ACOUSTIC IDENTIFICATION OF SHIP-DERIVED DEBRIS BENEATH SHIPPING LANES: EXAMPLES FROM LAKE ONTARIO

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Anthropogenic particles in the Great Lakes can be traced to many sources including cargo ships. Ship-derived debris such as coal, taconite, and boiler slag have been and are currently being deposited along shipping lanes in Western Lake Ontario primarily by a process known as "cargo sweeping," the practice of cleaning cargo holds by dumping debris overboard. International regulations do not clearly restrict this practice.

Side-scan sonar is a valuable tool that can be used to estimate the acoustic properties of materials on the seafloor providing a means to characterize the texture of bottom sediments. Since coarser particles generally have a higher backscatter intensity than do finer particles, side-scan sonar can be used to identify deposits which may be of ecological importance. These deposits can then be studied in more detail.

Dual frequency side-scan sonar was used to identify deposits that are believed to be the result of cargo sweeping. These deposits, or ABAs (Acoustic Backscatter Anomalies) appear in the sonar images as areas of very intense acoustic backscatter beneath modern shipping lanes. In order to determine the nature of the ABAs, and the depth of these deposits relative to the sediment surface, we have conducted a series of cruises to Western Lake Ontario. Ship box cores were collected in conjunction with box cores and sediment suction samples collected by a Remotely Operated Vehicle (ROV). Video imagery from the ROV was also used to assess features on the surface of the sediment.

The structure of the cargo sweeping deposits is well preserved in Lake Ontario sediment samples because biological mixing is less intense and is limited to the upper 8 cm. In addition, in Lake Ontario there is less reworking of bottom sediments by physical processes. Sediment cores from three study sites have been analyzed for magnetic susceptibility and sound velocity. X-radiographs taken of these cores can be compared with the magnetic susceptibility and sound velocity profiles to determine the lateral and vertical distribution of ship-derived debris in the sediments. The sedimentary structure and relative proximity of anthropogenic particles to the sediment surface can then be correlated with the sonar images in order to make side-scan sonar a better tool for characterizing environmentally important aspects of modern sediments.