



Carbon isotopic behaviour of high molecular weight DOC in estuarine waters adjacent to the North Sea: An encounter between modern and 'postmodern' sources

J. M. E. Ahad (1,2), R. G. M. Spencer (3,4), R. S. Ganeshram (1), G. Uher (3), P. Gulliver (2), C. L. Bryant (2)

(1) School of GeoSciences, University of Edinburgh, UK, (2) Now at Scottish Universities Environmental Research Centre, NERC Radiocarbon Laboratory, UK (j.ahad@suerc.gla.ac.uk), (3) School of Marine Science and Technology, University of Newcastle upon Tyne, UK, (4) Now at Dept. of Viticulture and Enology / Dept. of Land, Air and Water Resources, University of California, Davis, USA

The carbon isotopic composition ($\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$) of high molecular weight dissolved organic carbon (HMW DOC) was studied in the Tyne and Tweed estuaries, NE England. $\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$ values of riverine HMW DOC discharging into these estuaries ranged between -26.7 to -28.6 permil and 76 to 121 permil, respectively, suggesting that UK rivers draining peat and moorland catchments are a source of modern HMW DOC. Despite significant removal (~30-70%) of terrigenous HMW DOC in the low salinity regions ($S < 15$) of both estuaries, $\Delta^{14}\text{C}$ signatures remained modern in age with little variation around 115 permil. This lack of apparent age discrimination was attributed to either non-oxidative removal or to the absence of a significant proportion of old refractory C in the HMW DOC pool. At $S > 15$, we observed seaward increases in $\delta^{13}\text{C}$ and $\Delta^{14}\text{C}$, with the latter reaching values of up to 471 permil (Tyne) and 811 permil (Tweed). Plots of $\delta^{13}\text{C}$ versus $\Delta^{14}\text{C}$ yielded decent positive linear relationships, indicating mixing between isotopically lighter (terrestrial) and heavier (marine) end-members. With no documented local ^{14}C inputs, we attributed non-bomb related ^{14}C -enrichment (i.e., 'postmodern' C) at $S > 15$ to a possible 'lingering effect' of distal anthropogenic sources in near-coastal North Sea HMW DOC. Given the global distribution of potential industrial, biomedical and nuclear industry-related sources, we propose that anthropogenic ^{14}C should be considered in assigning ages of DOC pools in near-coastal waters.