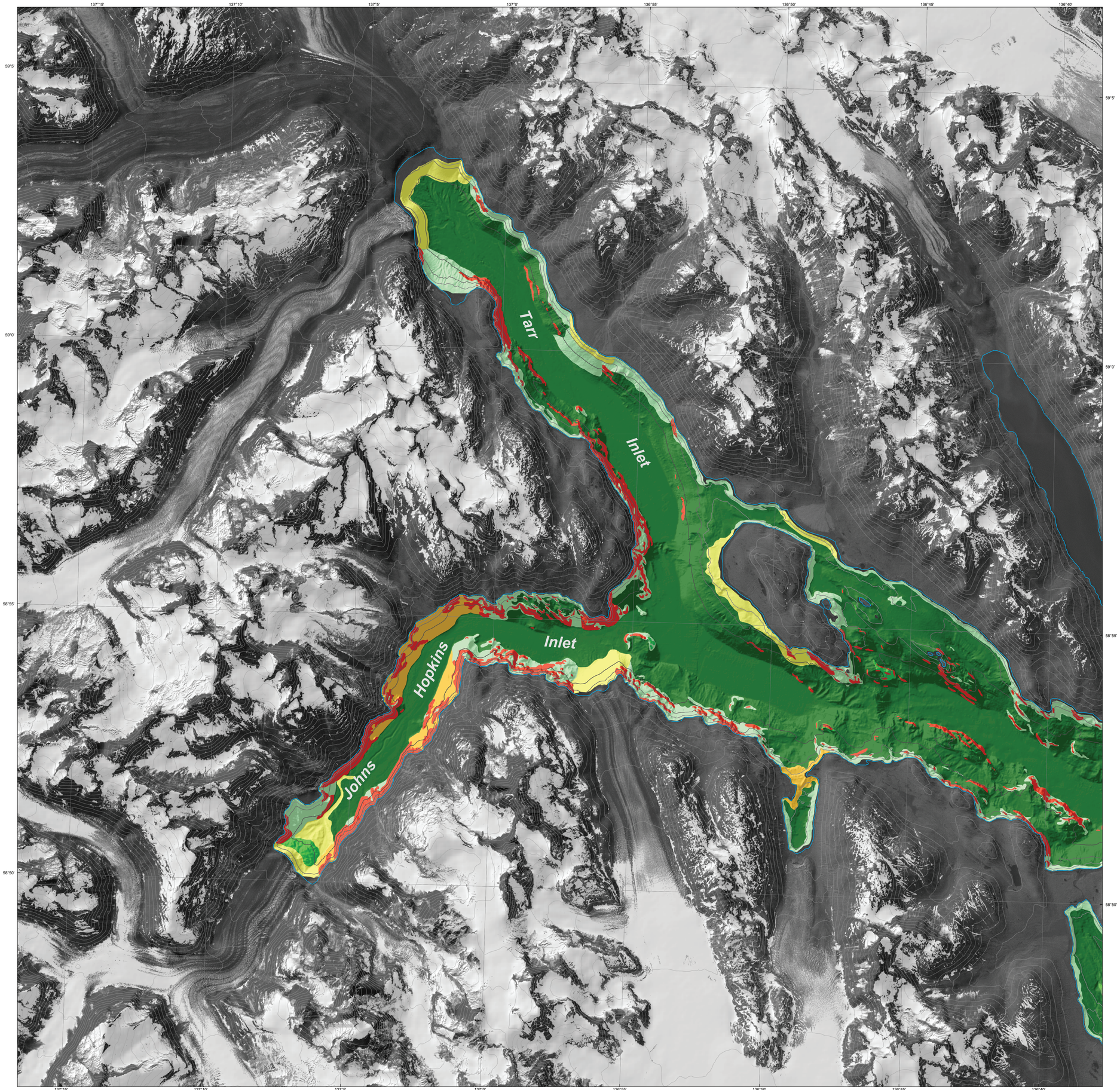
U.S. Department of the Interior
U.S. Geological Survey

Scientific Investigations Map 3253
Sheet 3 of 4
Pamphlet accompanies map



CMECS SUBCLASS LEVEL: SURFACE GEOLOGY

- Bedrock
- Boulder/rubble
- Cobble/gravel
- Sand
- Mixed
- Unclassified soft sediment
- Mud

Description

This map shows surficial sediment within the West Arm, Glacier Bay National Park and Preserve, Alaska, and was produced by manual polygon selection using geological reasoning, seafloor property measurements from the multibeam bathymetry, and knowledge of substrate types from video observations, seismic reflection profile interpretations, and sediment sampling. The sea floor properties examined during manual classification were rugosity (a dimensionless measure of seafloor roughness) and seafloor slope. These were used to help identify steeply sloping and rugose areas that are most likely bedrock or consolidated sediment.

The Coastal and Marine Ecological Classification Standard (CMECS, v. III, June 2009) by the National Oceanic and Atmospheric Administration (NOAA) and NatureServe was used to classify various substrate types (Madden and others, 2009). Units displayed on this map represent the surface geology component subclass level of the CMECS classification draped over the shaded bathymetry. Substrate distributions are summarized for the entire West Arm in the tables below. Table 1 shows the percent and area of the substrate distribution by CMECS class. The unconsolidated bottom CMECS class is divided into mud, mixed sediments, and cobble/gravel subclasses.The rock bottom CMECS class is divided into bedrock and boulder/rubble. Table 2 shows the substrate distribution across each benthic depth zone. Bathymetric contours represent the division between benthic depth zones as defined in CMECS. The zones depicted in this map are shallow infralittoral (0–5 m), deep infralittoral (5–30 m), circalittoral (30–80 m), circalittoral offshore (80–200 m), and mesobenthic (200–1,000 m). Substrate distribution within the shallow infralittoral (0–5 m) depth zone is included in table 2. However, due to coverage and resolution constraints, these values are conservative estimates. The bathymetric contour demarking the shallow infralittoral zone has been omitted for aesthetic reasons.

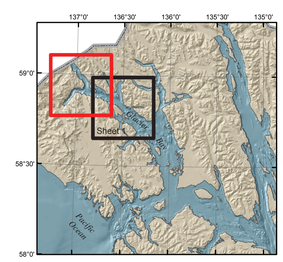
Mud is the dominant substrate in the West Arm, comprising 72% or 277 km^2 (table 1), and the greatest abundance is in the mesobenthic depth zone (table 2). Abundant glacimarine mud in the West Arm is primarily sourced today from glaciers in Johns Hopkins, Tarr, and Queen Inlets. See the accompanying pamphlet for more information regarding sources and rates. Unclassified soft-bottom is the second most abundant substrate at 14.4% or 55.4 km^2, and the greatest percentage is located in the circalittoral and deep infralittoral depth zones. The unclassified soft-bottom subclass was applied to areas where ground-truthing coverage was poor, but higher-energy processes such as winnowing are suspected of disrupting hemipelagic deposition. Areas where no single size fraction constituted the majority of the substrate fall under the mixed sediments subclass. Mixed sediments comprise 1.6% or 6.2 km^2 and are primarily found in the shallows of Hugh Miller Inlet and at the mouth of Tidal Inlet where winnowing has exposed ice-contact sediments deposited during the post-Little Ice Age retreat of the Russell System. The sand subclass covers 3.0% or 11.8 km^2 and typifies the foresets of side-wall and fjord head deltas and active morainal banks. The latter environment likely includes a large component of other size fractions, reflecting depositional processes, including dumping and sediment gravity flows, yet it still conforms to the CMECS definition of the sand subclass. The cobble/gravel subclass, comprising 1.7% or 6.5 km^2 of the measured area in the West Arm, commonly occurs where high-gradient glacifluvial streams enter the fjord, such as along Johns Hopkins Inlet, or in tidally winnowed shallows as in Reid Inlet. Of the two rock bottom subclasses, bedrock was the most abundant, constituting 7% or 26.7 km^2 of the West Arm, or 98% of rock bottom substrates. Boulder/rubble could only be confidently mapped in 0.2% or 0.6 km^2, but likely contributes to the unclassified soft-bottom and bedrock subclasses in areas proximal to steep bedrock cliffs.

Table 1. Substrate distribution in the West Arm, Glacier Bay National Park and Preserve, Alaska.

CMECS class	CMECS subclass	Percentage of total area	Area (km^2)
Unconsolidated bottom	Unclassified soft-bottom	14.4	55.4
	Mud	72.0	276.6
	Sand	3.0	11.8
	Mixed sediments	1.6	6.2
	Cobble/gravel	1.7	6.5
Rock bottom	Boulder/rubble	0.2	0.6
	Bedrock	7.0	26.7

Table 2. Substrate distribution vs. depth zone for the West Arm, Glacier Bay National Park and Preserve, Alaska.

	Shallow infralittoral 0–5 m water depth		Deep infralittoral 5–30 m water depth		Circalittoral 30–80 m water depth		Circalittoral (offshore) 80–200 m water depth		Mesobenthic 200–1,000m water depth	
CMECS subclass	Percent	Area (km^2)	Percent	Area (km^2)	Percent	Area (km^2)	Percent	Area (km^2)	Percent	Area (km^2)
Unclassified soft-bottom	0.3	1.0	3.9	15.0	4.1	15.9	3.4	13.1	2.6	10.0
Mud	0.0	0.0	2.1	8.1	9.3	35.8	17.5	67.3	43.0	165.2
Sand	0.0	0.1	0.5	2.0	0.7	2.8	1.0	3.9	0.7	2.9
Mixed sediments	0.0	0.0	0.2	0.8	0.4	1.6	0.7	2.5	0.3	1.2
Cobble/gravel	0.1	0.3	0.5	1.9	0.2	0.8	0.3	1.1	0.6	2.4
Boulder/rubble	0.0	0.0	0.0	0.1	0.1	0.3	0.0	0.2	0.0	0.0
Bedrock	0.0	0.0	0.4	1.7	1.3	4.9	2.4	9.2	2.8	10.7



Location map showing CMECS surface geology component maps of lower West Arm (sheet 1, black) and upper West Arm (this map, red), Glacier Bay National Park and Preserve, Alaska.

Base from U.S. Geological Survey, National Elevation Dataset
NASA Landsat 7 Imagery, 1999
Universal Transverse Mercator Zone 8N Projection, WGS84

NOT INTENDED FOR NAVIGATIONAL USE

21° TRUE NORTH / GRID NORTH
APPROXIMATE MEAN DECLINATION, 2013

SCALE 1:50000
2 1 0 2 MILES
2000 0 2000 4000 6000 8000 10000 12000 14000 FEET
2 1 0 2 KILOMETERS
LAND CONTOUR INTERVAL 100 METERS
BATHYMETRIC CONTOURS: 30, 80, AND 200 METERS
SEA LEVEL, CYAN

Seafloor geology mapped by T.O. Hodson, 2010. Based on multibeam sonar data collected in 2009 during NOAA NOS hydrographic surveys H12140, H12141, and H12142

GIS database and digital cartography by T.O. Hodson

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CMECS Surface Geology Component Map of Upper West Arm, Glacier Bay National Park and Preserve, Alaska

By
Timothy O. Hodson[1], Guy R. Cochrane[2], Ross D. Powell[1]

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[1] Department of Geology and Environmental Geosciences, Northern Illinois University
[2] Pacific Coastal and Marine Science Center, U.S. Geological Survey

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