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Study of Estuarine Sediments From Galway Bay, Ireland

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Emphasis is being placed on the need to sequester carbon (C) from atmospheric CO2 because of international concerns about greenhouse gas emissions and global warming. These concerns are highlighted by the Kyoto Protocol (Conference of the Parties, 1997). Oceanic sediments contain 150 Pg of organic matter (OM) (Ridgewell and Edwards, 2007). Sediment samples from Galway Bay in Ireland are being studied to investigate the amount of carbon stored in this sink in the Bay area. The project seeks to determine the amounts and types of OM present.

Detailed studies are being carried out of humic substances (HS) from sediment samples collected. Four core samples (6 m in depth) were taken using a vibrocorer, and four grab samples were obtained at the surface of the coring positions using a day grab. Studies of the organic and inorganic colloidal components contained at different depths within the sediments can give indications of changes that have occurred over time to the compositions of the materials transported to the estuary and contributed by the marine organic materials. The data will provide an insight into the compositions of carbon sequestered in the sediments.

Nuclear Magnetic Resonance (NMR) is currently the most powerful tool available for the determination of complex structures and interactions in OM. Isolation and fractionation of humic acid (HA), fulvic acid (FA) and humin from grab and core samples are on going. The solvent sequence being used involve 0.1 M NaOH, 0.1 M NaOH + 6 M urea, and the isolates are fractionated using XAD-8 and XAD-4 resin packed columns in tandem (Hayes et al. 2008). A dimethylsulphoxide (DMSO) + 6% H2SO4 (concd) solution isolated a humin fraction, recovered as a precipitate when added to water. The clay residue was treated with 10% HF and the residual humin material was recovered after dialysis. Elemental analyses, titration data, X-ray diffraction (XRD), scanning electron microscopy (SEM) and solid and liquid state NMR procedures are used to characterise the isolates in aqueous media, and the humin fractions.

Detailed studies are ongoing on the core samples. Intact cores have been examined using a multi sensor core logger (MSCL) which accesses core quality, sediment density, water content, and magnetic susceptibility. XRF analysis has been carried out on all four core samples to determine elemental contents of the sediments. Elemental analysis will also be carried out for C, H and N using an elemental analyser. In a related project the palaeoecology of the sediments is being studied. Diatoms and foraminifera are being examined to investigate biological diversity. 14C AMS dating has been carried out on one of the four cores.

The data collected will provide more detailed information about the nature and the associations of the OM in estuarine sediments and will help to ascertain the extent to which these are sinks for carbon. The past environment will be reconstructed through studying biological proxies, carbon dating and elemental analysis.

References

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