DESCRIPTIVE NOTES

THE STUDY AREA

The Bay of Fundy (Figs. 1, 2) is a southwest–northeast trending funnel-shaped bay 155 km long that tapers from 75 km wide in the southwest to 45 km wide at its northeastern end where it bifurcates into Chignecto Bay and Minas Basin. The floor of the bay, although hummocky in detail, presents a gently dipping profile along its axis from northeast to southwest. Much of the bay is less than 100 m in depth. Grand Manan Island and its adjacent southeastern shoals occupy nearly half the entrance to the bay, and divide it into two channels.

Geological processes have shaped the geomorphology of the bay. First, glaciation has left the bay with a bedrock framework that is overlain by a veneer of glacial sediments. Second, modification of the overlying layer of glaciomarine sandy mud deposited by meltwater plumes after recession of the glacier. Relative sea-level dropped to a postglacial low of -25 m, creating (relatively limited) emergent areas and coastal landforms such as spits. During the Holocene Epoch tidal amplitude increased in the bay (Shaw et al., 2010), bringing about an increase in energy that continues to this day. The resulting strong currents (Fig. 3) have created extensive fields of bedforms in the mid- to upper-bay and deep scours troughs at topographic constrictions.

GEOLOGICAL CONSTRAINTS AND GEOHAZARDS

The Bay of Fundy contains a series of geological constraints that must be considered should seabed infrastructure be emplaced in the future. The bay contains broad swaths of active bedforms that can, for example, expose buried transmission cables. Tidal flow through the mouth of a harbours in scour troughs can undercut the seabed and induce slope failure. Strong tidal currents and storm waves during extreme erosion can remove all surficial sediments, revealing underlying bedrock that is favourable for emplacement of structures. The TISEC device test site in Minas Passage is located in this type of terrain. Irregular seafloor such as in outcropping bedrock is a constraint for bottom-founded structures sensitive to tilt. While transmission cables can be laid across an irregular seafloor, they require slack. Large areas of the sea floor are characterized by cobbles and boulders that can be an impediment to pile driving, trenching, ploughing, and suction dredging.

SEASCAPES

We define seascapes as underwater landscapes with recurring patters of geomorphology, texture, and biota.

GEOMORPHOLOGY

The various geomorphologic classes are prime drivers for the seascape classification, since they reflect the underlying processes over time and tend to control the distribution of textures and biota. The essential method of delineating topographic units is the analysis of shaded-relief elevation models derived from gridded multibeam sonar bathymetry data. Data treated in this manner reveal relief characteristics with a vertical accuracy of ± 0.1 m, and permits delineation areas with similar slope characteristics. An important aspect of this analysis is the application of shading from varying azimuths, resulting in the delineation of subtle features on the sea floor. In an integrated seascape approach it is necessary to understand the genesis of the geomorphic classes, and towards this end we use sub-bottom seismic reflection profiling (both high- and low-resolution) to determine the acoustic characteristics of sediment with depth, and hence delineate the surficial geology classes, which are broadly those described by Fader et al. (1977).

The large range of morphologic features in the map area extends from high-relief bedrock topography, through moderate relief areas sculpted by glacial ridges (moraines, streamlined landforms, and eskers) to widespread very low-relief sea floor. Extensive areas of the mid- upper-bay contain mobile sandy bedforms of various types. Unique to the bay are the deep scour troughs at its head and in constricted tidal channels.

TEXTURE AND MOBILITY

While texture conventionally refers to sediment grain size at the seafloor, we also expand the definition to describe sediment properties at depth and sediment mobility at the sea floor. A critical component of delineating sediment textures is backscatter strength (Fig. 2), a proxy for sea floor texture. In the main area this parameter is broadly bi-modal: areas of high backscatter strength correspond to bedrock and coarse lag, and areas of low backscatter strength correspond to sediments that are sandy, silty, and mud. Side-scan sonar was used in the bay to ascertain the presence or absence of bedforms such as megaripples, which are below the resolution of the multibeam sonar data. Inferences about mobility were made using bedforms characteristics as a guide. However, the modeled sediment mobility index (Fig. 4) was also a guide.

BIOTA

Biota were observed on sea floor photographs (Figs. 5–10) and video collected in areas considered representative of the geomorphic and textural classes. In general, hard substrates have attached biota, in contrast to sandy and muddy seafloors that may contain infauna. The long, linear, horse mussels reefs constitute a unique seascape unit, and host horse mussels (Modiolus modiolus) in association with the bryozoan Flustra foliacea, and hydroids sp. in sponge gardens. Generally the analysis of biota was not systematic, and we have taken the approach that geomorphology and texture are important determinants.

CLASSIFICATION

We distinguish eight types of seascape terrain (see legend) and further sub-divide, so that, for example, there are seven types of sandy seascape. In this instance we recognize that there exists awide range of bedform types, each with characteristics of morphology and mobility. We also add information on the distribution of gas masking on seismic reflection profiles, pockmarks, and also areas of irregular terrain in the muddy seascapes. Two of the many seismic profiles in the bay are shown (Figs. 11, 12).

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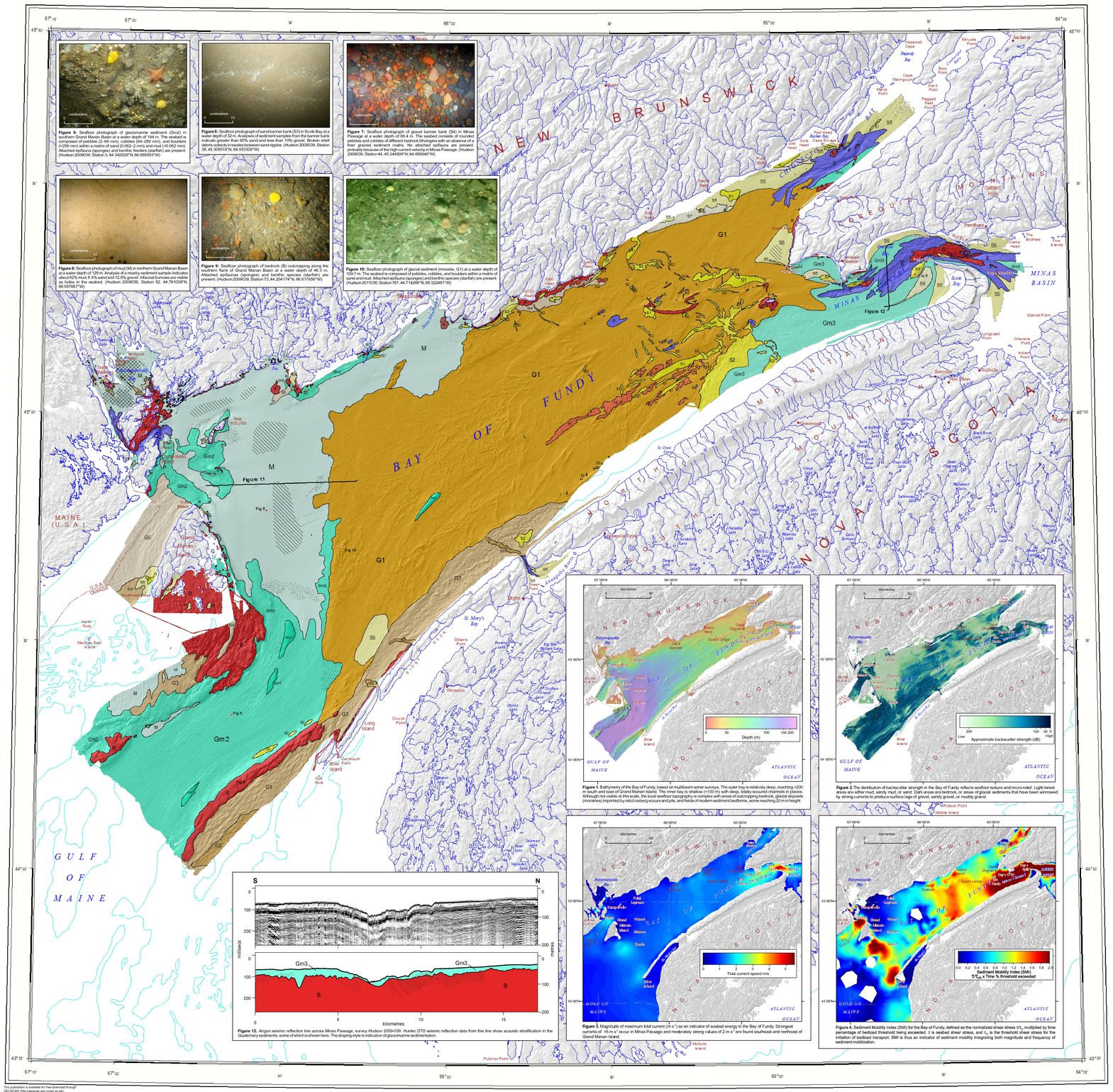
NEW BRUNSWICK
NOVA SCOTIA
MAINE
GULF OF MAINE
BAY OF FUNDY
MINAS BASIN
MINAS CHANNEL
CHIGNECTO BAY
ATLANTIC OCEAN
Grand Manan Island
Brier Island
Long Island
Digby Neck
Digby
Annapolis Royal
Wolfville
Parrsboro
Advocate Harbour
Five Islands
Minudie Point
Amherst
Joggins
Cape Chignecto
Cape Enragé
Point Lepreau
Saint John
Saint John Harbour
Black Point
Partridge Island
Maces Bay
Deadman Island
Quaco Ledge
Quaco Head
Fundy Rock
Fundy Spur
Fundy Deep
Scot Bay
Scot Shoal
Scot Ledge
Scot Rock
Red Head
Rocky Head
Rocky Point
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