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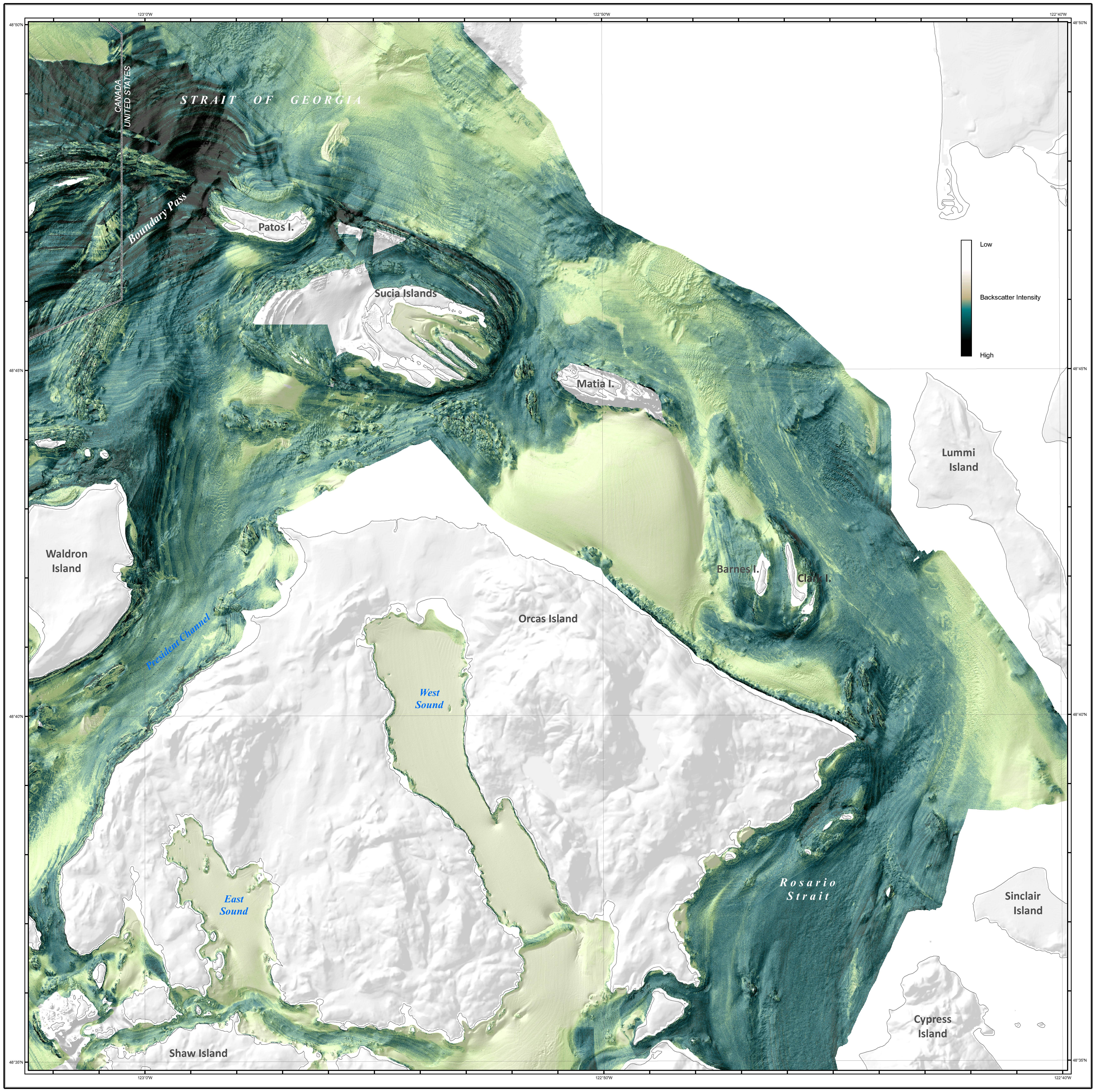

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LOCATION MAP

OPEN FILE 6626

BACKSCATTER STRENGTH AND SHADED SEAFLOOR RELIEF

SOUTHERN GULF ISLANDS AND SAN JUAN ARCHIPELAGO

CANADA AND U.S.A.

Sheet 3: Orcas Island

Scale 1:50 000/Échelle 1/50 000

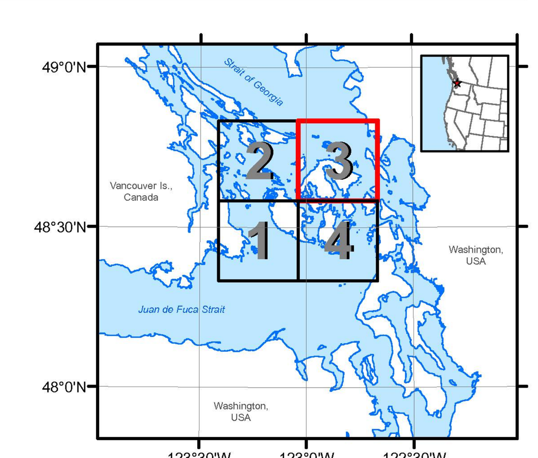
kilometres 1 0 1 2 3 4 kilomètres

Universal Transverse Mercator Projection, Zone 10
North American Datum 1983

This map is not to be used for navigational purposes

Projection transverse universelle de Mercator, Zone 10
Système de référence géodésique nord-américain, 1983

Cette carte ne doit pas être utilisée aux fins de navigation



Map Index

DESCRIPTIVE NOTES

A pilot mapping project was undertaken in 2000 where a series of disparate "postage stamp size" (Davis Point (Cattle Pass), Neck Point, Pile Point, Turn Island, and Lawson Reef) areas within the San Juan Archipelago were mapped using a pole-mounted Reson 8101 SeaBat (240 kHz) swath (150 swath coverage) multibeam echosounder (MBES) mounted aboard the R/V *MacGinitie*. The data was collected under contract with the Seafloor Mapping Lab of California State University Monterey Bay through the Center for Habitat Studies, Moss Landing Marine Laboratories (MLML). From 2001 through 2008, cooperation between the Geological Survey of Canada (GSC) and MLML's Center for Habitat Studies/Tombolo/SeaDoc Society, led to the extension of the existing multibeam coverage. Under the direction of the Canadian Hydrographic Service (CHS), the Canadian Coast Guard Research Vessels (CCGS) *Otter Bay, Revisor, R.B. Young and Vector,* acquired additional high-resolution bathymetric datasets of the waterways surrounding the Southern Gulf Islands and the San Juan Archipelago (Greene & Barrie (Eds), 2011a).

Co-registered along with high-resolution depth data, multibeam systems also record backscatter strength data. During the pilot project, however, data acquisition was maximized for collection of accurate bathymetry rather than backscatter data. Consequently, the quality of the backscatter data was substandard and unusable. The backscatter strength presented in this open file is only from the data collected following the pilot project.

Backscatter strength is a measure of acoustic energy that is reflected or scattered by surfaces or seafloor materials at the sediment-water interface and within the sediment by volume scattering. The quantitative value associated with backscatter strength is normally expressed in decibels (dB), ranging from 0 to -128 dB. To reduce the dynamic range of the recorded data, the systems applied a partial correction to the backscatter strength values for varying angles of incidence, using Lambert's law for angle variation assuming a flat seafloor (Dartnell and Gardner, 2004). Backscatter strength is calculated using calibration values for the electronics and transducers established at the time of instrument manufacture. Without further calibration during data collection, backscatter strength values may be inaccurate. Many factors influence the strength value, including the angle of incidence of the beam, the volume scattered as energy penetrates the substrate and is scattered by sub-bottom layers, the seabed slope, and the surficial sediment type and surface roughness. Consequently, some features in the backscatter strength data may be artifacts from data collection, environmental conditions during the survey, and data processing. To minimize the artifacts, a proprietary software (GSC) was used to process the data, correcting for beam pattern artifacts, as well as the imbalance between port and starboard signal amplitude. However, after applying corrections, some artifacts are still visible. The orientation of the survey track lines can, in some instances, be identified by faint parallel stripes in the image.

Despite the negative effects of this type of data collection, backscatter strength datasets are cautiously used to infer sediment textural differences. Courtney and Shaw (2000) summarized the relationship of backscatter strength to seafloor sediment. There exists no direct relationship between backscatter amplitude and surficial sediment type. However, for an angle of incidence greater than about 20° (specular range), there is a correspondence between backscatter strength and surficial sediment roughness. This correlation can be used for cursory mapping and sediment identification. Coarse gravel and cobbles tend to be locally rough and return high-amplitude for wide-angle backscatter signals, while sands and fine-grained materials can be locally smooth with a much lower backscatter strength return. Because backscatter strength is a function of a suite of acoustical variables, it is prudent to interpret backscatter images in conjunction with other geophysical data (seismic reflection profiles, sidescan sonar sonograms), geological samples of seafloor materials and seafloor photographs. For instance, this open file map series uses backscatter strength data in conjunction with multibeam echosounder bathymetry derivative datasets, such as seafloor shaded relief (Greene & Barrie (Eds), 2011a), slope analysis and bathymetric contours to optimize mapping accuracy and improve confidence in the derived classification.

The transboundary region covered by this open file has been divided into four quadrants represented as one sheet each. This sheet (Sheet 3 of 4; Orcas Island area) covers most of the area surrounding Orcas Island including West and East Sounds, Patos, Sucia, Matia, Barnes and Clark Islands. Backscatter intensities vary from high (darker areas in mosaic) to low (light shades in mosaic). The high intensities represent hard and acoustically reflective substrates, such as differentially eroded sedimentary bedrock (sandstone and conglomerate), faulted and fractured metamorphic or volcanic basement rocks, and coarse-grain sediment (pebbles, cobbles, boulders). The medium to low intensities represent fine-grain sediment (sand and mud) included in dynamic bedforms and other sediment deposits in the Haro and Rosario Straits area. This backscatter strength dataset is the second open file presented as part of an open file map series. Seafloor topographic multibeam sonar data is presented as the first open file of the series (Greene & Barrie (Eds), 2011a) and potential marine benthic habitat map, interpreted using multibeam bathymetric and backscatter strength datasets, is presented as the third open file (Greene & Barrie (Eds), 2011b).

REFERENCES

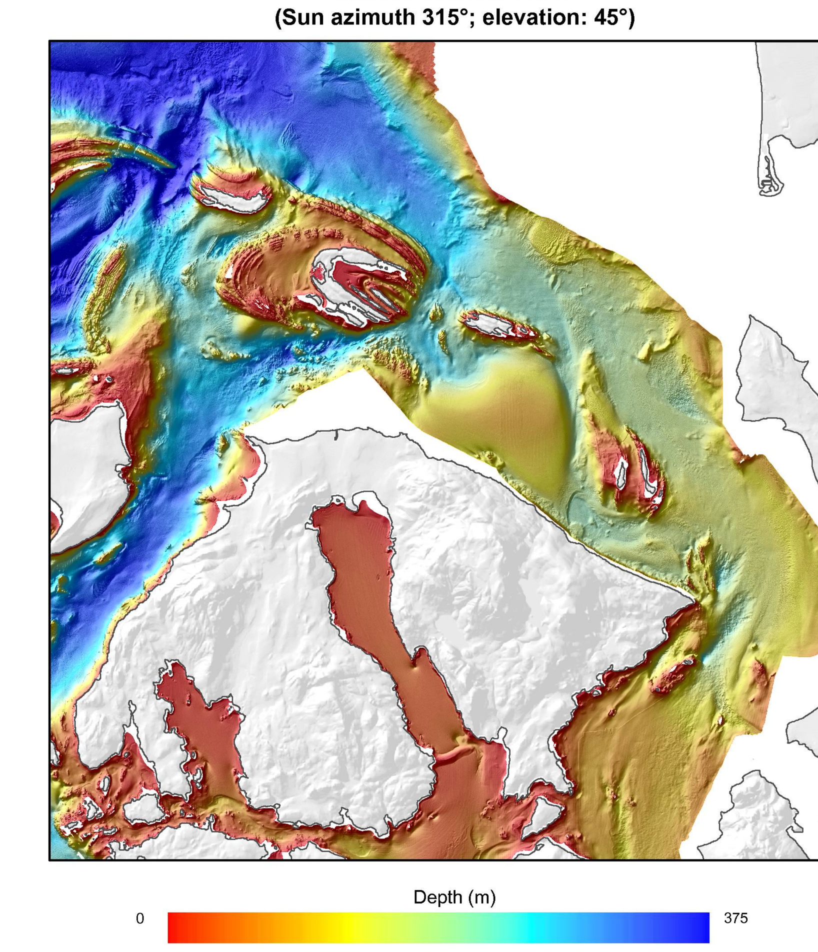
Courtney, R.C., and Shaw, J., 2000. Multibeam bathymetry and backscatter imaging of the Canadian continental shelf. Geoscience Canada, v. 27, p. 31-42

Dartnell, P., and Gardner, J.V., 2004. Predicting seafloor facies from multibeam bathymetry and backscatter data. Photogrammetric Engineering and Remote Sensing, v. 70, no. 9, p. 1081-1091

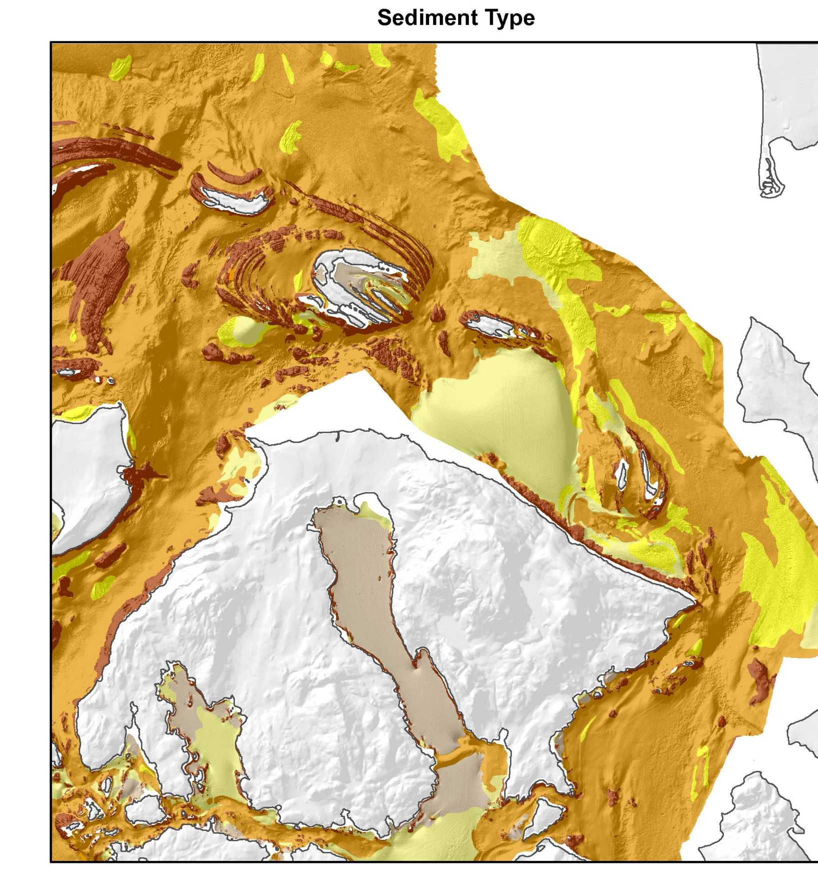
Greene, H.G. (ed.), and Barrie, J.V. (ed.), 2011a. Shaded seafloor relief, southern Gulf Islands and San Juan Archipelago, Canada and U.S.A. Geological Survey of Canada, Open File 6627, 4 sheets.

Greene, H.G. (ed.), and Barrie, J.V. (ed.), 2011b. Potential marine benthic habitats and shaded seafloor relief, southern Gulf Islands and San Juan Archipelago, Canada and U.S.A. Geological Survey of Canada, Open File 6625, 4 sheets.

Shaded seafloor relief
(Sun azimuth 315°; elevation: 45°)



Sediment Type



Rocks, pinnacles, or boulders | Sand/Gravel | Sand | Sand/Mud | Mud

The sediment type was derived using a combination of the backscatter strength and bathymetry-derived data. Where no backscatter strength data was available, the interpretation was done using only the bathymetric data and knowledge from the surrounding areas. For more details, see Greene and Barrie (Eds; 2011b)

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OPEN FILE
DOSSIER PUBLIC
6626
GEOLOGICAL SURVEY OF CANADA
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2011
SHEET 3 OF 4
FEUILLET 3 DE 4

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Sheet 3 of 4, Orcas Island
Endris, C.; Picard, K.

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