

Ocean Sediments in Google Earth: Distribution of Surficial Marine Sediments & Virtual Visits to “Type Localities” on the Seafloor

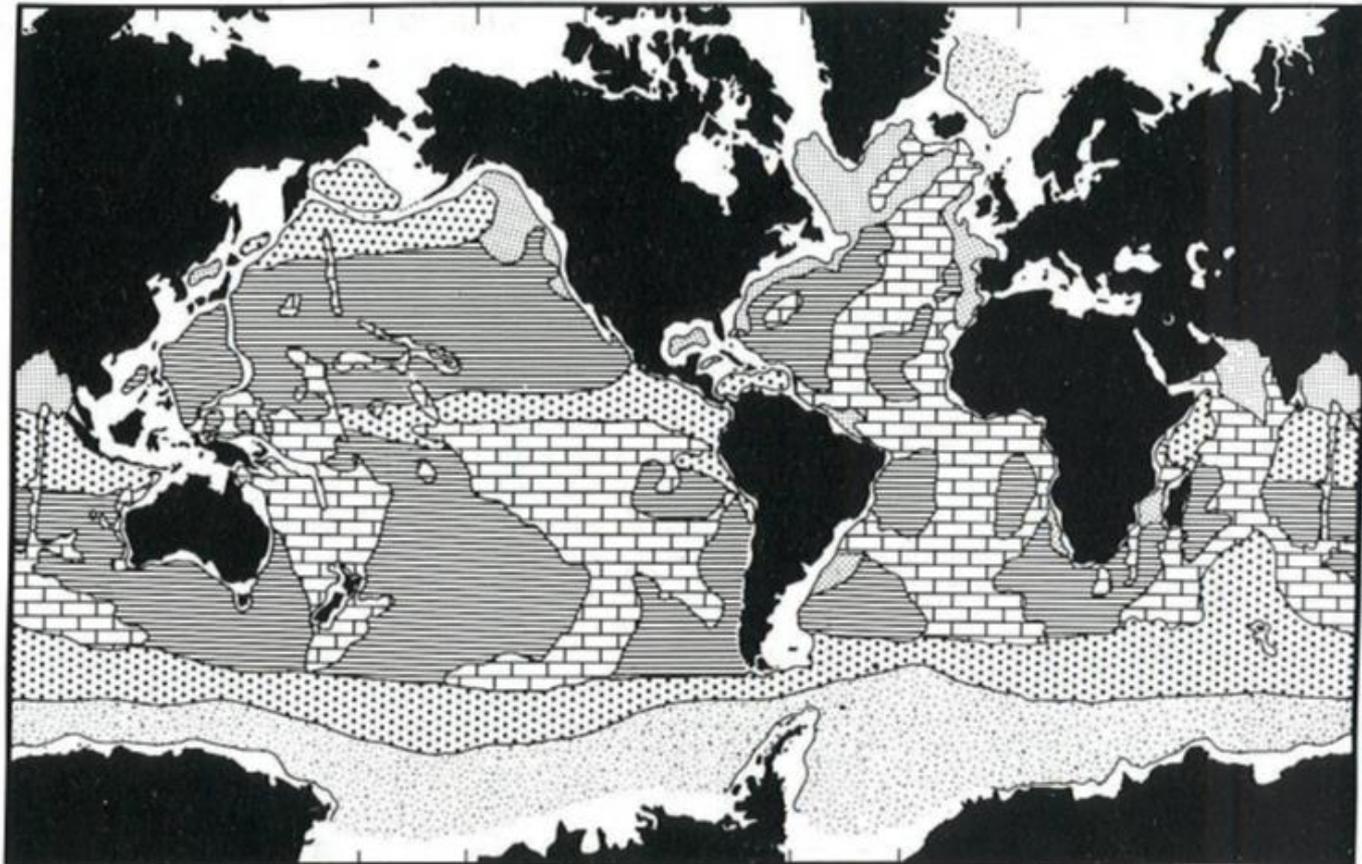


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- Marine sediment types and their distribution are essential topics in **oceanography** and **marine geology courses**.
- The geographic distribution of marine sediments in the global ocean depends on factors such as:
 - water depth
 - distance from land
 - biological productivity
 - surface currents
 - Climate
 - ocean chemistry.
- Illustrate complex interactions in the Earth system.
- An archive for paleoceanographic and paleoclimatic reconstructions.

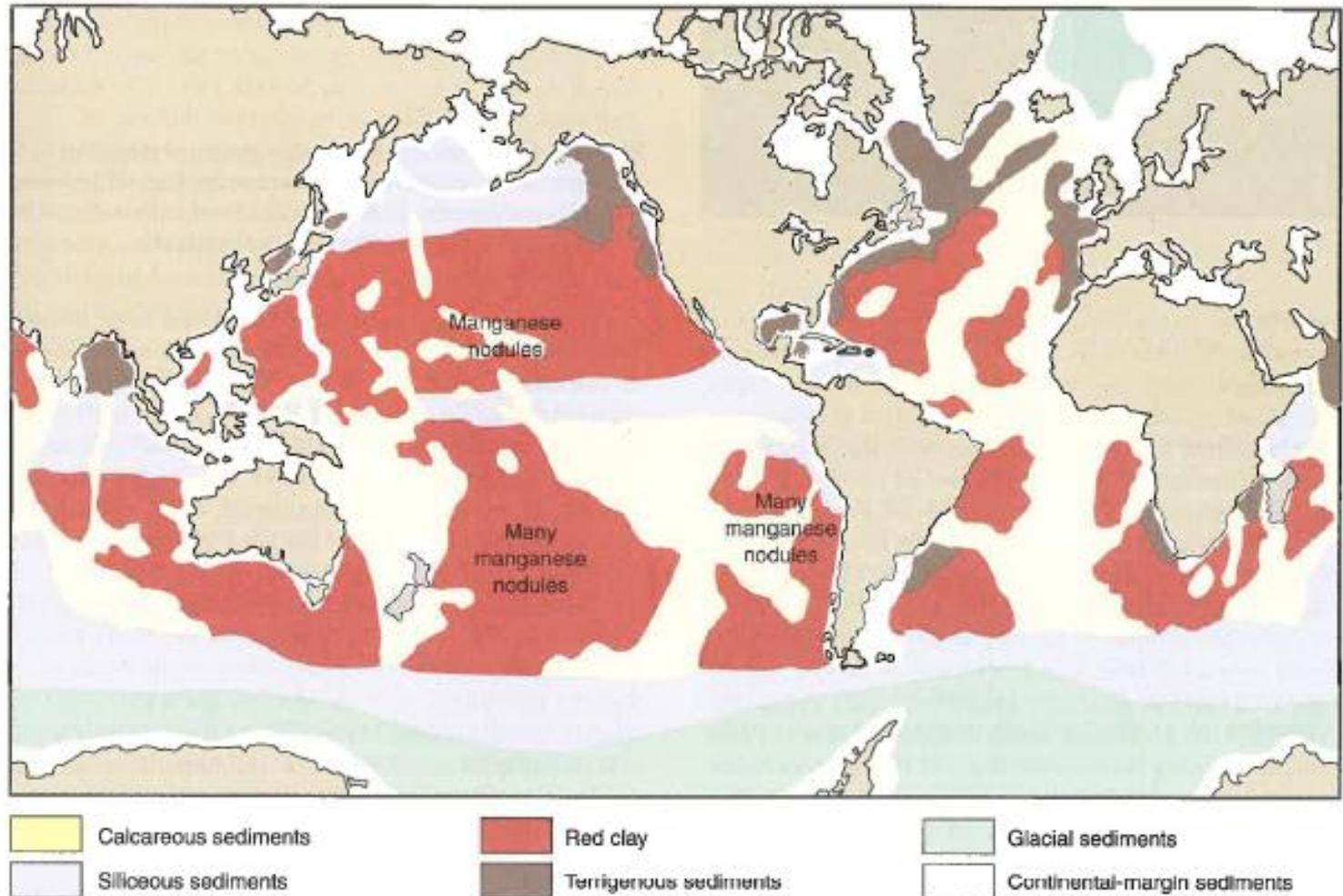
Importance of Marine Sediments in Geoscience



- | | | |
|--|---|---|
|  Calcareous sediments |  Terrigenous sediments |  Glaciogenic sediments |
|  Siliceous sediments |  Deep-sea clay |  Margin sediments |

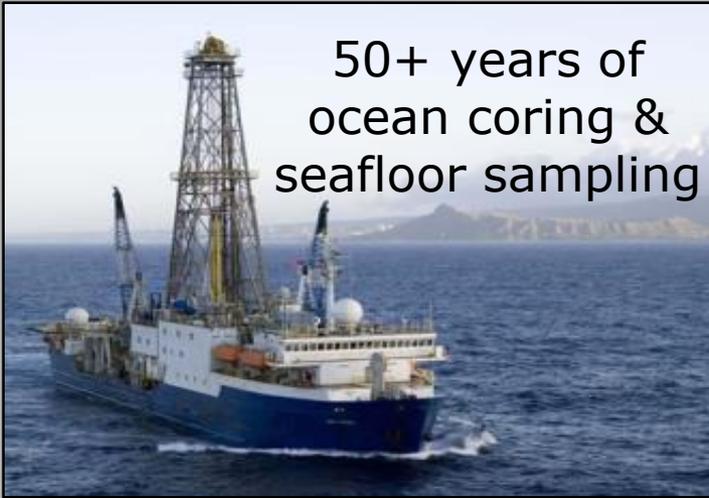
From Rothwell, 1989, after Davies and Gorsline, 1976.

Distribution of Surficial Marine Sediments



From Sverdrup and Armbrust, *Introduction to the World's Oceans* 9th ed, 2008

Adaptation of the 1976 map still used today



International Ocean Discovery Program
UNITED STATES IMPLEMENTING ORGANIZATION

Overview | Search | Go to LIMS | Home
Janus data (Exp 1-312)

Smear Slides

Open Access to Big GeoData

Data Request Form

Leg

Site

Hole

Core

Section

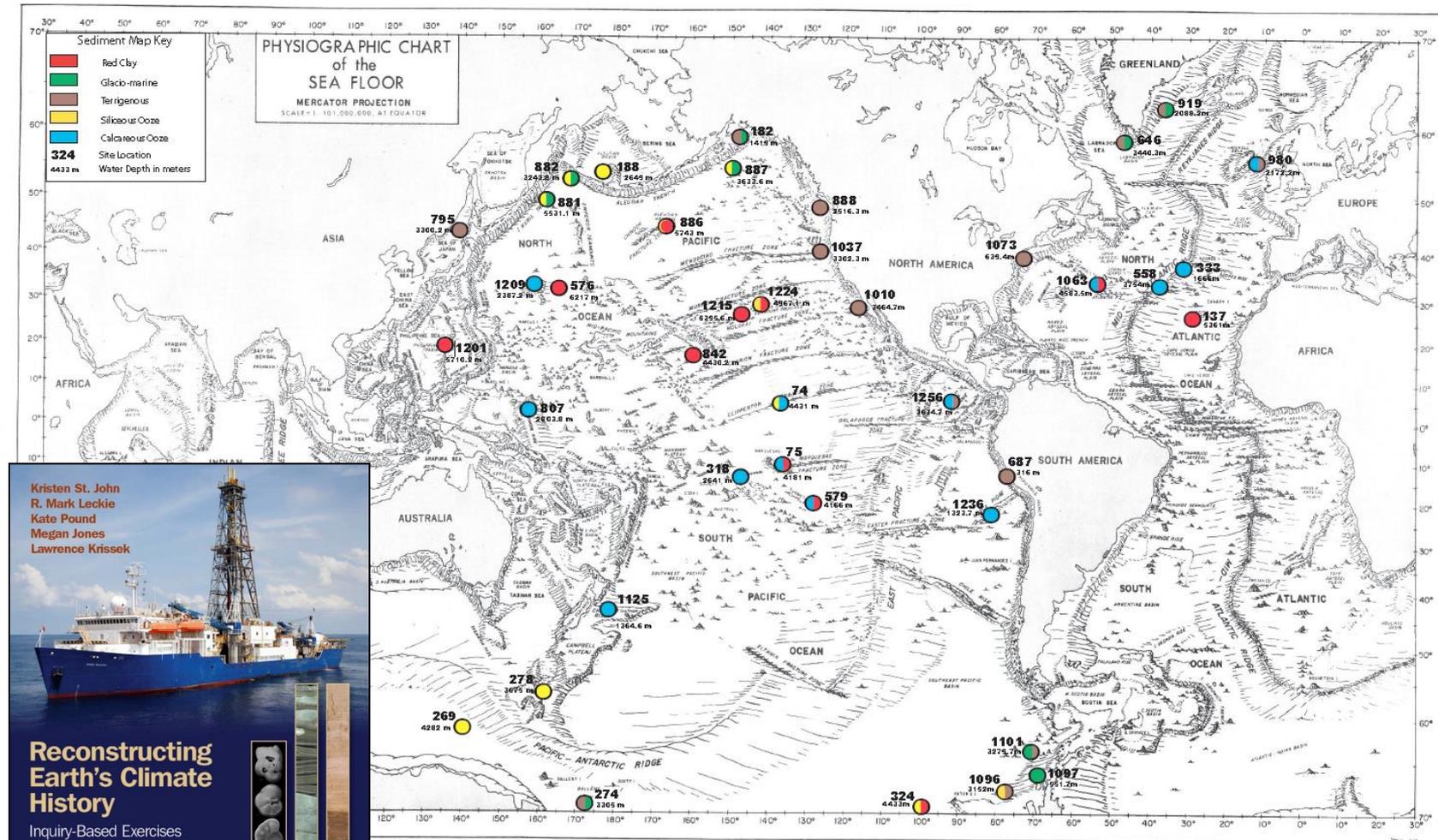
Depth to meters

Latitude to degrees (South -90 to 0; North 0 to 90)

Longitude to degrees (West -180 to 0; East 0 to 180)

Project Goal: Use empirical data to map the global distribution of surficial sea floor sediment types in Google Earth and develop related learning materials.

An opportunity to display data from the global ocean in a volume and format not previously possible.



Kristen St. John
R. Mark Leckie
Kate Pound
Megan Jones
Lawrence Krissek

Reconstructing Earth's Climate History
Inquiry-Based Exercises for Lab and Class

WILEY-BLACKWELL

From St. John et al 2012, instructor guide

Building on Existing Curriculum

Layers

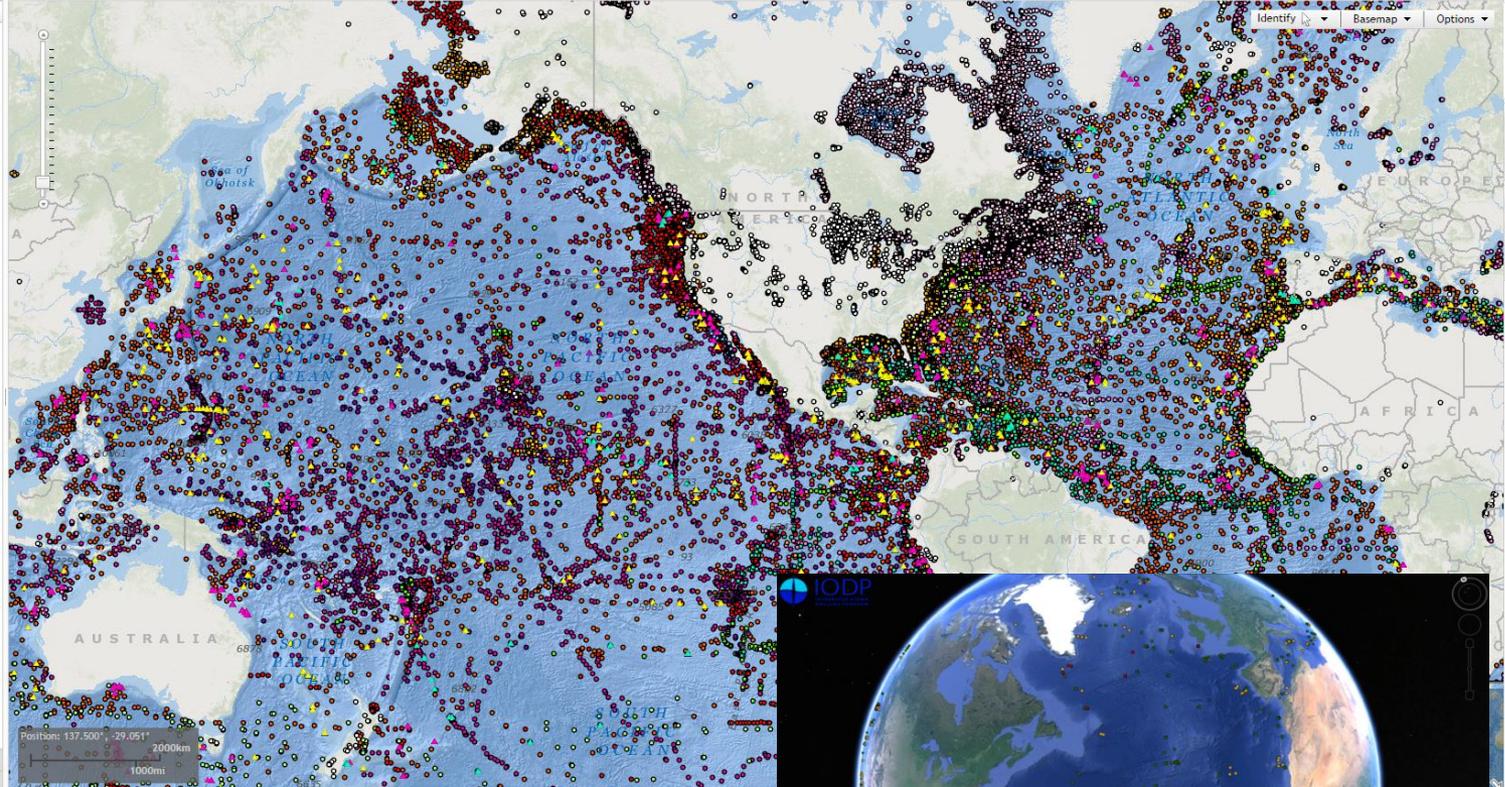
Select Repository:

- All Samples by Institution
- None
- AOML
- AWI
- BOSCORF
- BPRC
- Canada
- DSDP
- ECS
- FSU
- GEOMAR
- IODP
- LDEO
- LacCore
- ODP
- OSU
- PIWEL
- RSMAS
- SIO
- SOEST
- URI
- USC
- USGSMF
- USGSWH
- USGSSP
- UT
- WHOI
- WISC
- NMNH

Filter Samples Reset

More Information

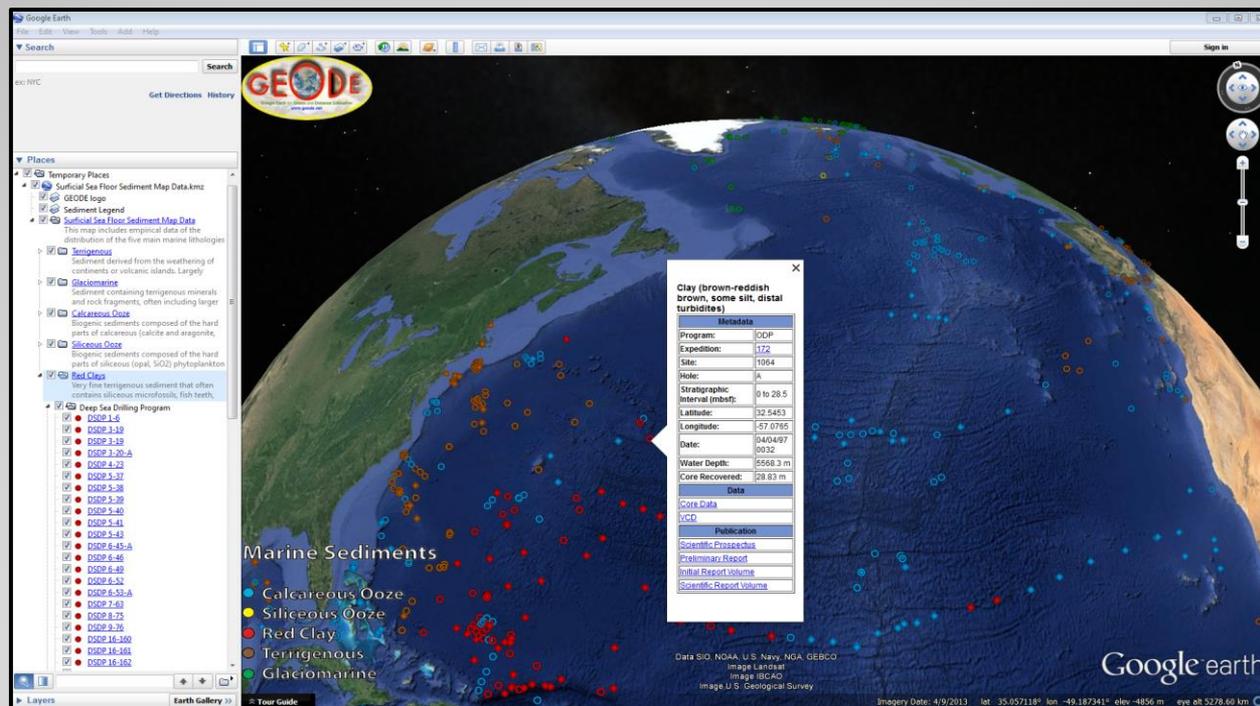
Help



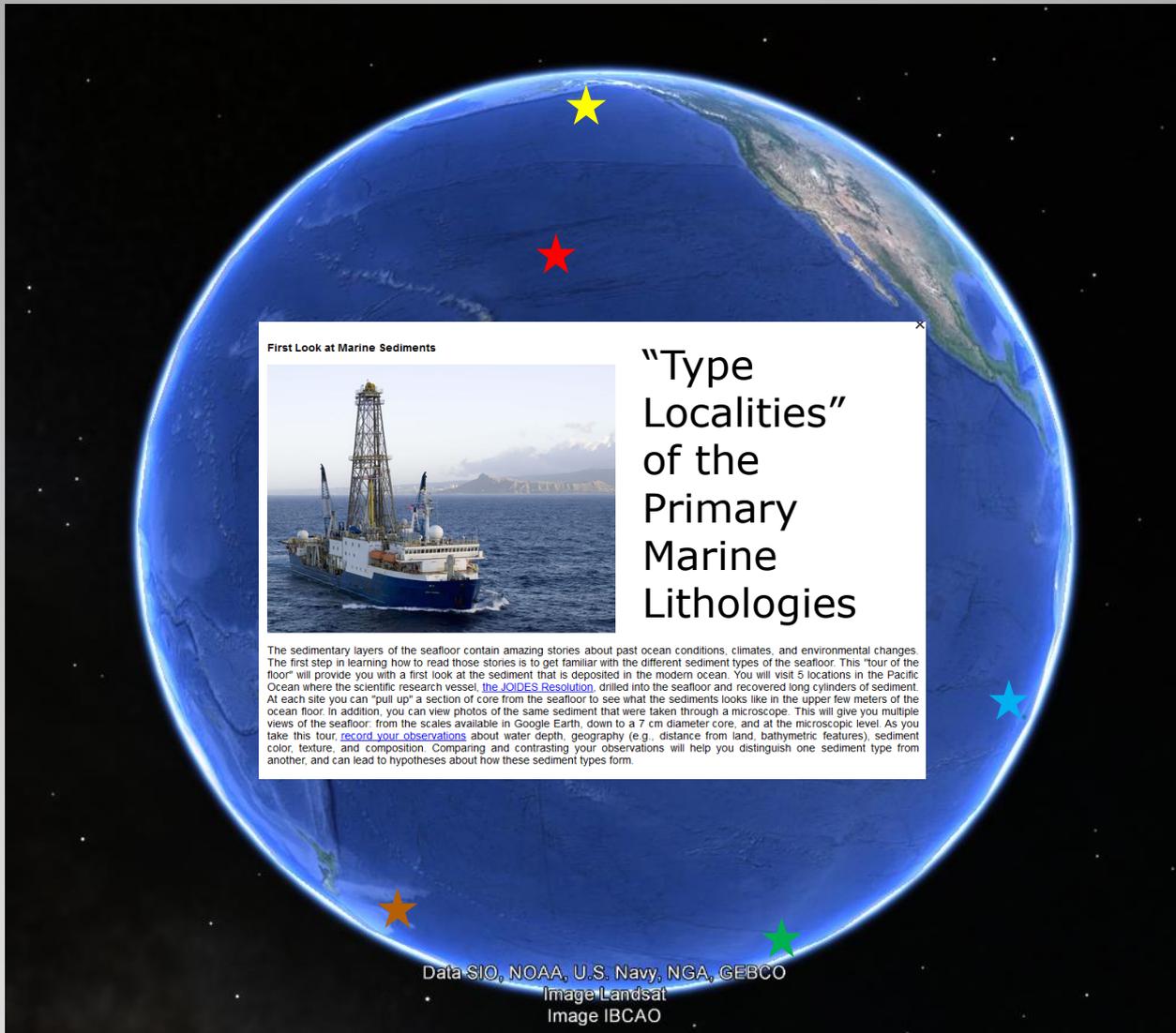
- National Geophysical Data Center Index to Marine and Lacustrine Geologic Samples
- IODP-ODP-DSDP borehole map

Drawing from Big GeoData

- 2000 sites have been plotted in Google Earth from DSDP, ODP, IODP, and WHOI research programs, with links to the original data.
- Draft Student Exercise: *Exploring Marine Sediments Using Google Earth*
 - *Part 1. A First Look at Marine Sediments*
 - *Part 2. Exploring the Distribution of Marine Sediment Types on the Sea Floor*
 - *Part 3. Refining Your Hypotheses on Biogenic Marine Sediment Distributions*



Project Status



First Look at Marine Sediments

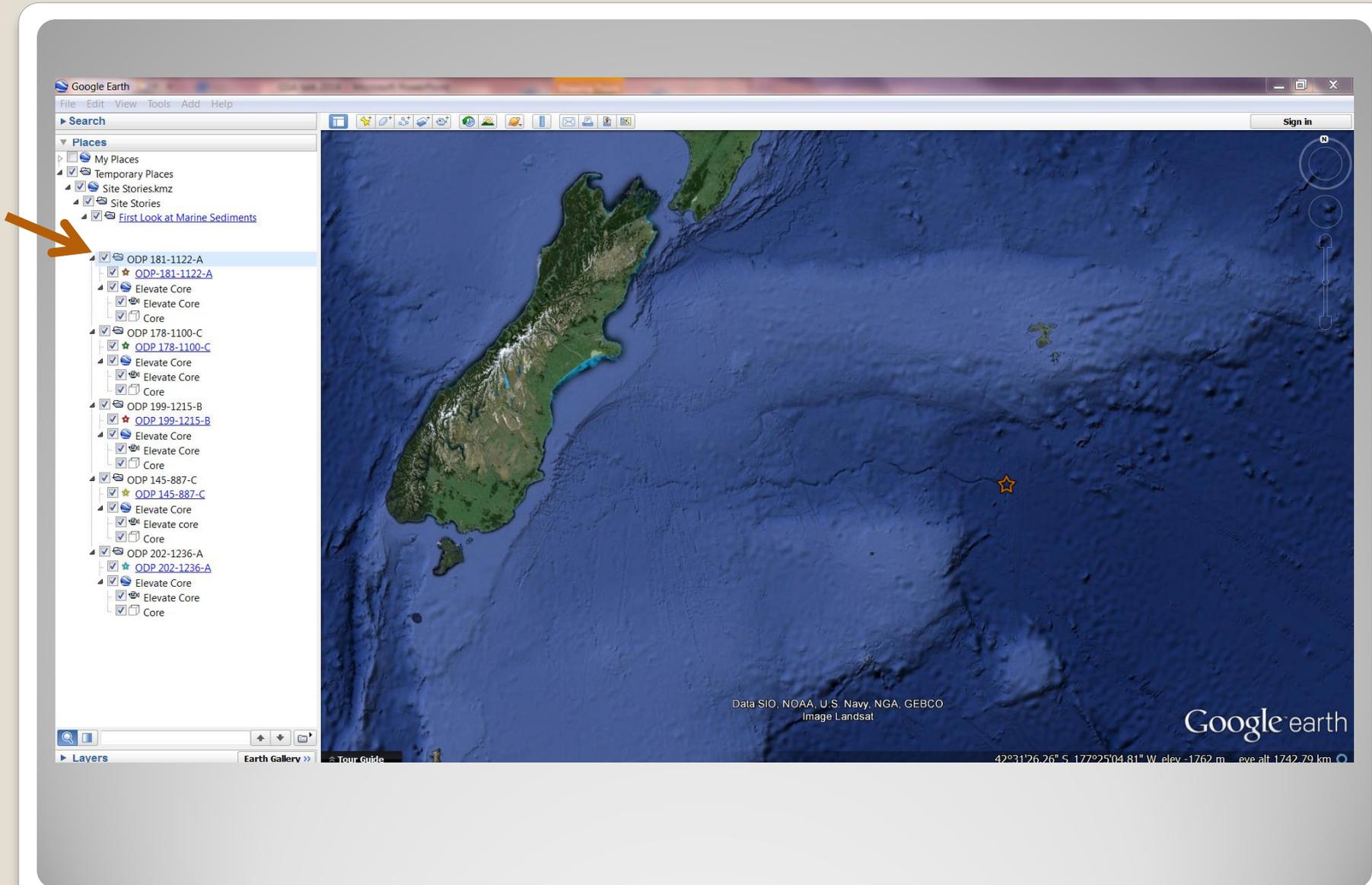


"Type Localities" of the Primary Marine Lithologies

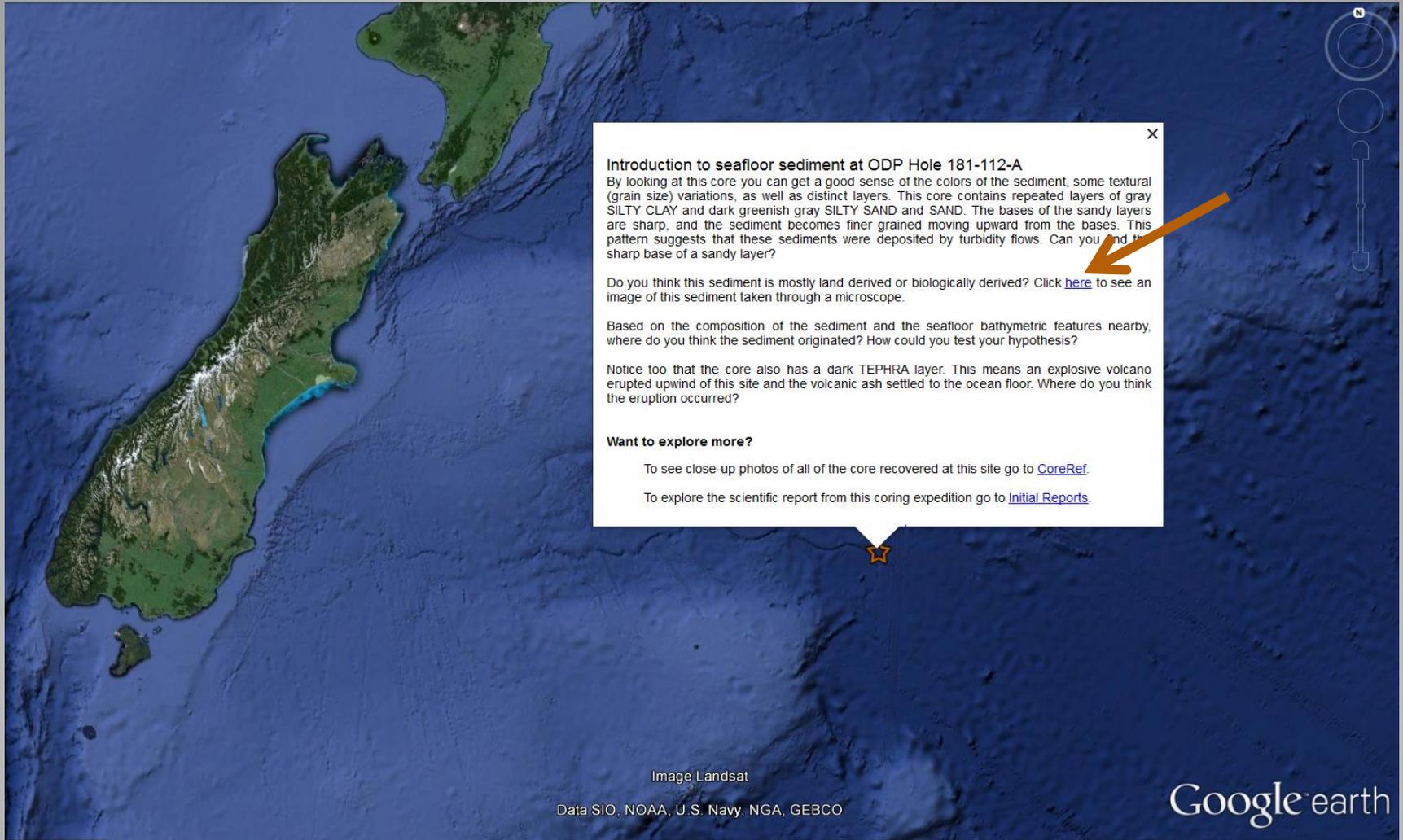
The sedimentary layers of the seafloor contain amazing stories about past ocean conditions, climates, and environmental changes. The first step in learning how to read those stories is to get familiar with the different sediment types of the seafloor. This "tour of the floor" will provide you with a first look at the sediment that is deposited in the modern ocean. You will visit 5 locations in the Pacific Ocean where the scientific research vessel, [the JOIDES Resolution](#), drilled into the seafloor and recovered long cylinders of sediment. At each site you can "pull up" a section of core from the seafloor to see what the sediments look like in the upper few meters of the ocean floor. In addition, you can view photos of the same sediment that were taken through a microscope. This will give you multiple views of the seafloor from the scales available in Google Earth, down to a 7 cm diameter core, and at the microscopic level. As you take this tour, [record your observations](#) about water depth, geography (e.g., distance from land, bathymetric features), sediment color, texture, and composition. Comparing and contrasting your observations will help you distinguish one sediment type from another, and can lead to hypotheses about how these sediment types form.

Data SIO, NOAA, U.S. Navy, NGA, GEBCO
Image Landsat
Image IBCAO

Part 1: First Look at Marine Sediments



Part 1: First Look at Marine Sediments



Introduction to seafloor sediment at ODP Hole 181-112-A

By looking at this core you can get a good sense of the colors of the sediment, some textural (grain size) variations, as well as distinct layers. This core contains repeated layers of gray SILTY CLAY and dark greenish gray SILTY SAND and SAND. The bases of the sandy layers are sharp, and the sediment becomes finer grained moving upward from the bases. This pattern suggests that these sediments were deposited by turbidity flows. Can you find the sharp base of a sandy layer?

Do you think this sediment is mostly land derived or biologically derived? Click [here](#) to see an image of this sediment taken through a microscope.

Based on the composition of the sediment and the seafloor bathymetric features nearby, where do you think the sediment originated? How could you test your hypothesis?

Notice too that the core also has a dark TEPHRA layer. This means an explosive volcano erupted upwind of this site and the volcanic ash settled to the ocean floor. Where do you think the eruption occurred?

Want to explore more?

To see close-up photos of all of the core recovered at this site go to [CoreRef](#).

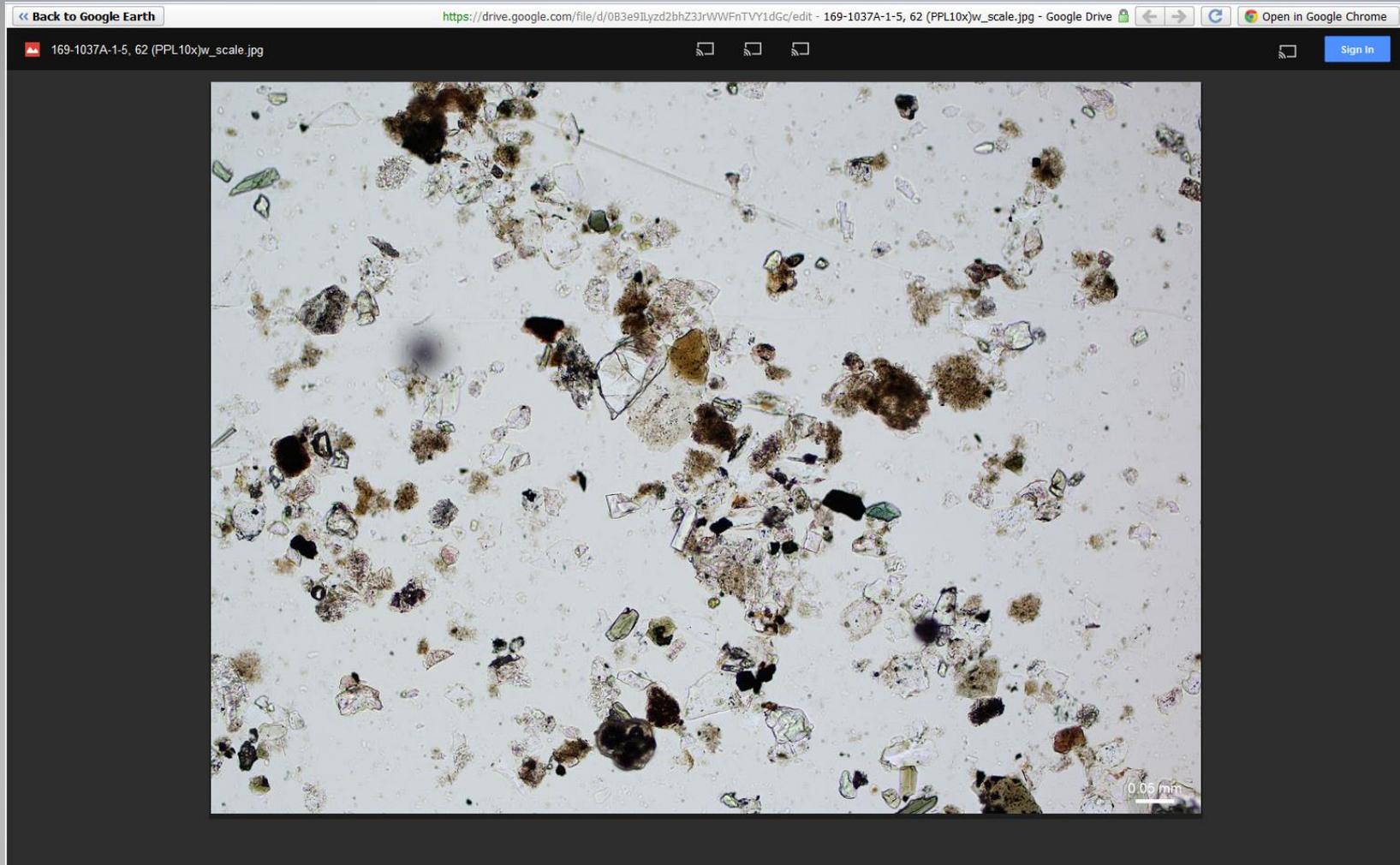
To explore the scientific report from this coring expedition go to [Initial Reports](#).

Image Landsat

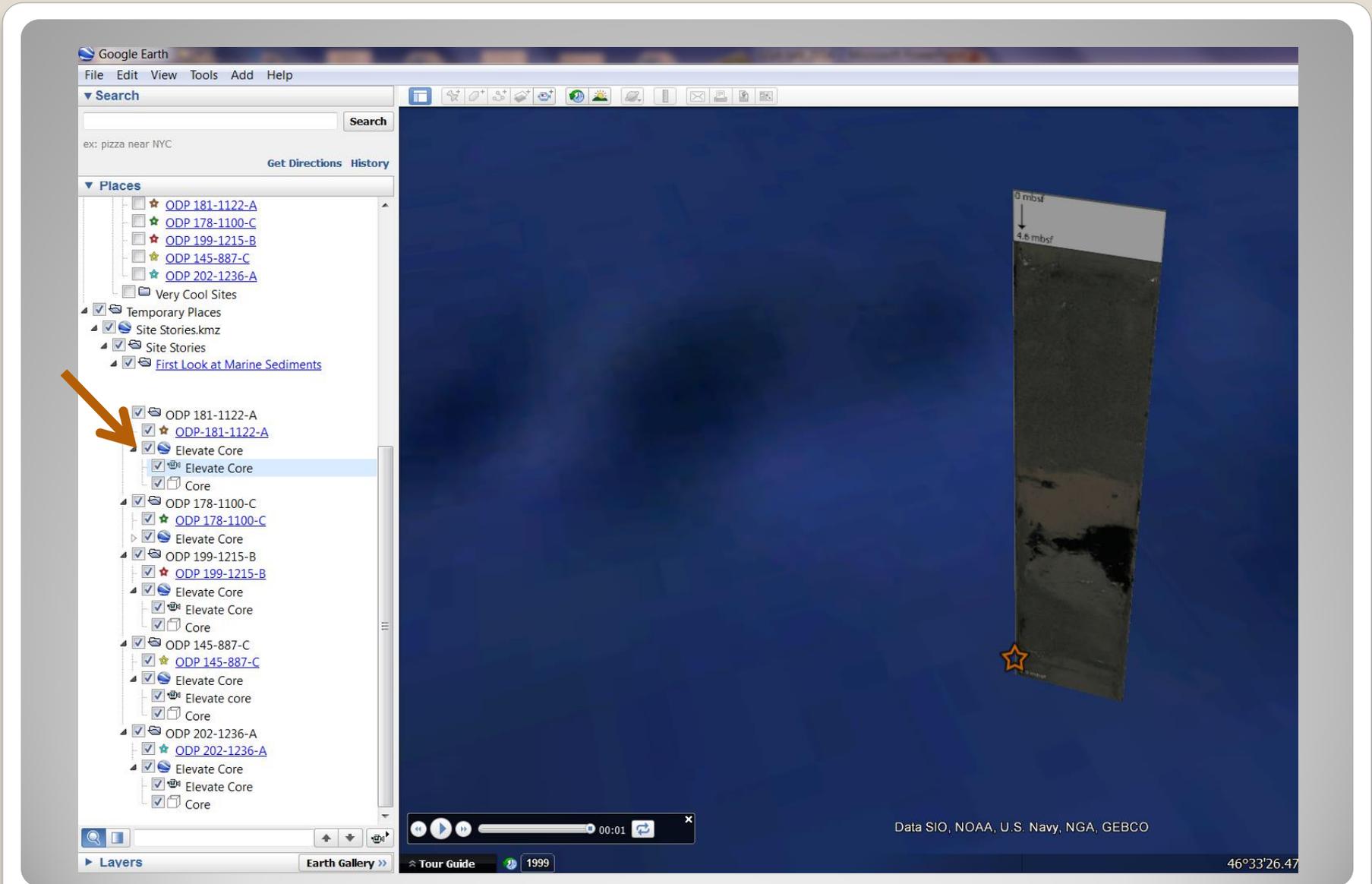
Data SIO, NOAA, U.S. Navy, NGA, GEBCO

Google earth

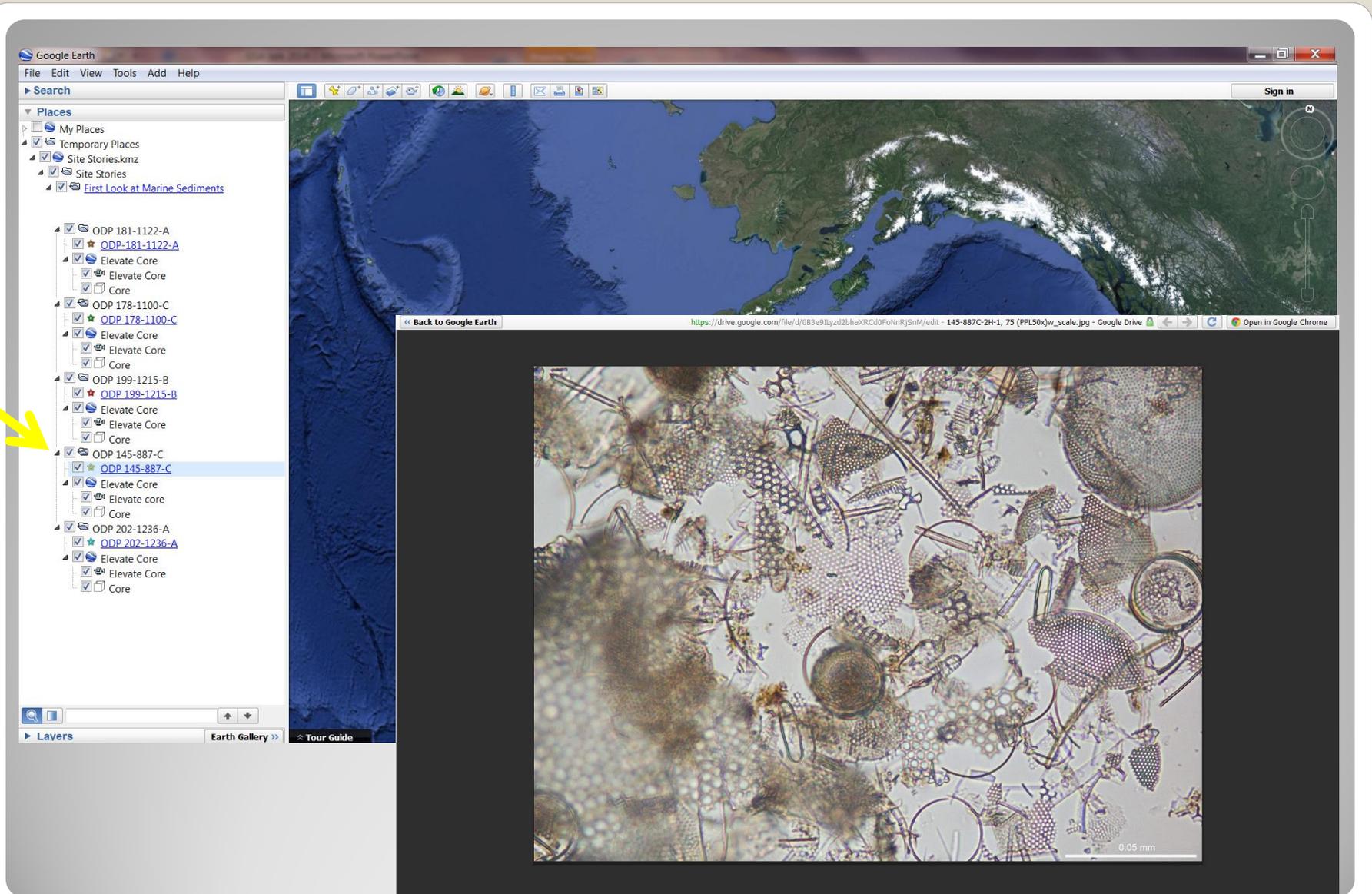
Part 1: First Look at Marine Sediments



Part 1: First Look at Marine Sediments



Part 1: First Look at Marine Sediments



Part 1: First Look at Marine Sediments

Table 1. First Look at Marine Sediments - Summary Observations

	Site Locations				
	ODP 181-112-A	ODP 145-887C	ODP 199-1215B	ODP 202-1236A	ODP 178-110C
<i>How deep (meters) is the water at this site?</i>					
<i>How far (km) is this site from land?</i>					
<i>What is the shape of the seafloor here? (e.g., flat, submarine plateau, continental slope...)</i>					
<i>What does the</i>					

Table 2. First Look at Marine Sediments - Responses to Site-Specific Questions

ODP 181-112-A

Can you find the sharp base of a sandy layer?

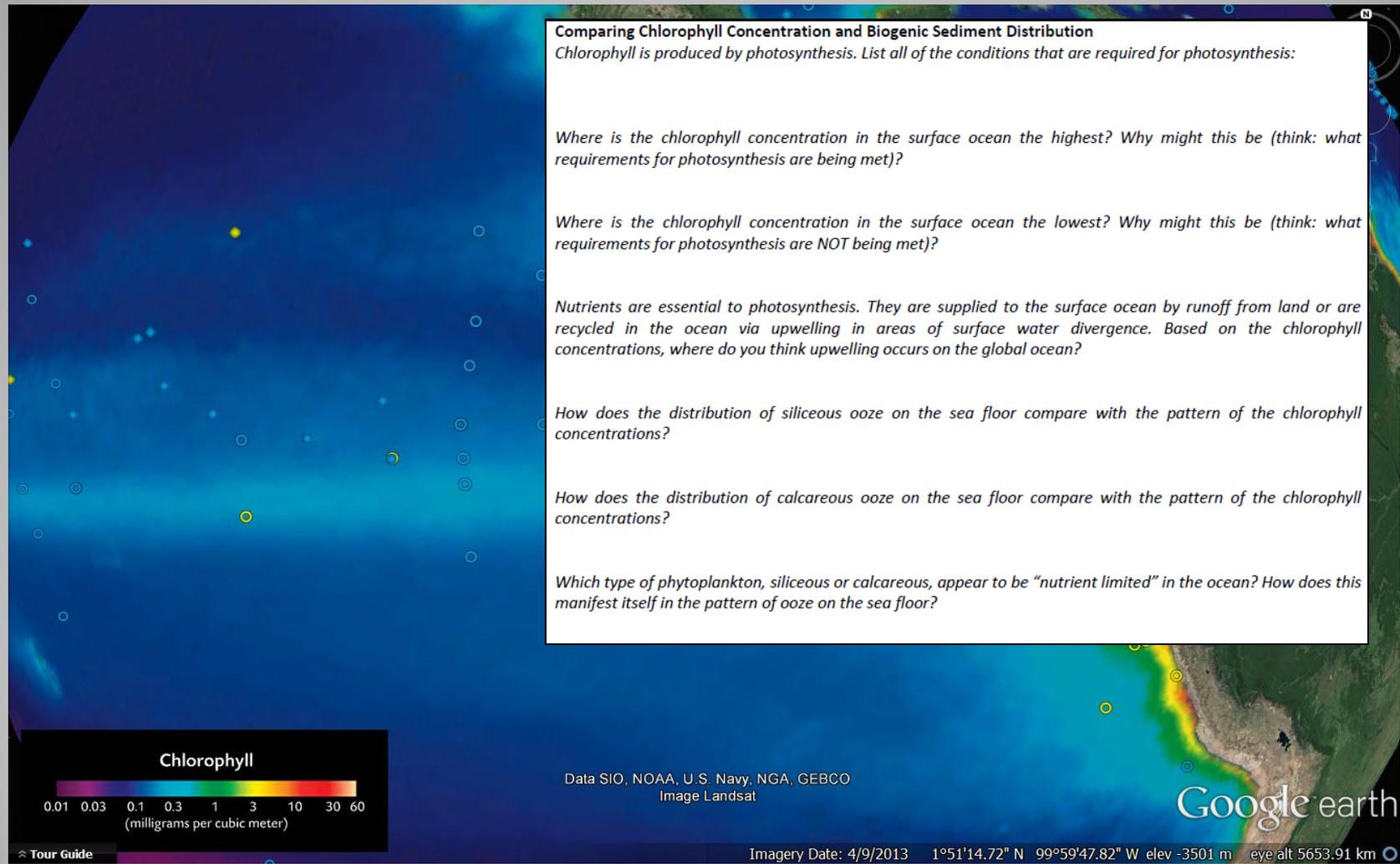
Do you think this sediment is mostly land derived or biologically derived?

Based on the composition of the sediment and the seafloor bathymetric features nearby, where do you think the sediment originated?

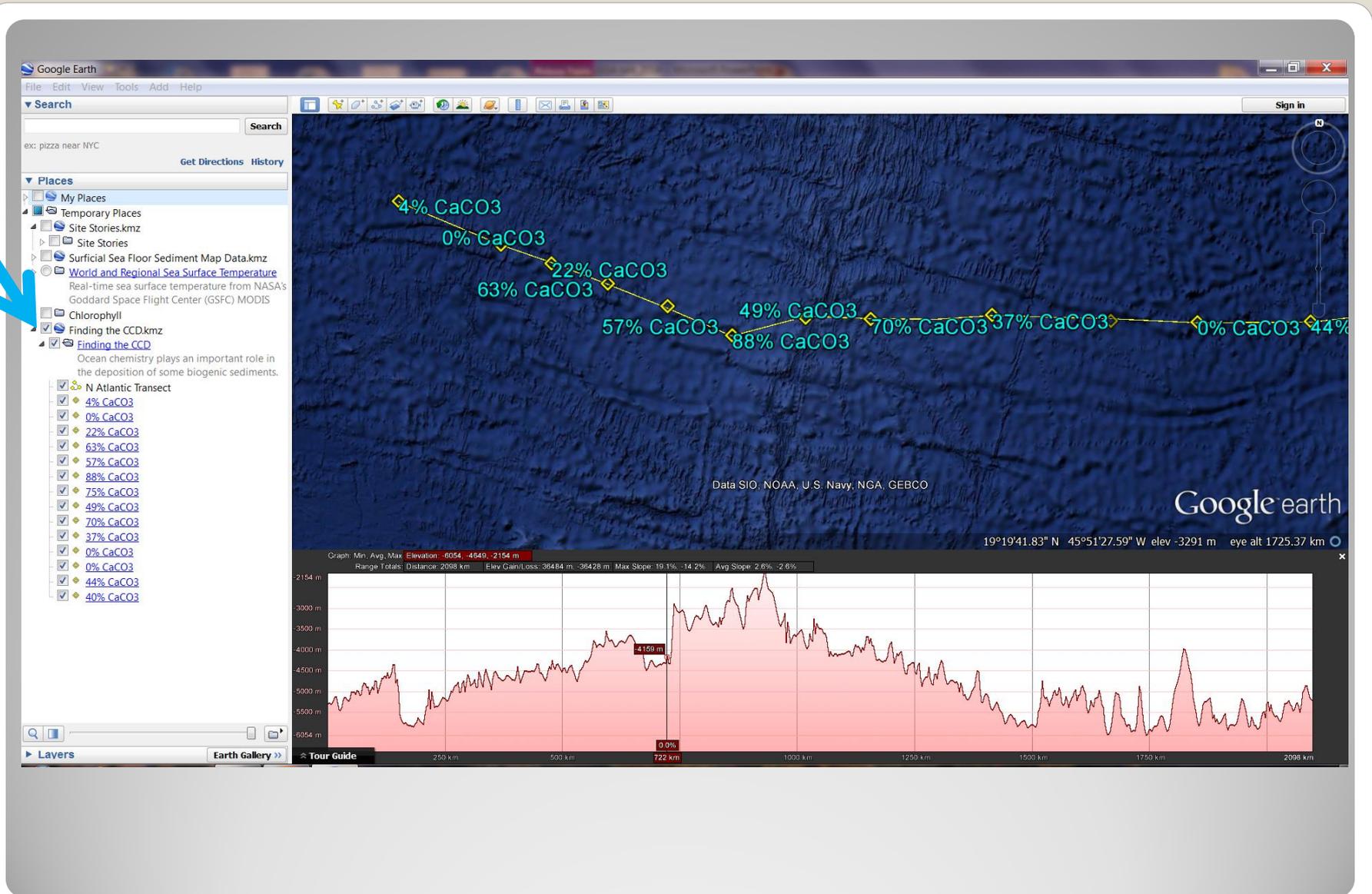
How could you test your hypothesis regarding the sediment origin?

Notice the dark tephra (ash) layer in core. Where do you think the eruption occurred?

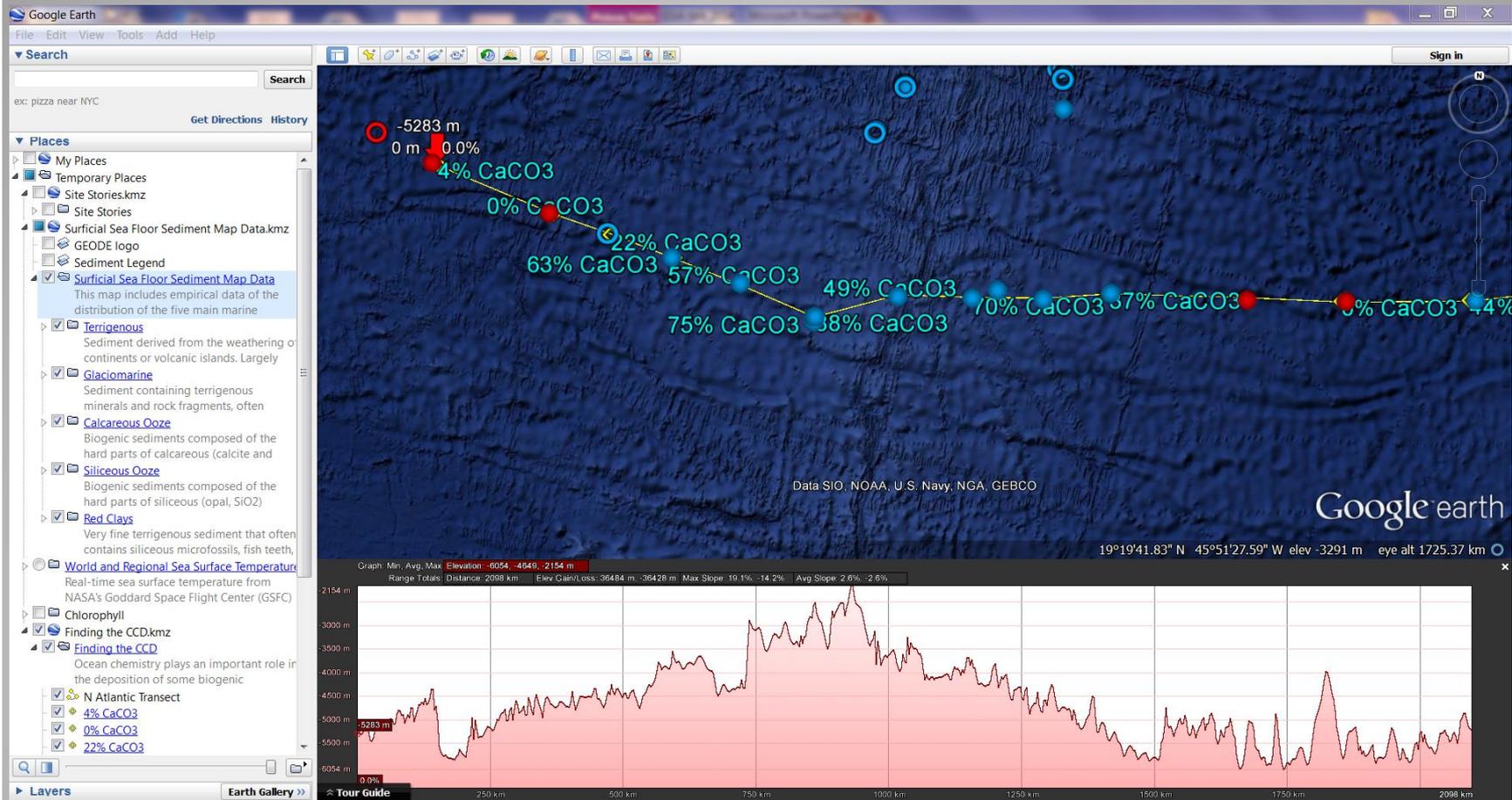
Part 1: First Look at Marine Sediments



Part 3: Refining Your Hypotheses on Biogenic Marine Sediment Distributions – comparing to other “Big Data”



Part 3: Refining Your Hypotheses on Biogenic Marine Sediment Distributions – Connecting Observation to Theory on the CCD



Part 3: Refining Your Hypotheses on Biogenic Marine Sediment Distributions – Connecting Observation to Theory on the CCD

