HOLOCENE ORGANIC CARBON BUDGET OF THE ARCTIC OCEAN: SOURCES AND SINKS

R. Stein and R.W. Macdonald

1 Alfred Wegener Institute for Polar and Marine Research, 27568 Bremerhaven, Germany, rstein@awi-bremerhaven.de, 2 Institute of Ocean Sciences, PO Box 6000, Sidney, B.C. V8L 4B2, Canada, MacDonaldRob@pac.dfo-mpo.gc.ca

The predominance of terrigenous organic matter in Arctic Ocean sediments from the continental margin as well as the deep-sea basins is unique compared to the other world oceans where the proportion of marine organic matter preserved in the sediments is much higher. In the Arctic marginal seas, an average of about 5.5 x 10^6 t y^{-1} of terrigenous and 3.2 x 10^6 t y^{-1} of marine OC have been buried annually during the Holocene. Concerning the burial of marine OC, > 60% is accounted for by the Barents Sea alone (about 2 x 10^6 t y^{-1}). In the central Arctic Ocean about 1.9 x 10^6 t y^{-1} and 0.5 x 10^6 t y^{-1} of terrigenous and marine OC, respectively, are buried. Taking the average global burial rate of OC of 100 to 160 x 10^6 t y^{-1} (or 0.1 to 0.16 Gt), the Arctic Ocean with 11 x 10^6 t y^{-1} accounts for about 7 to 11% of the global budget. This number is disproportionately high considering that the Arctic Ocean accounts for only 2.5% of the global ocean area. Thus, the burial efficiency of OC is significantly higher in the Arctic Ocean than the global average. In balancing modern inputs and outputs of organic carbon it is important to note that the average Holocene OC burial rates are significantly higher than late Holocene (modern) values. The latter (which are about 60% of the Holocene average values based on data from the Kara and Laptev seas) are more appropriate to compare with the modern organic carbon input data. Using late Holocene burial data and assuming that 35% of the terrigenous POC is labile and becomes remineralized, about 35% (4.4 x 10^6 t y^{-1}) of the initial modern terrigenous POC input (12.6 x 10^6 t y^{-1}) is buried in Arctic Ocean sediments. This burial is approximately distributed as 26% in shelf sediments and 9% in central Arctic Ocean sediments. The remaining 3.8 x 10^6 t y^{-1} (or 30% of the initial input) is exported. 1% of the primary production or 1.9 x 10^6 t y^{-1} of marine POC is buried in
Arctic shelf sediments. In the central Arctic, $0.3 \times 10^6$ t y$^{-1}$ marine OC ($< 0.5\%$ of the primary production) are buried.