ORGANIC CONTAMINATION IN SEDIMENTS OF THE LOWER PASSAIC RIVER: AN ENVIRONMENTAL FORENSICS APPROACH.

Michael A. Kruge, Nicole M. Bujalski, and Kevin Olsen
Dept. of Earth & Environmental Studies and Passaic River Institute, Montclair State University, Montclair, NJ 07043, (p) 973-655-7902, (f) 973-655-4072, krugem@mail.montclair.edu, csam.montclair.edu/earth/

As part of a comprehensive sediment quality study, a series of long cores were taken by Malcolm Pirnie, Inc. in fall, 2005 from the mouth of the Passiac River up to the Dundee Dam. Montclair State University received samples from these cores and is analyzing them for a suite of organic contaminants. Coring at site 7A, near the mouth of the Passaic at river mile 1.4, recovered five meters of sediment, one of the longer cores in the series. Nineteen subsamples of this core were analyzed by pyrolysis-gas chromatography/mass spectrometry (Py-GC/MS) for polycyclic aromatic hydrocarbons (PAHs), polycyclic aromatic sulfur and nitrogen compounds (S-PAHs, N-PAHs), as well as petroleum hydrocarbons and biomass marker compounds.

At least four vertical zones are recognized based on the concentrations and proportions of the organic compounds. There are coarse sediments at the base of the core, with relatively low concentrations of the compounds of interest, predominantly parent PAHs, as well as secondary amounts of S-, and N-PAHs. Above this layer, a zone about a half meter thick exhibits high concentrations of parent PAHs (e.g., phenanthrene: 11 mg/kg sediment, benzo[a]pyrene: 1 mg/kg), as well as S- and N-PAHs, all suggesting coal tar contamination. Above this level, the character changes markedly, exhibiting lower concentrations of PAHs in general, with four-ring PAHs predominating, rather than three-ring, and a fuel combustion signature overall. Petroleum hydrocarbons, including hopanes, become more abundant, particularly between 2 and 4 meters sediment depth. Towards the top of the core, there is an increased relative abundance of lignin marker compounds, derived from terrestrial vegetation in the watershed, while PAHs and petroleum hydrocarbons persist.

The organic matter in the core exhibits a complex, heterogeneous vertical distribution and is dominantly fossil fuel-derived. It presents evidence of changing contaminant input over time, from suspected coal tar (or similar) sources in the past to combustion and petroleum products. Terrestrial vegetation also makes an important contribution to the sedimentary organic matter in the upper portion of the core.