Seabed Characteristics and Sediment Mobility at CAS Study Sites on the Inner Scotian Shelf

D.L. Forbes
Geological Survey of Canada, Atlantic Geoscience Centre, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2
J.T. Judge
Martec Limited, 5670 Spring Garden Road, Halifax, Nova Scotia B3J 1H6
R. Boyd
Centre for Marine Geology, Dalhousie University, Halifax, Nova Scotia B3H 3J5
G. Drapeau
INRS-Oceanologie, 310 ave des Ursulines, Rimouski, Quebec G5L 3A1
and
J. Shaw
Geological Survey of Canada, Atlantic Geoscience Centre, P.O. Box 1006, Dartmouth, Nova Scotia B2Y 4A2

Wave gauges, current meters and other instruments were deployed in early 1986 on a transect across the inner Scotian Shelf east of Halifax as part of the Canadian Atlantic Storms Program (CASP). The resulting measurements of the near-bottom flow regime have been combined with core and sample data, sidescan and shallow seismic records, ROV video imagery, and diver observations of seabed scour and accretion, to provide a detailed picture of bottom characteristics, scour potential, and sediment mobility on the inner shelf.

The study area (in 20-37 m water depth) is characterized by irregular bathymetry and a complex distribution of bottom types, including sand, gravel, cobble-boulder lag surfaces, and bedrock. Anomalous depressions up to 2.4 m deep and 30 m across are present at a site in 30 m of water where mud is exposed at a break in the overlying sand veneer. A 4.3-m vibracore (87042-033) obtained nearby contains an upper 0.8-m marine sand unit (with 0.1 m of gravel at the base), underlain by 3.5 m of fossiliferous sand, silt-sand, and silt-clay interpreted as estuarine. A TOC sample from mud at the seafloor depression site has yielded a radiocarbon date of 6790±80 years BP (Beta-19587).

Large-scale symmetrical ripples in gravel, with wavelengths up to 2 m or more and relief up to 0.4 m, occurring in discrete patches and ribbons, reveal the localized nature of gravel mobility. The gravel in the ripples is multimodal, with dominant modes of the order of 10 mm and larger, and is mobilized frequently during winter storms. The sand in the area is well sorted with a modal size of about 0.2 mm. It occurs in thin patches with horizontal dimensions of the order of 100-1000 m.

Maximum observed values of scour during CASP were less than 0.1 m. Computations of sand load (depth-integrated concentration) and transport, based on a model in which the load is related to the excess normalized shear stress, have been used with a scour model based on continuity arguments to estimate scour rates of the order of 1 mm/h under moderate storm conditions at the 20-m site. These results are generally compatible with the observed scour.