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SEAFLOOR RELIEF — BAFFIN ISLAND SHELF

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INTRODUCTION

The southeastern Baffin Island continental shelf from Broughton Island in the north to Resolution Island in the south, including Frobisher Bay, has been mapped to show seafloor relief. The shelf in the central portion of this area, from just south of Cape Dyer to Cumberland Sound, is much wider than in the bordering areas, and forms a broad platform on the southeastern margin of the Island. The narrow shelf of the Broughton Island-Cape Dyer area consists of shallow nearshore banks with steep seaward slopes near the shelf break. Southward between Cape Dyer and Cape Mercy the shallow banks disappear and the steep slopes give way to a gently eastward dipping surface extending to the edge of the widened shelf. South of Frobisher Bay the shelf is again narrower with steep seaward slopes.

On the basis of acoustic data, two series of charts of seafloor relief on the shelf have been constructed. The first series indicates the relief along the lines of ships' tracks. The second are areal relief charts, in which the data has been correlated line to line to provide an interpretative areal view.

These charts were compiled from acoustic data as a preliminary to a study of the distribution of Quaternary sediments on the southeastern Baffin shelf. Variations in the degree of roughness are in places associated with changes in the nature of the seabed material, e.g. rougher terrain in areas

of exposed Precambrian metamorphic rocks, smoother terrain in areas of fine sediment. Data provided by these charts are particularly pertinent to seabed engineering or other applications where the shape of the seabed is an important consideration.

The chart bases are Canadian Hydrographic Service charts 7050, Resolution Island to Cape Mercy and 7052, Cape Mercy to Kangeeak Point at a scale of 1:500,000.

CHART SET I: RELIEF ALONG TRACK

A decade of exploration has provided considerable acoustic data on the Baffin shelf in the form of Huntec high resolution and 655 cm^3 airgun seismic reflection, echosounder, and sidescan sonar profiles. On the basis of these data, a chart showing seafloor roughness along track has been constructed. The Huntec system provides the most detailed picture of the seafloor, and has been used extensively where available. Areas without Huntec have been interpreted using airgun and echosounder profiles, or echosounder data alone where seismics are lacking. Although echosounder and airgun images of the seafloor lack the detail of Huntec for the purposes of relief measurement, classification intervals are such that this does not unduly affect the precision of the observation.

Six classes of relief have been defined for the purposes of this chart set, as shown in the legend. Relief is measured perpendicular to the slope of the regional land surface - it is therefore localized relief or detailed local morphology we are measuring, as opposed to regional relief trends. It is important not to confuse the concept of a smooth surface with one that is horizontal. The category of relief of a given section of seafloor is determined by the difference in height between its high and low

points measured perpendicular to the regional trend of the seafloor (not necessarily vertically).

Regional trends of morphology are illustrated by the arrows on the chart. Arrows point in the downslope direction; where there is no arrow, the surface is approximately level. Although no inference to steepness of slope is made, most slopes indicated by arrows are less than 45 degrees. Slopes of greater than 45 degrees appear almost vertical on seismic profiles, and are indicated as scarps. Further information on regional trends can be obtained from a bathymetric chart.

Three features of the Classification scheme require clarification:

SCARPS

Scarps are defined here as changes in elevation with apparent slopes of more than 45°. No genetic inference is attached to this term; scarps may represent a variety of features, such as faults, the edge of a till deposit, or a former low sea level stand. They are indicated on the chart by a boxed-in section of stipple laid perpendicular to track. The type of stipple indicates the height range of the scarp, and the arrow indicates the "down" direction. Scarps less than 5 metres high are usually not indicated. It should be pointed out that the space required for the scarp symbol on line does not necessarily reflect the true width of the scarp - e.g. a 90° dropoff would have no width at all, and if drawn to scale, would appear on the map as a line.

SOLITARY ELEVATIONS

We occasionally encounter along track an apparent solitary mound or peak of greater height than surrounding seafloor datum. It is indicated by a patch of the appropriate stipple, annotated with an R. Such a feature may

represent the intersection of the track line with an actual isolated "mound", or a cross section of a linear feature. Smaller such elevations are commonly encountered among till deposits, whereas larger rises are often associated with areas of acoustic basement.

DEPRESSIONS

In contrast to solitary elevations, we occasionally encounter along track an apparent solitary cut or gouge in the seafloor of a depth much exceeding the range of the surrounding relief. It is indicated by a patch of the appropriate stipple, annotated with a D. It may represent an actual isolated pit or hole or a cross section of a more elongated trough or gouge.

One apparent problem with the classification scheme is that lines of different relief class may occasionally cross each other on the chart. This is because the shape of the seabed along tracks at a large angle to each other may appear different on the resulting profiles; this is analogous to the difference between travelling along strike as opposed to across it. Thus, what appears to be a mound along track may actually represent the intersection of the track with a linear structure. It is important to remember that the view of the seabed obtained is that of a relatively narrow track, and in all cases descriptions of seabottom features such as mounds, depressions, and scarps are of only two-dimensional images.

CHART SET II: AREAL RELIEF

A second set of charts was prepared with the aim of areally interpolating seafloor relief based on the charts described in the previous section The same relief classes were retained, except that one unit, SI, was incorporated as part of the Smooth category, giving that class a range of 1 -7 m. The procedure was basically an interpretative line to line correlation. As

seen on the chart, known boundaries between roughness types are shown by solid black lines. Known boundaries are either those observed along track or those which are very strongly suggested from interpolation of the data. Inferred boundaries (less certain interpolations between lines) are shown with no black lines between stipple patterns. Areas where the line density is so low that we cannot infer what is happening with sufficient confidence, are left blank. Areas where there is only one line (and so no opportunity for extrapolation) usually have the line indicated, or are left blank. In some areas, as has been mentioned, different classes of relief may cross each other on tracks. Where this occurs to any significant extent, the dominant (i.e. higher) relief class is used.

It is important to note that this chart takes no account of regional slopes or gradients. Only the surface relief is shown, not the orientation of the bottom upon which it is superimposed. The large-scale tendencies of the bottom can be seen on a bathymetric chart of the shelf, or on a slightly more detailed scale drawn from the arrows on the track maps.

These areal charts offer a preliminary view of the general morphological tendencies of the Baffin Island shelf seafloor. Although line density in most cases is at present insufficient to present a detailed survey, future ships' tracks will amend this, as well as provide a good test of the charts' accuracy.