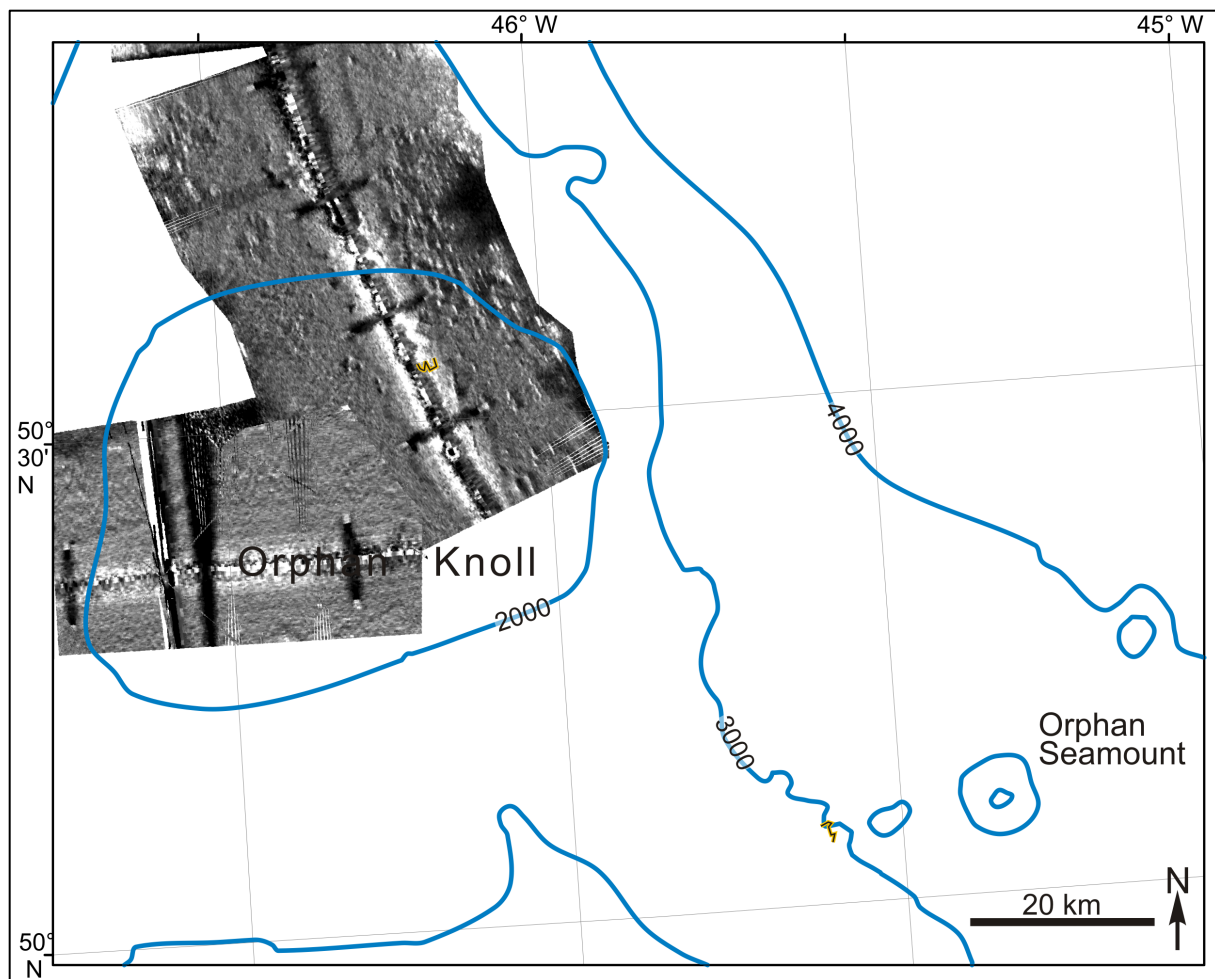


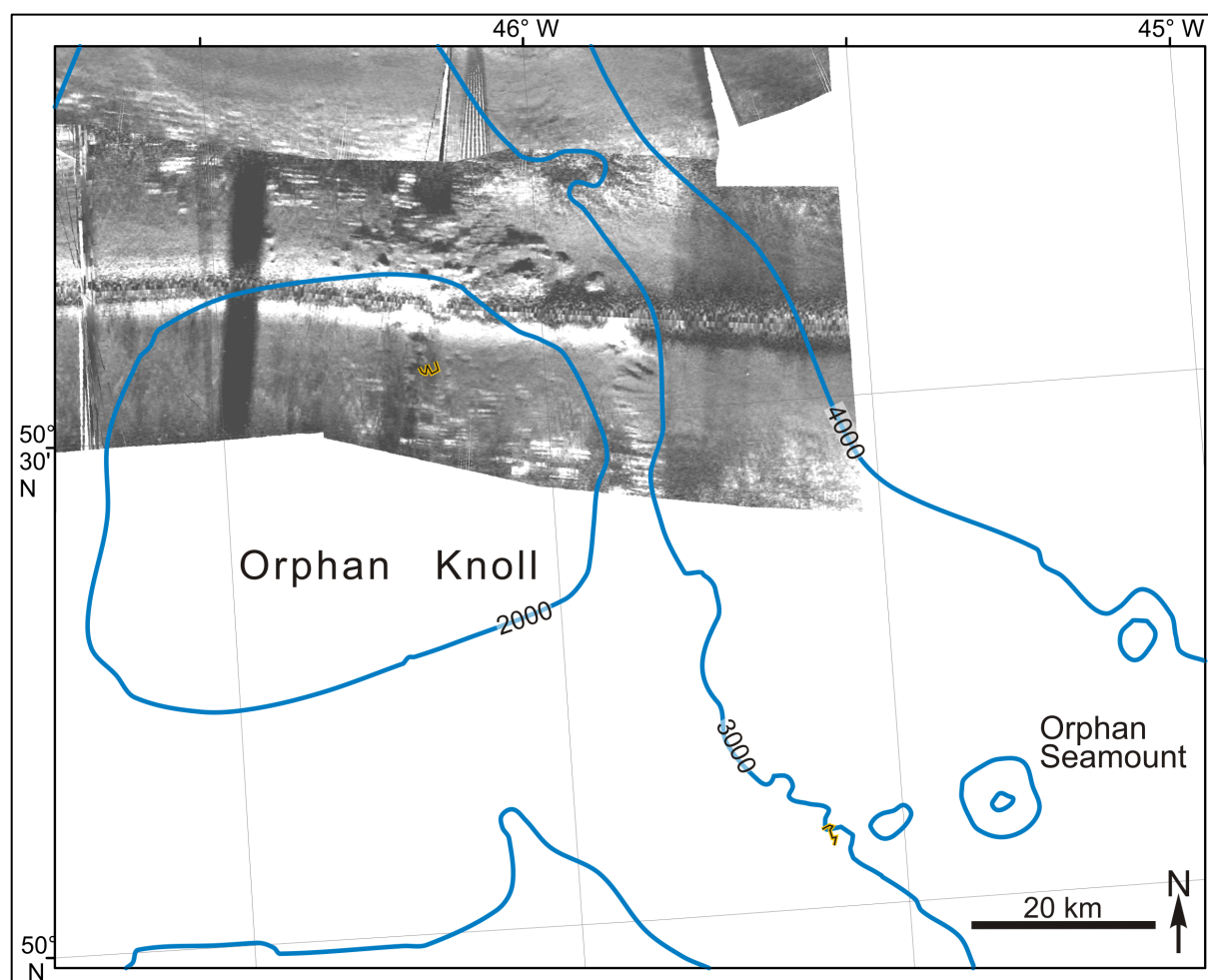
## Supplementary material.

Supplementary data for this manuscript includes maps showing the distribution and resolution of the various archival datasets analyzed. These include: the 1979 and 1981 GLORIA deep-towed side-scan sonar images of the mounds on Orphan Knoll, from *MV Farnella* and *MV Starella*, the distribution of Geological survey of Canada sub-bottom profile lines, piston cores and rock dredge samples, and the pertinent sections of the 2000 and 2006 multibeam bathymetry datasets collected by *USCGC Healy* and *MV Kommandor Jack*, respectively. In addition, we include an image showing the bounding rectangles used to define the size, length/width ratios, and orientation of the mounds described on Orphan Knoll.

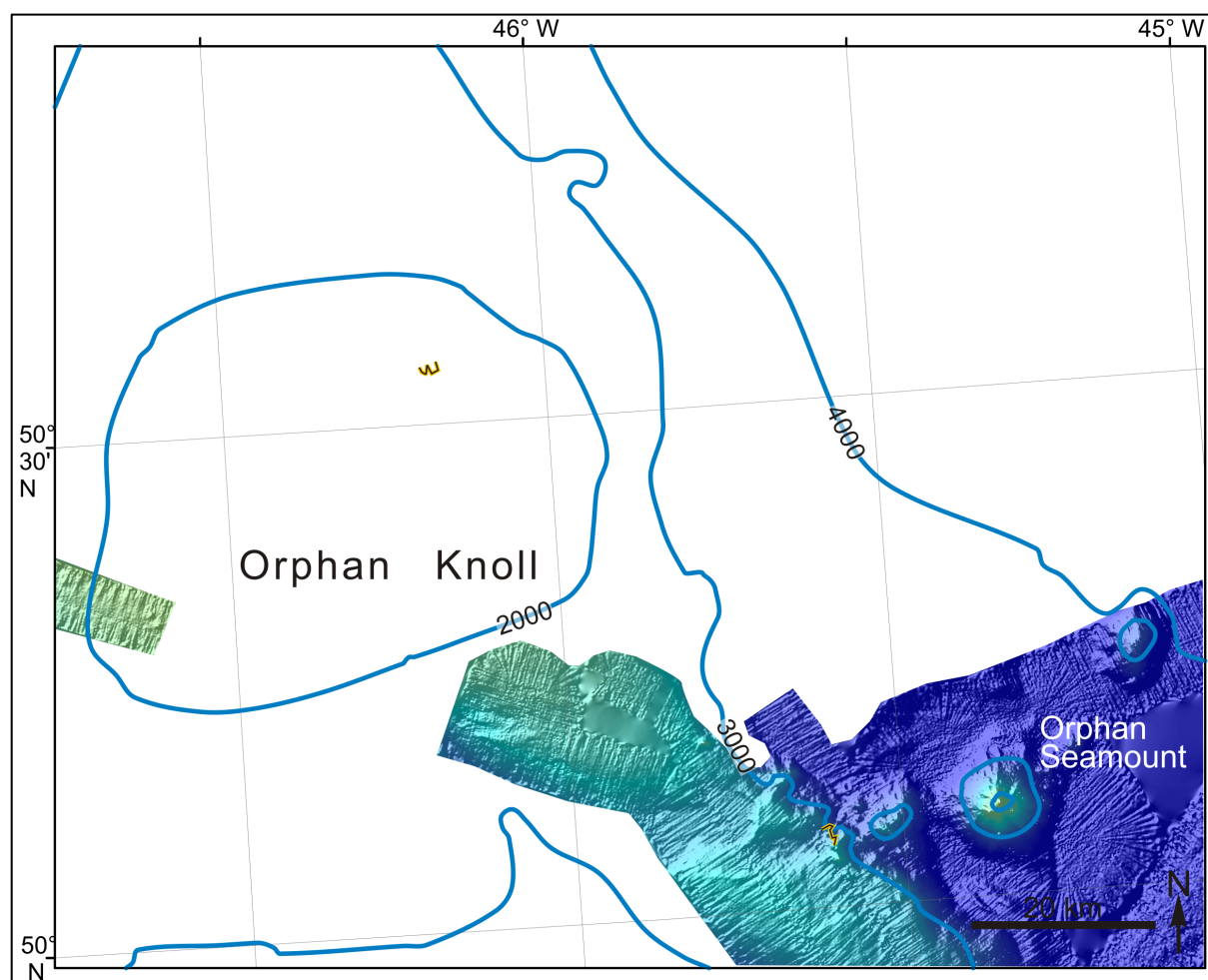
Archival data:



Supplementary Figure 1. Georeferenced GLORIA side-scan sonar image of deep-water mounds on Orphan Knoll collected by *MV Starella* in 1979. Side-scan sonar imagery overlaid with 2000 m, 3000 m, and 4000 m GEBCO contour lines of the region. Fine yellow and black curves indicate locations of ROPOS ROV dives R1341 (SE Orphan Knoll) and R1343 (NE Orphan Knoll).



Supplementary Figure 2. Georeferenced GLORIA side-scan sonar image of deep-water mounds on Orphan Knoll collected by *MV Farnella* in 1981. Side-scan sonar imagery overlaid with 2000 m, 3000 m, and 4000 m GEBCO contour lines of the region. Fine yellow and black curves indicate locations of ROPOS ROV dives R1341 (SE Orphan Knoll) and R1343 (NE Orphan Knoll).



Supplementary Figure 3. Multibeam bathymetry collected from *USCGC Healy* over Orphan Knoll in 2000. Note the fragmentary distribution over the Knoll, and the more complete distribution over the Southeast Knoll and over Orphan Seamount. Data are gridded to 100 m resolution. Bathymetric imagery overlaid with 2000 m, 3000 m, and 4000 m GEBCO contour lines of the region. Fine yellow and black curves indicate locations of ROPOS ROV dives R1341 (SE Orphan Knoll) and R1343 (NE Orphan Knoll).

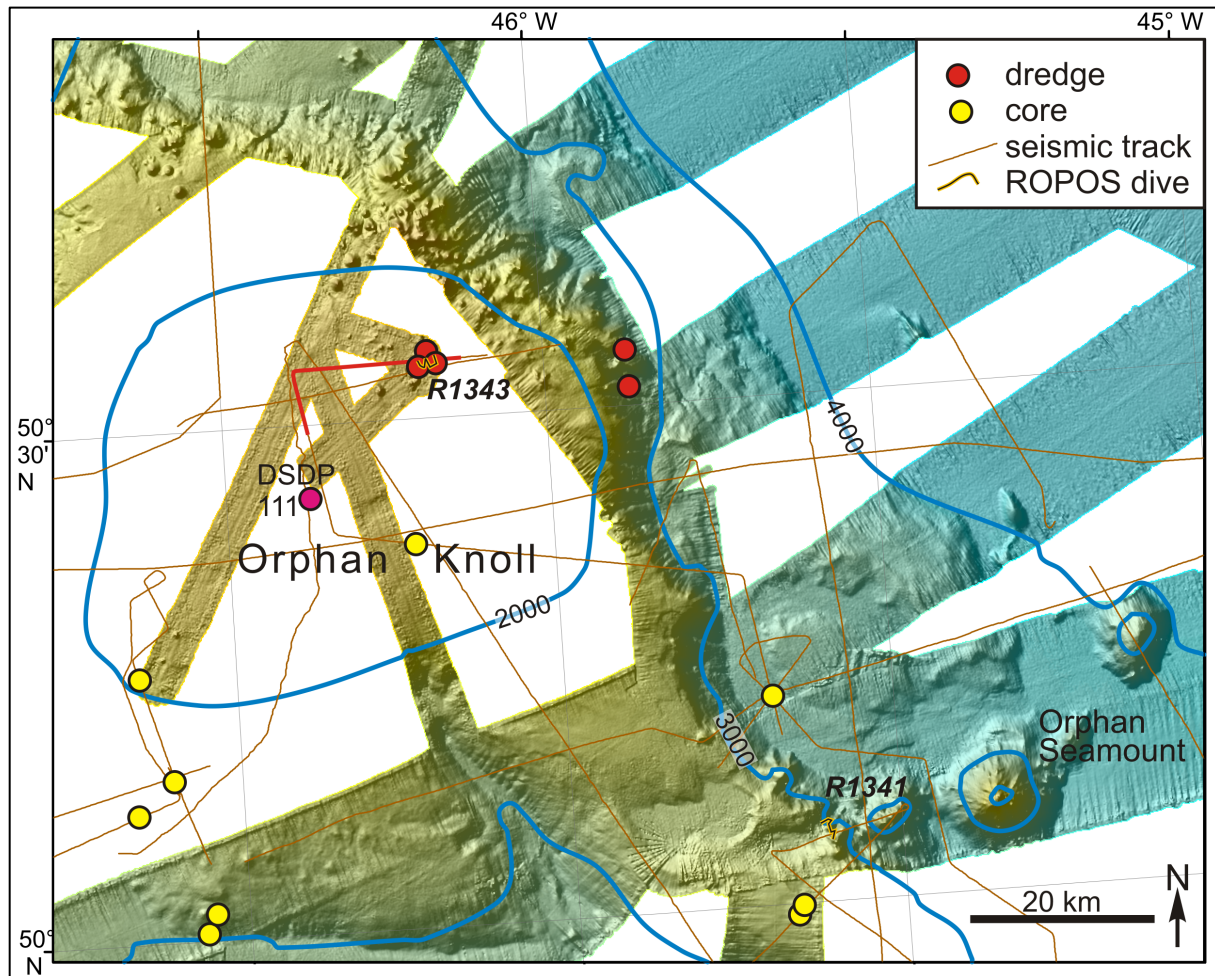
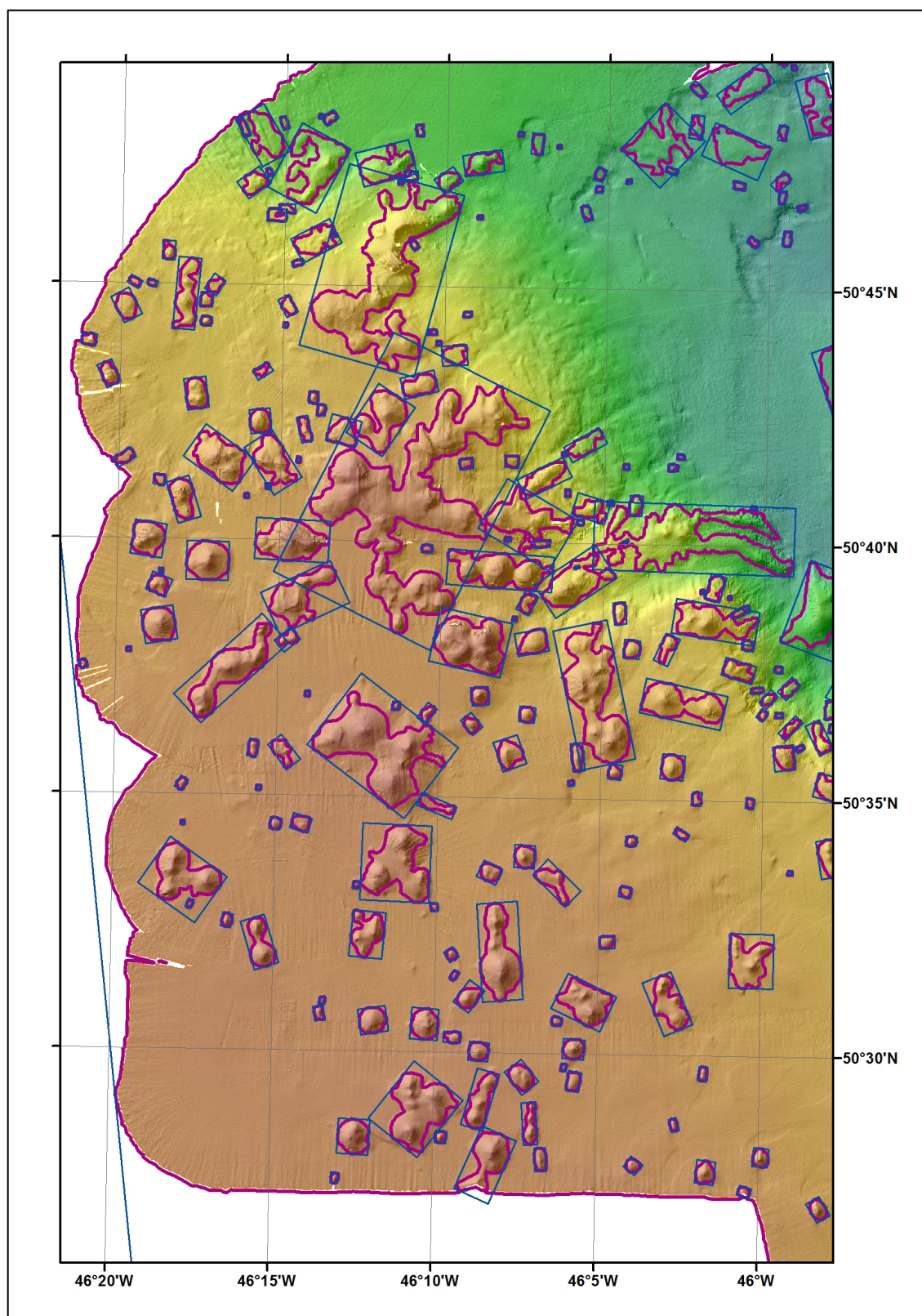


Figure S4. Multibeam bathymetry collected from *MV Kommandor Jack* over Orphan Knoll in 2006. The Kommandor Jack was chartered by Natural Resources Canada primarily for mapping to define the edge of the continental shelf and slope off Eastern Canada for Canada's UNCLOS claim for extended jurisdiction in continental shelf and slope waters. Note the zigzag orientation of the multibeam swaths over the Knoll, and the more complete distribution over the Southeast Knoll and over Orphan Seamount. Data gridded to 100 m resolution. Also shown are Geological Survey of Canada acoustic sub-bottom profile lines and shallow seismic profile lines over Orphan Knoll, along with distribution of piston cores and rock dredge or grab samples. Bold red line passing through R1343 indicates location of seismic profile show in figure 5 of the main body of the paper. Bathymetric imagery overlaid with 2000 m, 3000 m, and 4000 m GEBCO contour lines of the region. Fine yellow and black curves indicate locations of ROPOS ROV dives R1341 (SE Orphan Knoll) and R1343 (NE Orphan Knoll).





Supplementary Figure 5. Bounding polygons used to define size, length/width ratios, and orientations of Orphan Knoll mounds detected in RRS Discovery DY081 multibeam sonar data over Orphan Knoll.

Supplementary Table 1. Rock samples collected from Orphan Knoll mounds on ROV dives R1341 and R1343.

Dive	Sample number	Latitude	Longitude	Depth (m)	Exposure/collection method	lithology	comments
R1341	R1341_03	50.07654	-45.6209	-2873.12	Picked with Manipulator arm	Mn-nodules	
R1341	R1341_04	50.07662	-45.621	-2873.28	Scooped with Manipulator arm	calcareous ooze	Weakly lithified,
R1341	R1341_05	50.07656	-45.6211	-2873.5	Picked with Manipulator arm	Mn-nodules	
R1341	R1341_07	50.07826	-45.6155	-2874.77	Broken from bedrock exposure	pelagic limestone	Moderately lithified
R1341	R1341_10	50.07712	-45.6128	-2848.07	Broken from bedrock exposure	pelagic limestone	Moderately lithified
R1341	R1341_19	50.05945	-45.6075	-2398.83	Broken from bedrock exposure	Pelagic limestone	Moderately lithified
R1341	R1341_20	50.05943	-45.6074	-2378.93	Picked with Manipulator arm	Argillaceous limestone	Probably ice-rafted debris
R1343	R1343_04B	50.55423	-46.1716	-1777	Manipulator arm	Limestone and Mn-crust	
R1343	R1343_09,20,21,22	50.552082	-46.19317	-1741	Scooped from sediment	Mn-crusts, granite, Limestone, Gabbro, Basalt	Polymictic assemblage of granule to pebble size lithoclasts.
R1343	R1343_10	50.55209	-46.19340	-1729.72	Broken from bedrock exposure	Limestone phenocryst in laminated Mn-crust	Mn-oxidation, finely laminated
R1343	R1343_14A	50.55209	-46.19340	-1729.72	Broken from bedrock exposure	Mn-Crusts	Mn-oxidation, finely laminated
R1343	R1343_14B1	50.55209	-46.19340	-1729.72	Broken from bedrock exposure	Mn-Crusts	Mn-oxidation, finely laminated
R1343	R1343_14B2	50.55209	-46.19340	-1729.72	Broken from bedrock exposure	Mn-Crust with Limestone	Mn-oxidation, finely laminated
R1343	R1343_22A	50.552029	-46.19315	-1741.09	Scooped from sediment	Granite	Picked with Manipulator arm
R1343	R1343_22B	50.552029	-46.19315	-1741.09	Scooped from sediment	Basalt	Sludge sample, basalt, angular, in situ?
R1343	R1343_22C	50.552029	-46.19315	-1741.09	Scooped from sediment	Granite	Granite with quartz phenocrysts
R1343	R1343_22D	50.552029	-46.19315	-1741.09	Scooped from sediment	Quartzite	Ice-rafted debris
R1343	R1343_22E	50.552029	-46.19315	-1741.09	Scooped from sediment	Granite	Picked with Manipulator arm
R1343	R1343_22F	50.552029	-46.19315	-1741.09	Scooped from sediment	Gabbro	Picked with Manipulator arm