The distributions of carbon isotopes and the carbonate system variables in the eastern Mediterranean Basin

R. YAM[1*], G. SISMA-VENTURA[2], N. KRESS[3] AND A. SHEMESH[1]

[1]Department of Earth and planetary Sciences, Weizmann Institute of Science, 76100 Rehovot, Israel (*correspondence: ruth.yam@weizmann.ac.il)

[2]Department of Maritime Civilizations, Charney School of Marine Sciences, and Recanati Institute of Maritime Studies, University of Haifa, Israel.

[3]Israel Oceanographic and Limnological Research, National Institute of Oceanography, Haifa, Israel

The Mediterranean (Med) Sea is considered a region capable of absorbing relatively more anthropogenic CO_2 (C_{ant}) due to its warm and high alkalinity waters that are transported to the interior by the active overturning circulation. Large C_{ant} inventory and amplified acidification are estimated for all Med water masses which are exported to the North Atlantic water and precondition the thermohaline circulation. $\delta^{13}C$ of the Dissolved Inorganic Carbon ($\delta^{13}C_{DIC}$) provides a measure to quantify the penetration of isotopically light C_{ant}, however, knowledge on the distribution of $\delta^{13}C_{DIC}$, is currently lacking. We conducted a survey of $\delta^{13}C_{DIC}$ and carbonate system properties during 2009-2010 along the Southeast-Med (SE-Med) water column and compare the $\delta^{13}C_{DIC}$ results to the cruise conducted in 1988 [1]. The vertical profiles of $\delta^{13}C_{DIC}$ during 2009-2010 differ significantly from the uniform 1988 profiles. Comparing the average profiles of 1988 and 2010 yields a $\delta^{13}C_{DIC}$ temporal difference ($\Delta^{13}C_{DIC}$ ‰ yr^{-1}), propagating to depth of about 700m. A $\Delta^{13}C_{DIC}$ depletion rate of -0.13±0.03‰ and -0.11±0.03‰ $decade^{-1}$ was found for surface (0-200m) and intermediate waters (200-400m), respectively. The surface $\Delta^{13}C_{DIC}$ change, representing only ~50% of the atmospheric change (-0.26‰ $decade^{-1}$ fully equilibrated mixed layer). A mean C_{ant} accumulation rate of 0.38±0.12mol C m^{-2} yr^{-1} for the upper 700 m over the last 20 years was estimated, based on the mean depth-integrated $\delta^{13}C_{DIC}$ profile. This study also provides, for the first time, the seasonal changes in the carbonate chemisrty: total alkalinity and pH, of the SE-Med. We calculate the seasonal pCO_2 distribution in this region, and estimate a nearly annual super-saturation pCO^2, indicating relatively moderate CO_2 sink of the surface water.

[1] Pierre (1999) *Marine Geol*. **153,** 41–55.