^{182}W deficiency relative to the chondritic value reflects the timing of differentiation. Although the ε^{182}W varies significantly among these samples (from –4.1 to –2.9), the least radiogenic W from each petrographic group seems to be quite comparable among different groups. If the least radiogenic W of each group is taken as defining the initiation of core formation within the parent bodies, one can infer that the timing was extremely early, varied by <5 myrs among different asteroids. The large spread of ε^{182}W within each petrographic type can be best explained as defining a spread in the timing of metal segregation.

In contrast to previous results (Dauphas et al., 2001), none of the samples studied here show resolvable ^{97}Mo anomalies, suggesting that either ^{97}Tc was not present in the early solar system, or the initial abundance of ^{97}Tc was too low to resolve with the current techniques.

Furthermore, our data yield no clear evidence of deviation from the terrestrial standard except for barely resolvable ($\leq 1\varepsilon$) excesses in ^{96}Mo and ^{100}Mo. The variable ^{92}Mo and ^{94}Mo reported for iron meteorites (Dauphas et al., 2001) has not been found. The overall patterns for the iron meteorites are also similar to those of the carbonaceous chondrites but the deviations from the terrestrial Mo standard are smaller.

At present the data do not provide strong support for the proposed diversity of supernova sources (Yin et al., 2002), nor clear evidence of Mo isotope heterogeneity in the accretion disk.

References

Dauphas N., Marty B. and Reisberg L. (2001) *Ap. J., 565,* 640–644.

Yin Q., Jacobsen S. B. and Yamashita K. (2002) *Nature, 415,* 881–883