

A Tidal Delta with an Ebb-Flood Channel System in the Minas Basin,
Bay of Fundy: Preliminary Report *

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The Bay of Fundy (Figure 1) has had a complex history of crustal and sea-level changes since the beginning of the Quaternary Period. Sparker profiles show, at many places, massive material, presumed glacial till, lying directly on Triassic bedrock. This presumed till is overlain by stratified material which can be traced to glacial outwash deposits of sand and gravel outcropping along the shore. The stratified material is being reworked and the sand and gravel is being redeposited in lenses by the present-day tidal regime. The lenses also contain much material from shoreline cliffs which are being eroded at rates of up to two metres/year (CHURCHILL, 1924).

The tidal rise in the Minas Basin is the highest recorded in the world being over 17 metres at Burnt Coat Head (CANADIAN HYDROGRAPHIC SERVICES, 1966). In such an environment, therefore, tidal currents naturally play a leading role in sedimentation. Tidal current velocities range, on the average, up to 2.5 knots in the Minas Basin, but in certain areas, such as the Minas Channel, they may be much greater.

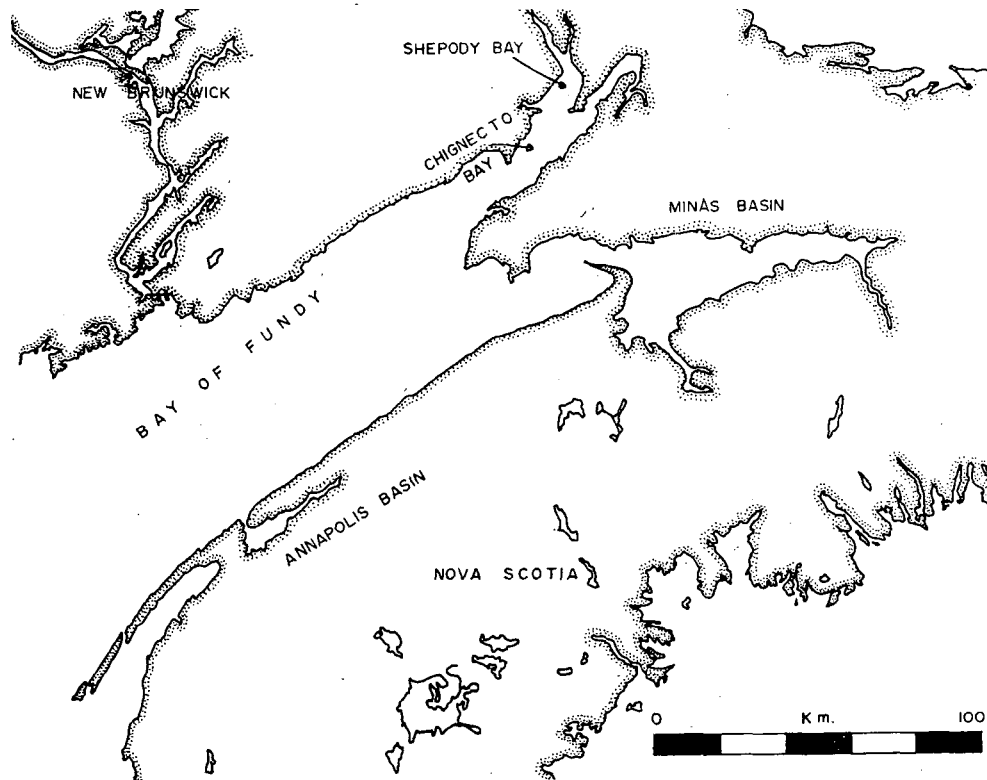


Figure 1 Index map of Nova Scotia, showing the location of the Minas Basin

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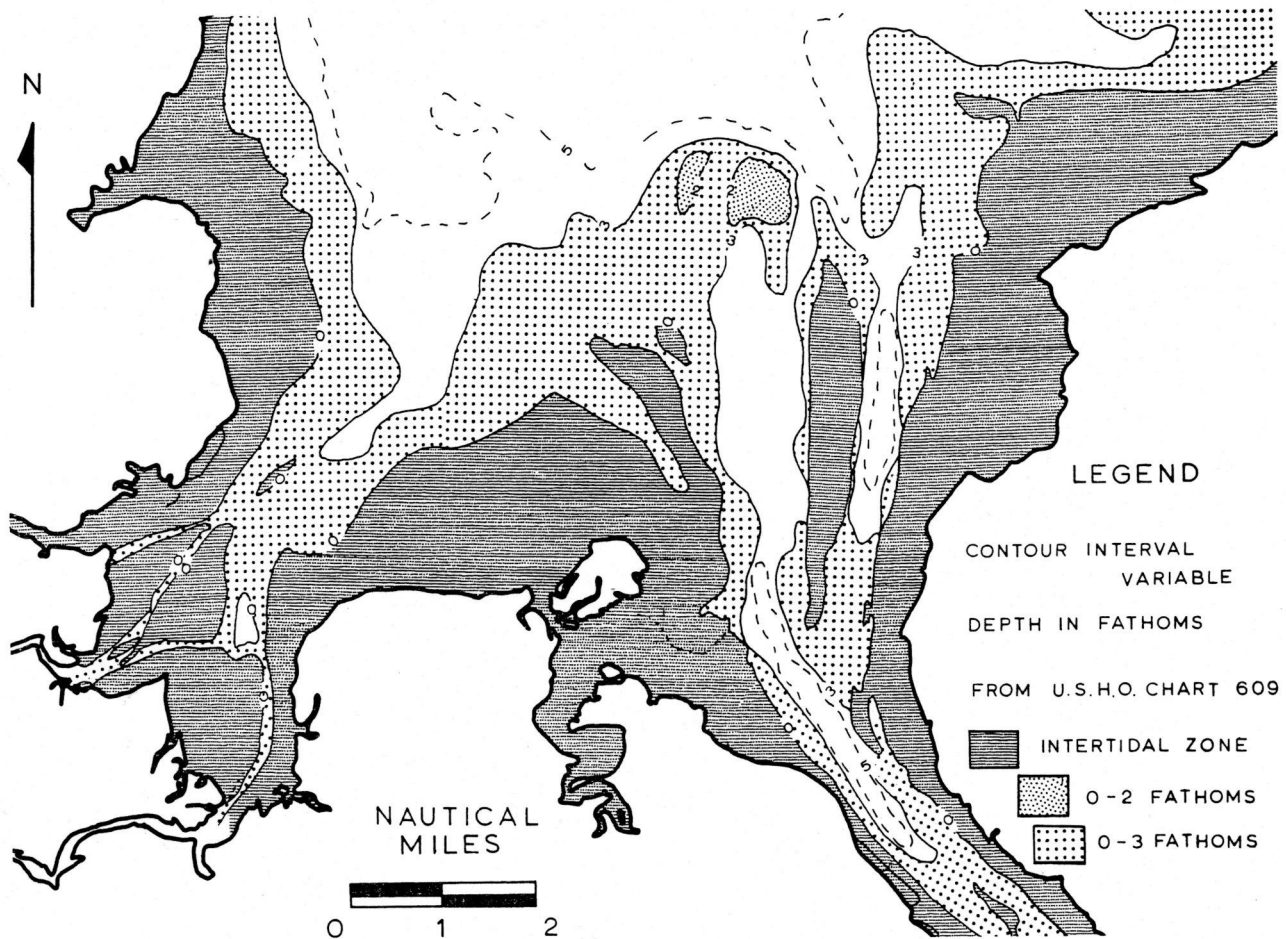


Figure 2 Windsor Bay - Bathymetry

One of the most striking of the present-day tidal deposits is the Windsor Bay sandbody complex. It can be classed most accurately as a tidal delta (presently forming at the mouth of the Avon River) because of its surface morphology (Figures 2 and 3). Much of this surface morphology is similar to that of the Mississippi delta (BATES, 1953). Western Bar and Middle Ground are levée-like bars flanking the main channel. A lunate cross-bar, dissected by three distributary-like passes, caps the main channel.

The crest of Middle Ground bar, shown on the left of Figure 4, is not on the margin of the main channel but on the margin of the eastern channel, where the strongest currents occur. This is partially due to the fact that the tidal nature of the regime has produced a system of mutually-evasive ebb and flood channels, as originally described by VAN VEEN (1936) and by such later workers as ROBINSON (1960, 1966).

The tide in the main channel continues to ebb for 15 minutes after the tide has turned in the open Minas Basin. During this time, the flood tide is blocked from entering the sandbody complex and so moves around it and flows up the eastern channel between Middle Ground and the shore. Current velocities were measured in both the eastern and main channels and these are shown, plotted against time, in Figure 5. The graphs also show that the time of both low water and current reversal are later in the main channel than in the eastern channel. The curves are relatively well rounded and symmetrical, and show little distortion; probably because the bulk of the Windsor Bay sandbody complex is basically sub-tidal, so that the response in the channels to the tide in the open Minas Basin is relatively sensitive. Other sandbody complexes in the Minas Basin which are basically inter-tidal (e. g. one in Cobequid Bay), yield tidal current curves with flattened low-tide segments. This condition is brought about because the channels draining the bars are independent of the open basin tide at low water, and their discharge is adjusted to

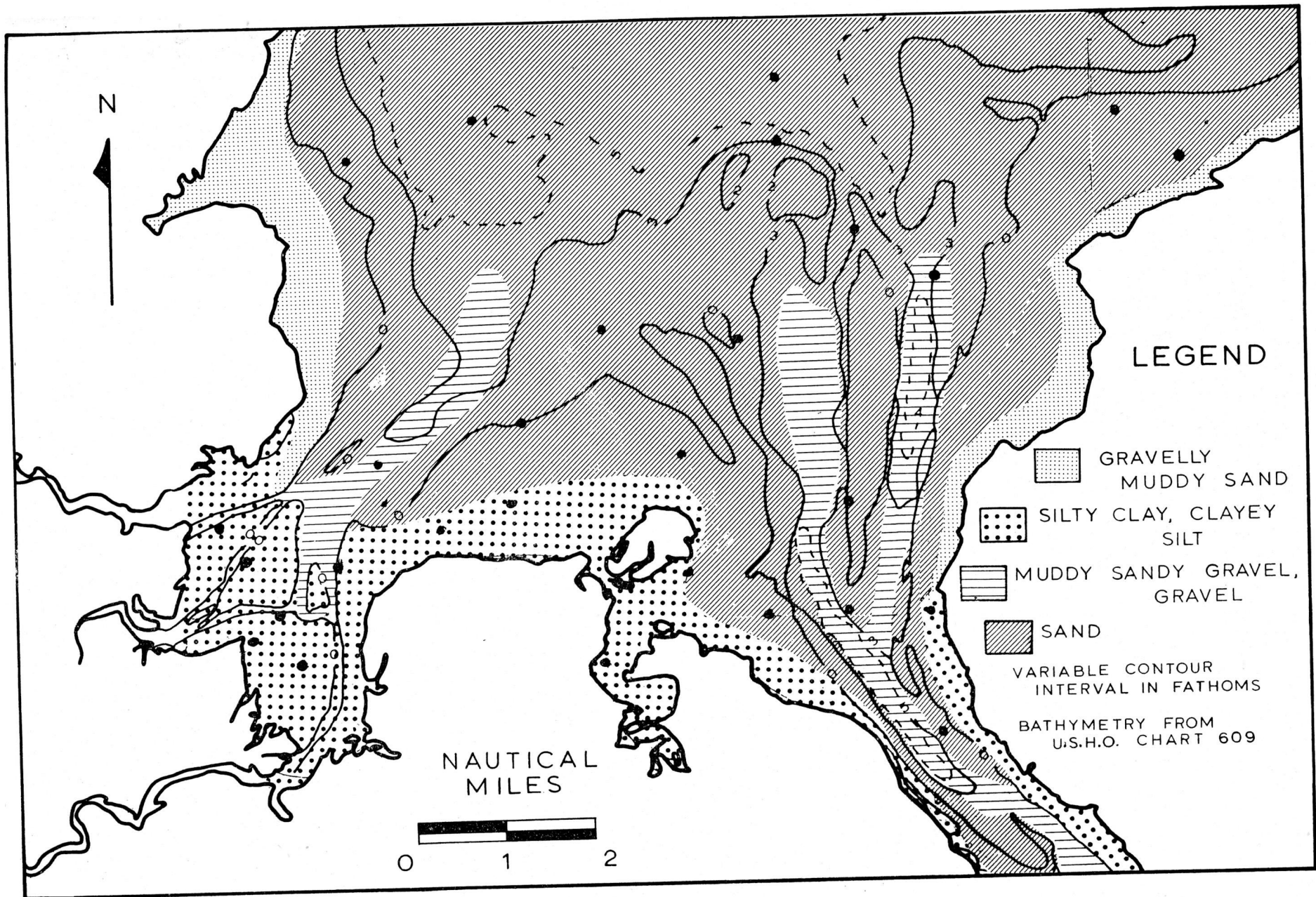


Figure 3 Windsor Bay - Sediment Facies

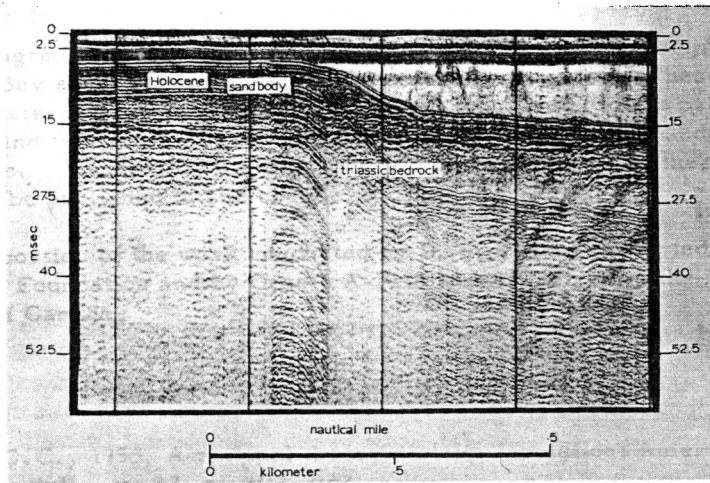


Figure 5 Tidal current velocity curves from Windsor Bay

WINDSOR BAY TIDAL VELOCITIES

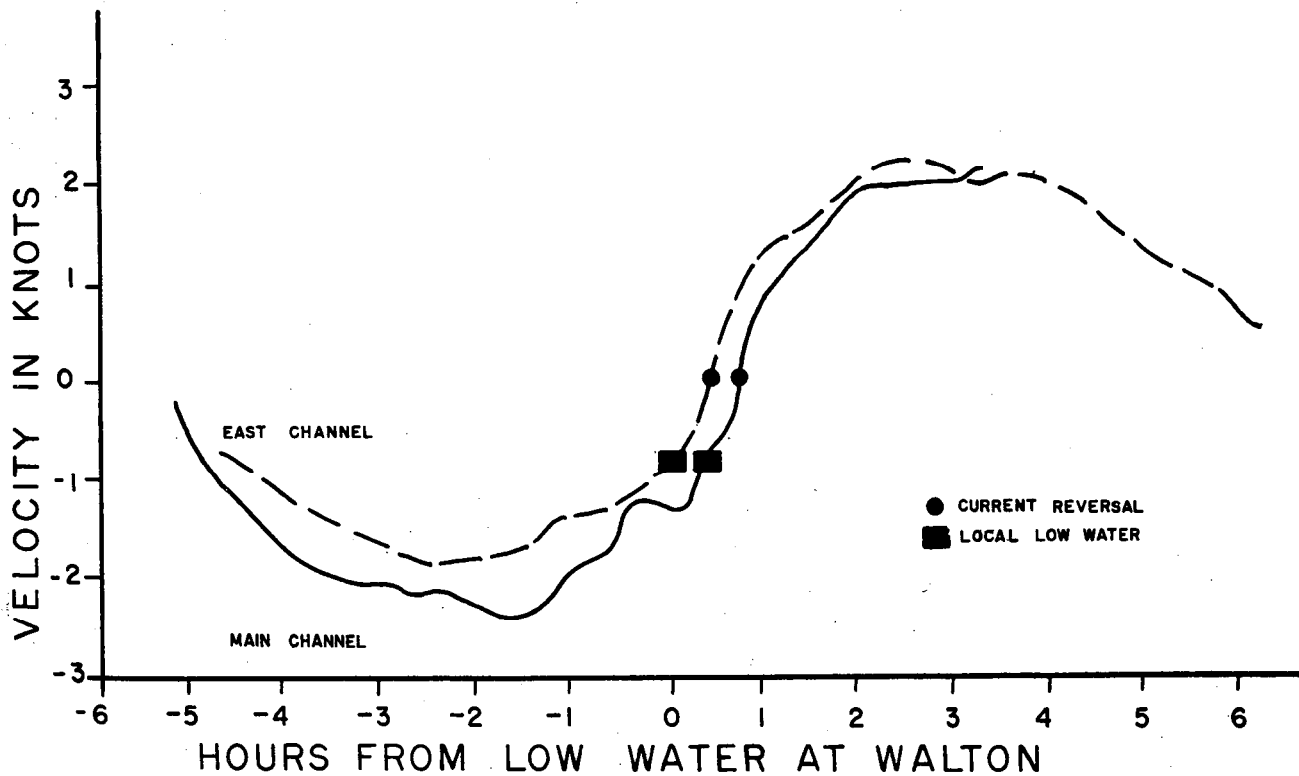


Figure 4 Sub-bottom profile across the eastern channel (right) and Middle Ground Bar.

their shape so that current velocity and water depth remain nearly constant.

Petrographic and grain-size distribution studies of the sediment making up the Windsor Bay sandbody complex are currently in progress. These are being undertaken to determine the nature of the textural adjustment to the prevailing hydraulic regime, and the part that the sandbody complex plays in the sand budget of the Minas Basin as a whole. An amplification of this study and other studies in the area will be published in due course.

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