Sedimentary Features in Expedition 341 Cores: A Guide to Visual Core Description

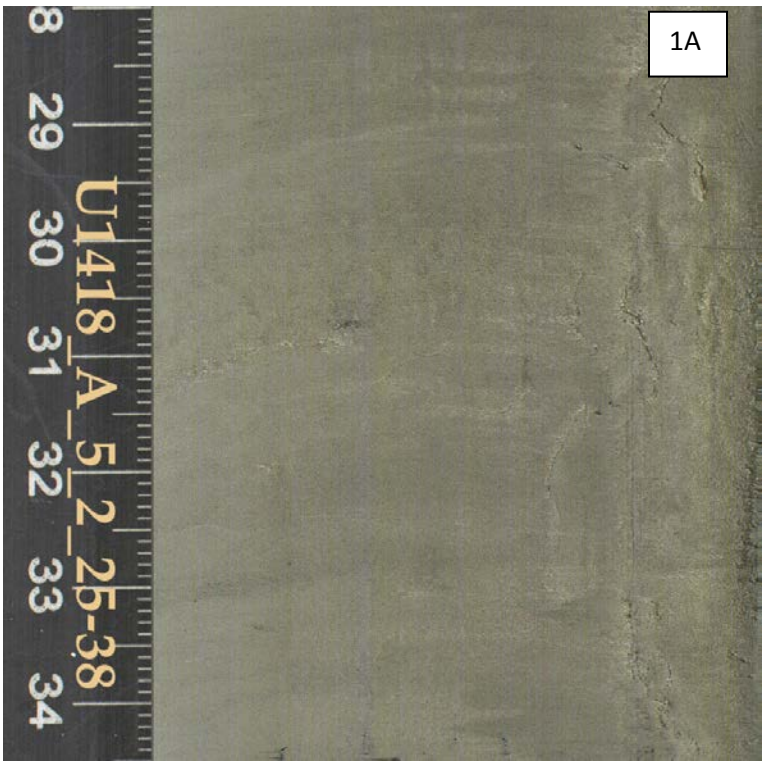
1. Typical Deep water Sediments in the Gulf of Alaska

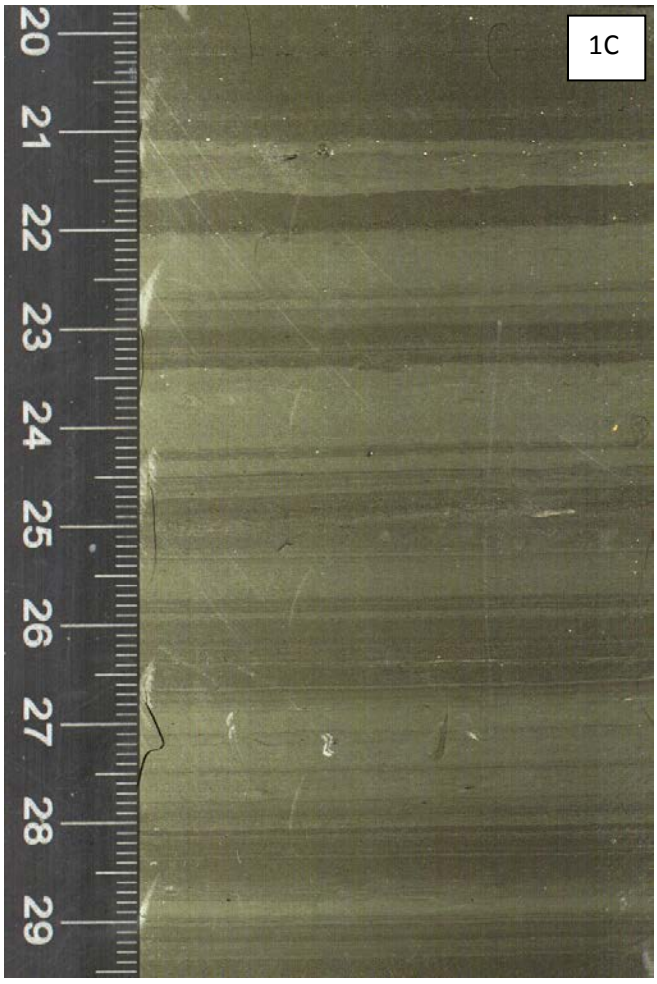
1A & B: Mud and **1C:** Laminated mud

Description: Mud is representative of typical deep water sediments in the Gulf of Alaska.

Identifying characteristics: Mud is gray in color and consists of fine-grained particles (smaller than a grain of sand).

Clues to the past: Because of the very small grain size of mud particles, mud is usually deposited in calm water environments where it can settle out of the water column. When mud is uniform in color and doesn't contain other sedimentary features, scientists can infer that the source of the sediment remained relatively constant.





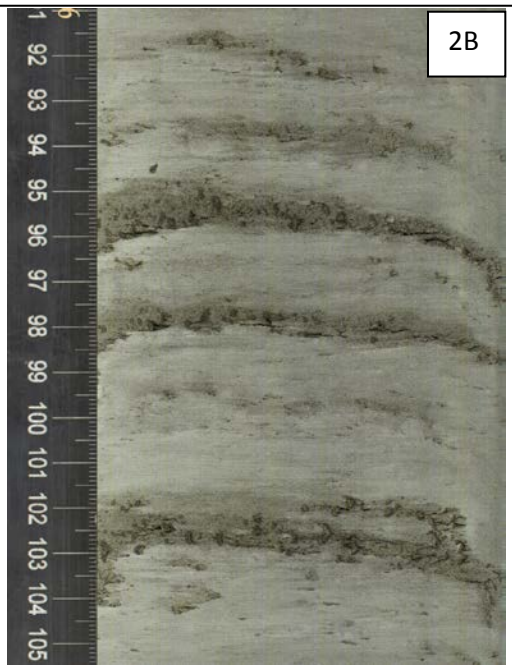
2. Evidence for Changing Energy Conditions on the Sea floor

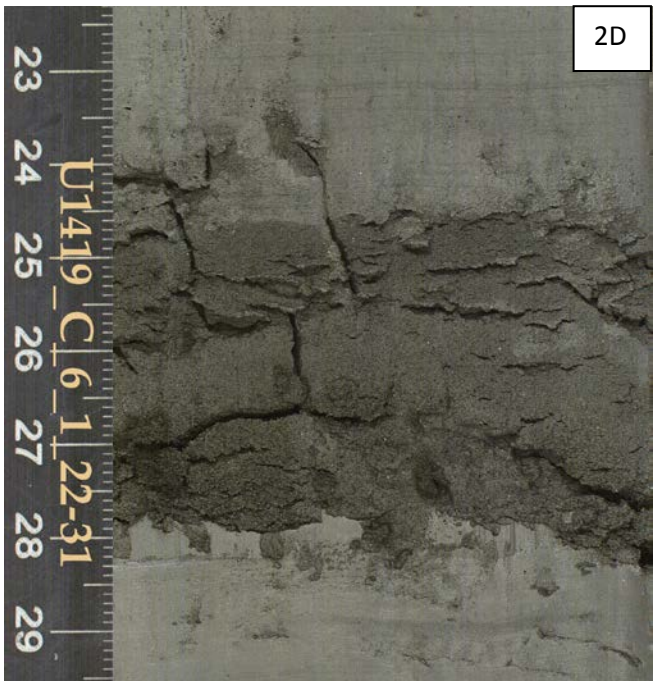
2A-C: Interbedded mud & silt and **2D-E:** Sand and mud

Description: Layering of sediments (mud-sand-mud) or (mud-silt-mud) of different particle sizes.

Identifying characteristics: Layers of fine-grained gray mud alternating with layers of sediment with larger grain sizes, such as sand or silt. The layers are different colors and textures. To quickly determine grain size, sedimentologists rub a little bit of sediment between their fingers. If the particles feel gritty like sand paper, this means more sand is present. If sediment grains slide past each other smoothly, smaller grains such as silt and mud are present. Microscopes are used for a more quantitative determination of grain size.

Clues to the past: The layering of sediments represents a change in energy of the depositional environment. Because more energy is required to transport larger particles (sand) than smaller particles (mud), this change in sediment grain size could indicate that the intensity of fast moving currents (turbidity currents) on the ocean floor increased, depositing coarser sediments (sand and silt) in layers with mud. Since Exp. 341 sediments were collected near the Surveyor submarine fan, these changing conditions could represent periods of time in which the submarine fan was growing.





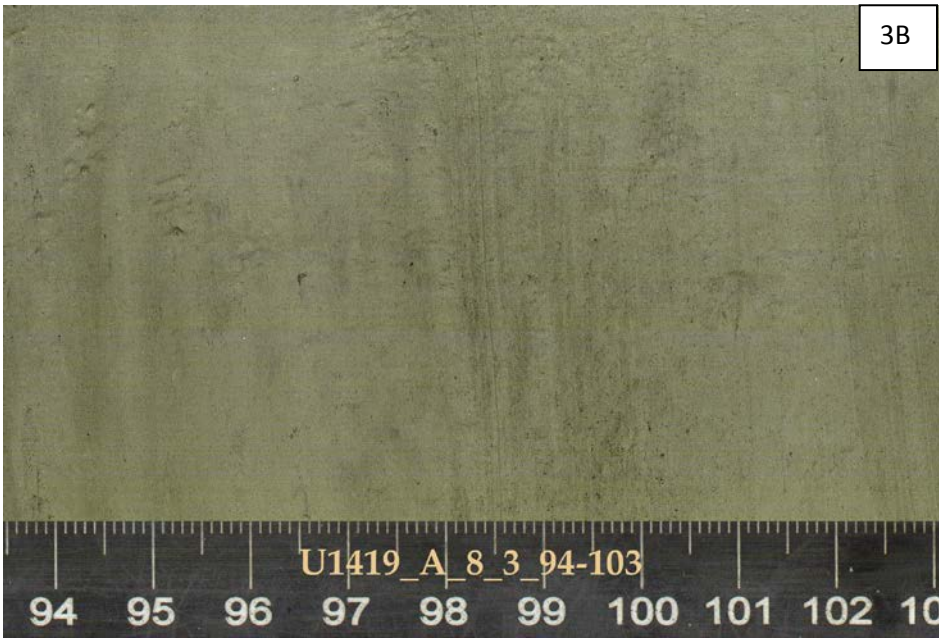
3. Evidence for Life on the Sea Surface

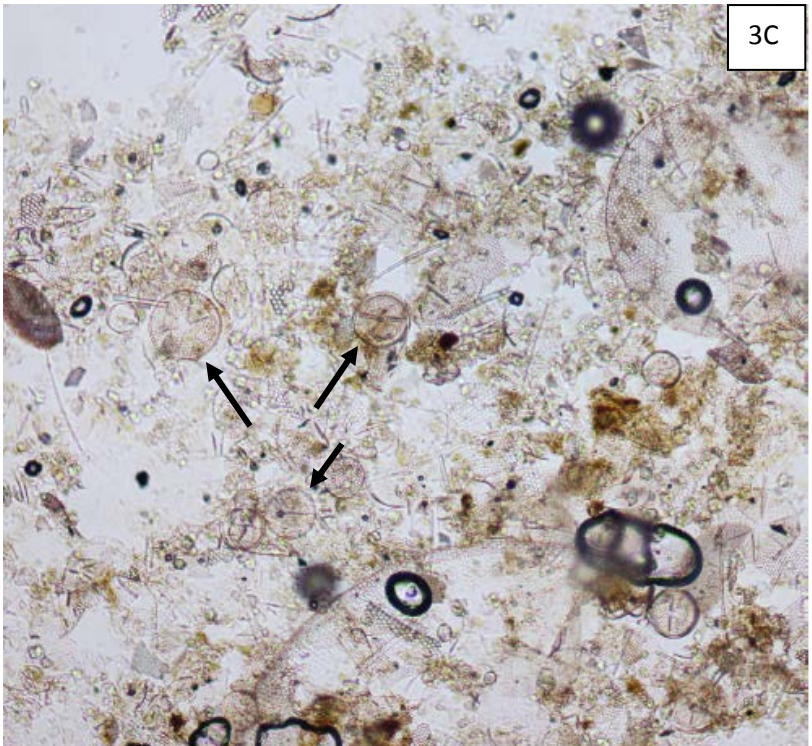
3A-B: Diatom Ooze, **3C:** Microscope image of smear slide to help with diatom ooze identification

Description: Sediments containing more than 50% diatoms is classified as "diatom ooze."

Identifying characteristics: Mud with a large percentage of diatoms (i.e. diatom ooze) often has a green-ish color and a gritty texture. Diatoms are identified in sediments using a microscope. Diatoms come in many shapes and are often symmetrical; the arrows in 4C point at radially symmetrical diatoms that are characteristic of Exp. 341 sediments.

Clues to the past: Diatoms are among the most common type of photosynthetic plankton (phytoplankton) living in the world's oceans and freshwater today. Because their shells are composed of silica (a very strong mineral), diatoms living millions of years ago become preserved in sediments when they die, making them useful for determining ages of sediments. Diatoms also provide clues about the environmental conditions in the earth's past because they thrive when nutrients and sunlight in the upper layers of the ocean are high and are absent when conditions for life are not favorable.





Source: IODP Smear slide tutorial,
Sample: Hole 1229A, Core 2H, Section 6W, 26 cm

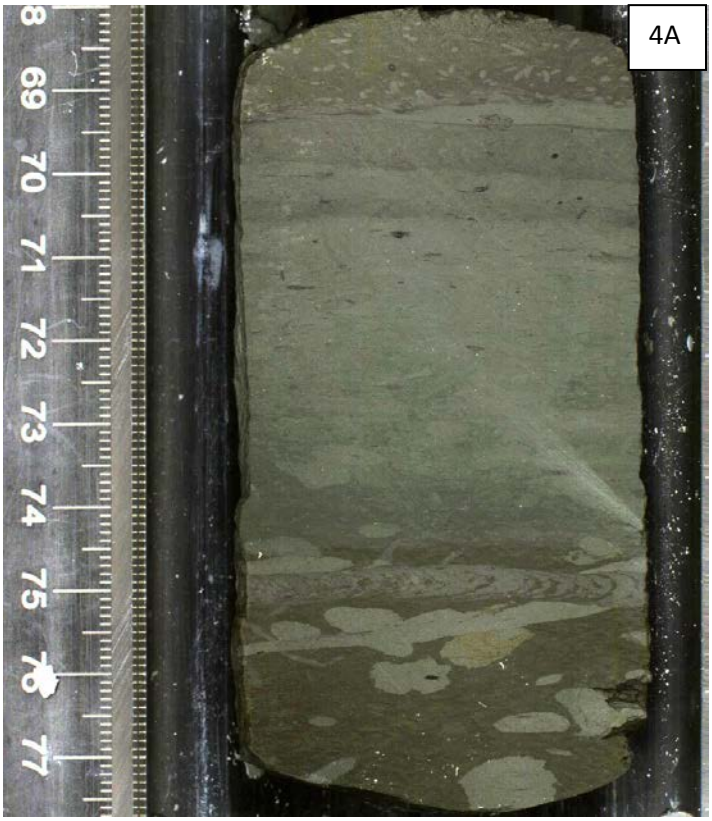
4. Evidence for Life at the Seafloor

4A-B: Bioturbation

Description: Sediments are disturbed, or reworked, due to the activity of living organisms (plants or animals) moving through the sediments. (*Bio* = life, *turbation* = disturbed)

Identifying characteristics: Commonly resulting from animals burrowing through sediments in Exp. 341 cores bioturbation appears as a change in texture or color, often present as an overlapping network of structures or as linear features across a sediment core.

Clues to the past: Burrowing, ingesting and defecating sediment grains, and filling in abandoned dwellings are all examples of bioturbation caused by organisms that live in sediments on the seafloor. Bioturbation can provide evidence for organisms like annelids (ringed worms) and bivalves (mussels, clams) at the seafloor. Scientists believe that the fossil worm *Zoophycos* was responsible for much of the bioturbation in Exp. 341 sediments.



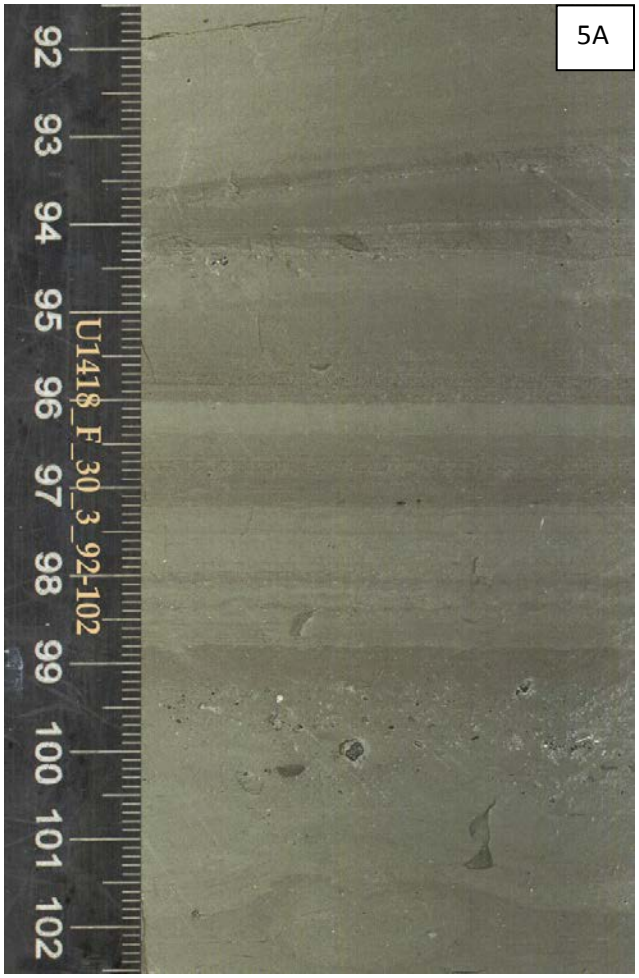
5. Evidence for Ice on Land and in the Ocean

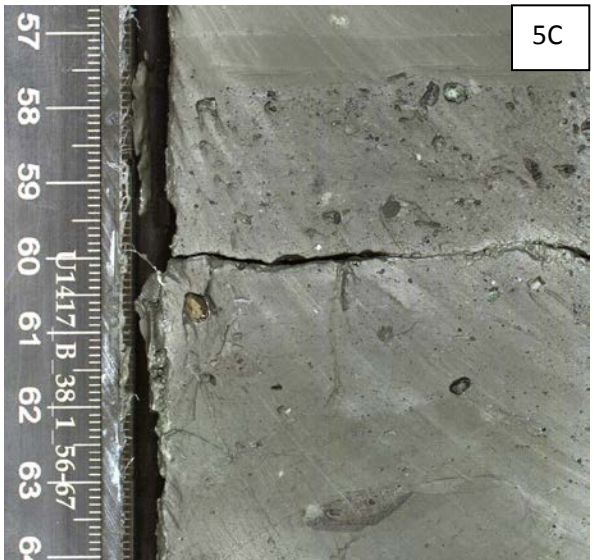
5A-E: Diamict texture

Description: Sediment grains larger than 2 mm in size intermixed with mud.

Identifying characteristics: Sediment grains are poorly sorted, ranging in size from 2 mm to several centimeters, and can appear as well defined layers (6A, 6C) in mud, or randomly distributed throughout intervals of mud (6B, 6D-E)

Clues to the past: Because the coarse sediment grains are poorly sorted and randomly distributed within a mud matrix, they were likely transported to the deep sea in ice bergs as ice rafted debris (IRD). Therefore, diamict texture in sediment cores provides evidence for the presence of ice in S. Alaska.





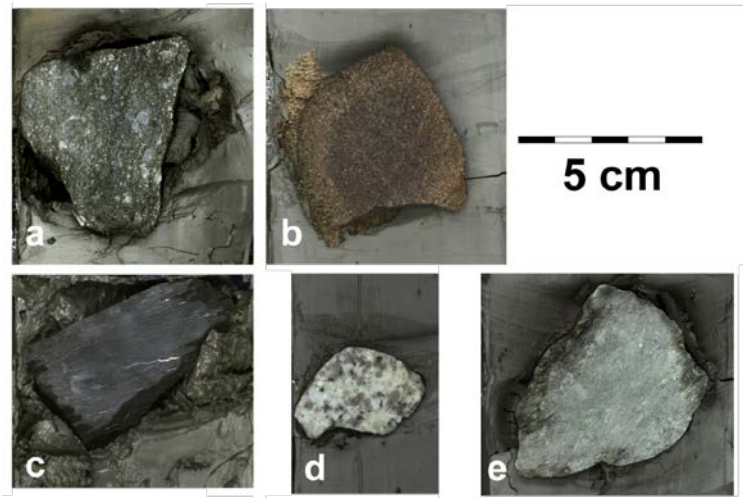
6. Evidence for Ice on Land and in the Ocean

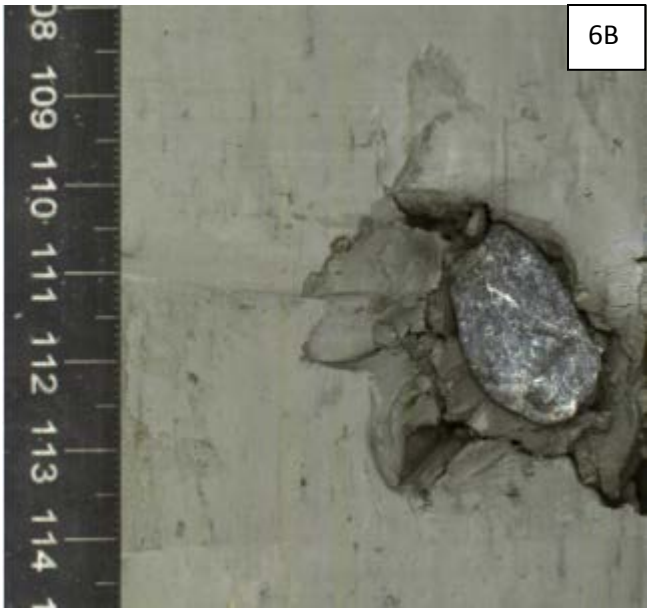
6A-C: Dropstones

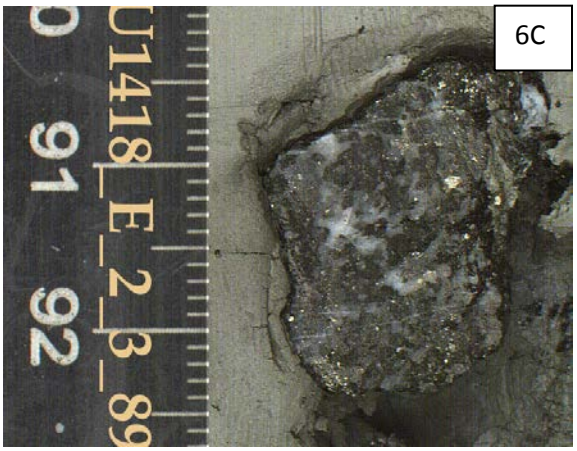
Description: Fragments of rock within the sediment core.

Identifying characteristics: Varying in composition (igneous, metamorphic, sedimentary) and generally several centimeters in size, these rock fragments stand out from the surrounding muddy matrix.

Clues to the past: Originating on land in S. Alaska, rock fragments travel to the deep sea in ice bergs. Therefore, dropstones provide evidence for glaciers and sea ice in S. Alaska.







7. Evidence for Volcanic Eruptions

7A-C: Volcanic Ash; **7D:** Smear slide of volcanic ash in reflected light microscope; **7E:** Scanning electron microscope image of volcanic ash grains

Description: Layers of sediment of a different color and texture within the core, varying in color to light gray to brown.

Identifying characteristics: Layers are generally well-defined and volcanic origins are positively identified by microscopic analysis of grains in smear slides (8D) and volcanic texture is identified with the scanning electron microscope (SEM, 8E).

Clues to the past: Provides evidence for volcanic eruptions on land in the past. Radioactive elements within volcanic ash, such as potassium-40 (40K), are useful for determining exact ages of the ash layers and surrounding sediment.