Is there a link between explosive volcanism and the Earth's climate? with Suzanne Straub

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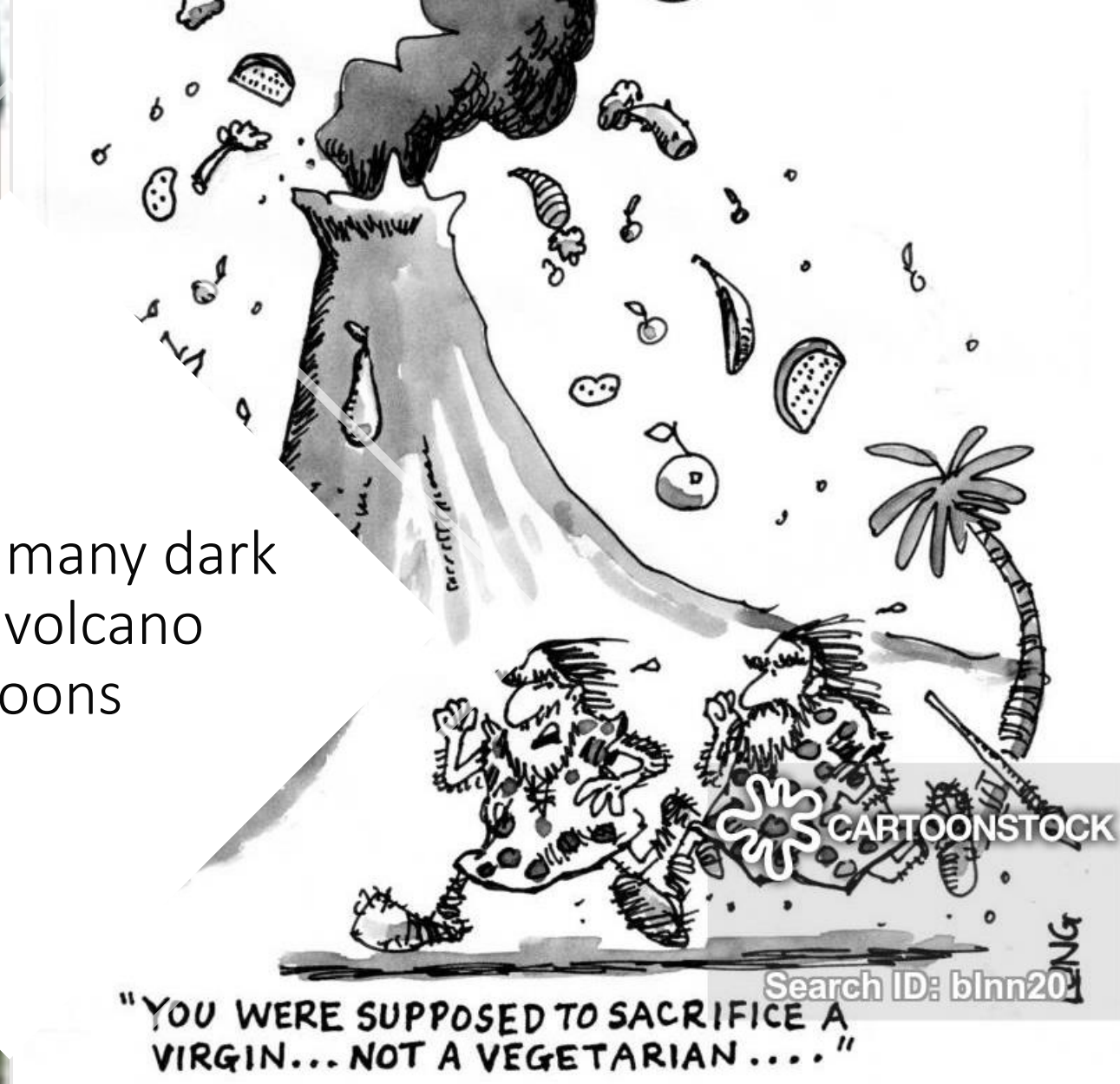
First, a few light-hearted looks at how many people view volcanoes.

There are many dark humor volcano cartoons



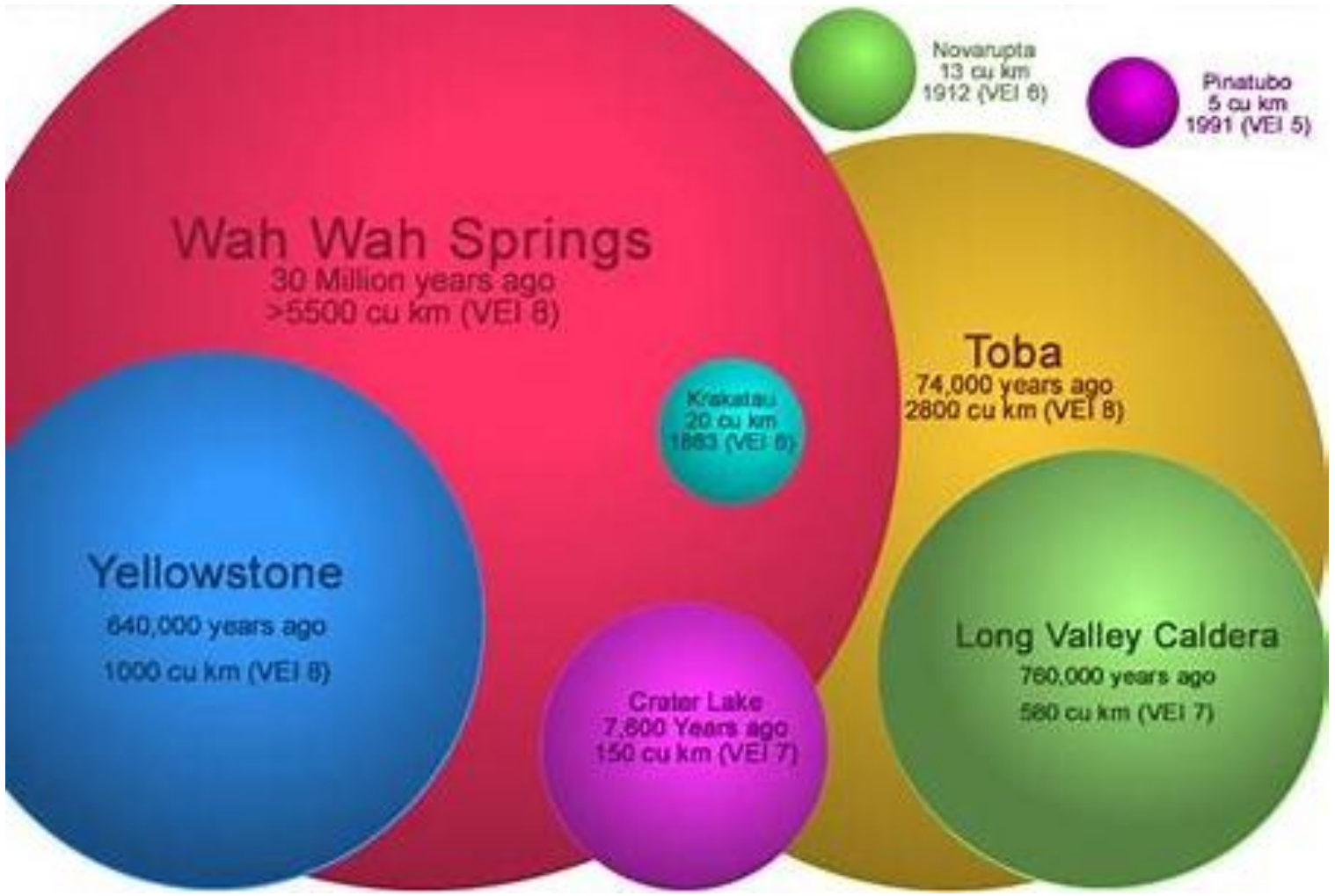

One does not simply
survive
a supermassive volcanic eruption

Not everyone who goes into a volcano stays in

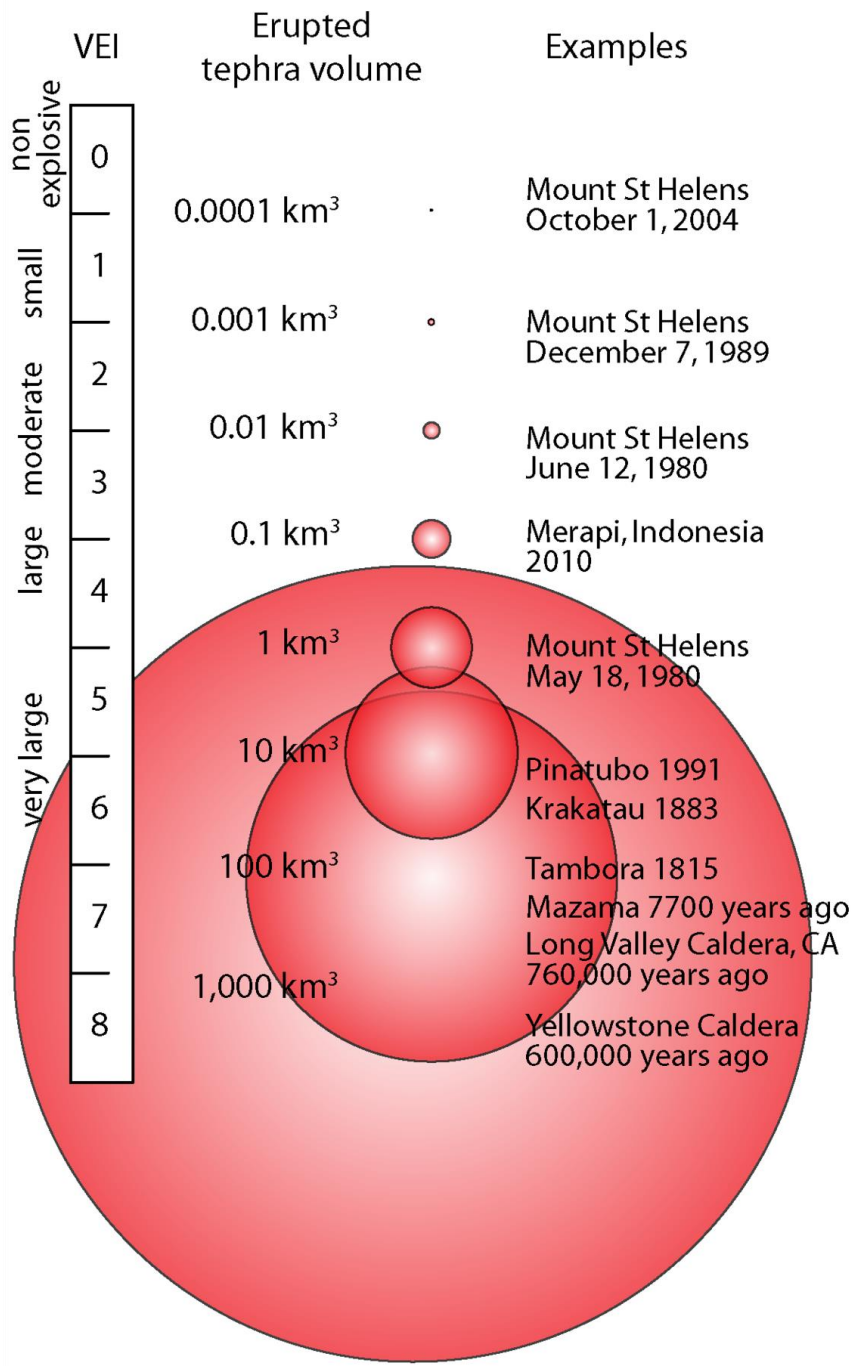
- Woman falls into volcano vent on Oregon's Mount Hood: 'I was terrified' - ABC News
- Woman falls into volcano vent on Oregon's Mount Hood: 'I was terrified’

- Now, let’s look at the science behind today’s presentation.

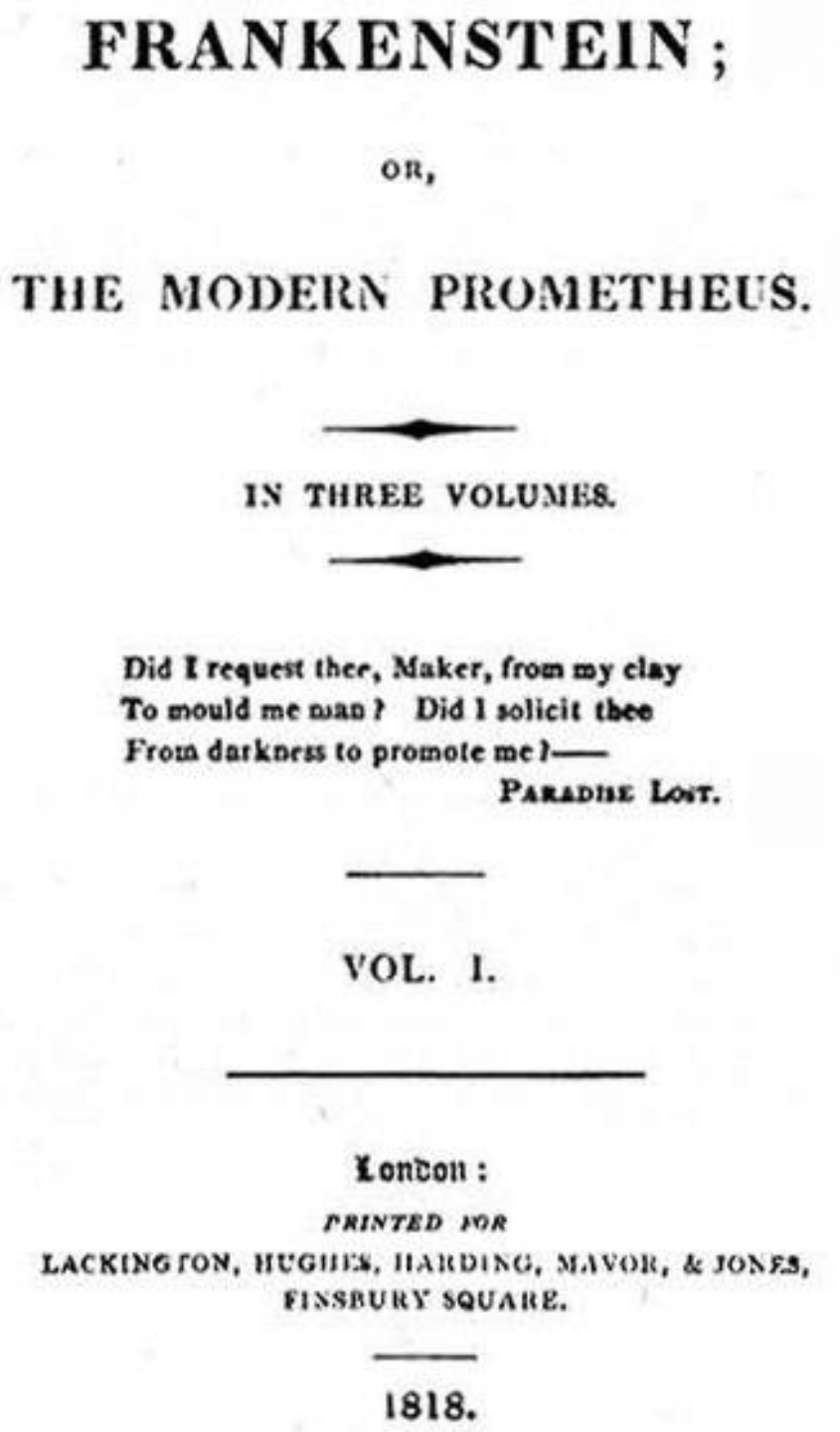
- All volcanoes are dangerous, but some are more so. Volcanologist describe the power and effects of an eruption by the Volcano Explosivity Scale (ore similar terms).


Novarupta
13 cu km
1912 (VEI 6)
Pinatubo
5 cu km
1991 (VEI 5)
Wah Wah Springs
30 Million years ago
>5500 cu km (VEI 8)
Toba
74,000 years ago
2800 cu km (VEI 8)
Krakatau
20 cu km
1883 (VEI 6)
Yellowstone
640,000 years ago
1000 cu km (VEI 8)
Crater Lake
7,800 Years ago
150 cu km (VEI 7)
Long Valley Caldera
760,000 years ago
580 cu km (VEI 7)

1	> 0.001 km³	Hawaiian / Strombolian	gentle	100–1000 m	daily	minor	Nyiragongo (2002)
2	> 0.001km³	Strombolian / Vulcanian	explosive	1–5 km	weekly	moderate	Mount Sinabung (2010)
3	>0.01 km³	Vulcanian / Peléan	severe	3–15 km	few months	substantial	Nevado del Ruiz (1985), Soufrière Hills (1995)
4	> 0.1 km³	Peléan / Plinian	cataclysmic	10–25 km	≥ 1 yr	substantial	Mount Pelée (1902), Eyjafjallajokull (2010)
5	> 1 km³	Plinian	paroxysmal	20–35 km	≥ 10 yrs	substantial	Mount St. Helens (1980)
6	> 10 km³	Plinian / Ultra-Plinian	catastrophic	> 30 km	≥ 100 yrs	substantial	Krakatau (1883), Mount Pinatubo (1991)
7	> 100 km³	Ultra-Plinian	super-colossal	> 40 km	≥ 1,000 yrs	substantial	Tambora (1815)
8							Yellowstone


VEI
Erupted tephra volume
Examples
non explosive
small
moderate
large
very large
0
1
2
3
4
5
6
7
8
0.0001 km³
Mount St Helens October 1, 2004
0.001 km³
Mount St Helens December 7, 1989
0.01 km³
Mount St Helens June 12, 1980
0.1 km³
Merapi, Indonesia 2010
1 km³
Mount St Helens May 18, 1980
10 km³
Pinatubo 1991
Krakatau 1883
100 km³
Tambora 1815
Mazama 7700 years ago
Long Valley Caldera, CA 760,000 years ago
1,000 km³
Yellowstone Caldera 600,000 years ago

One result of the “year without Summer” (1816) after Tambora



FRANKENSTEIN;

OR,

THE MODERN PROMETHEUS.

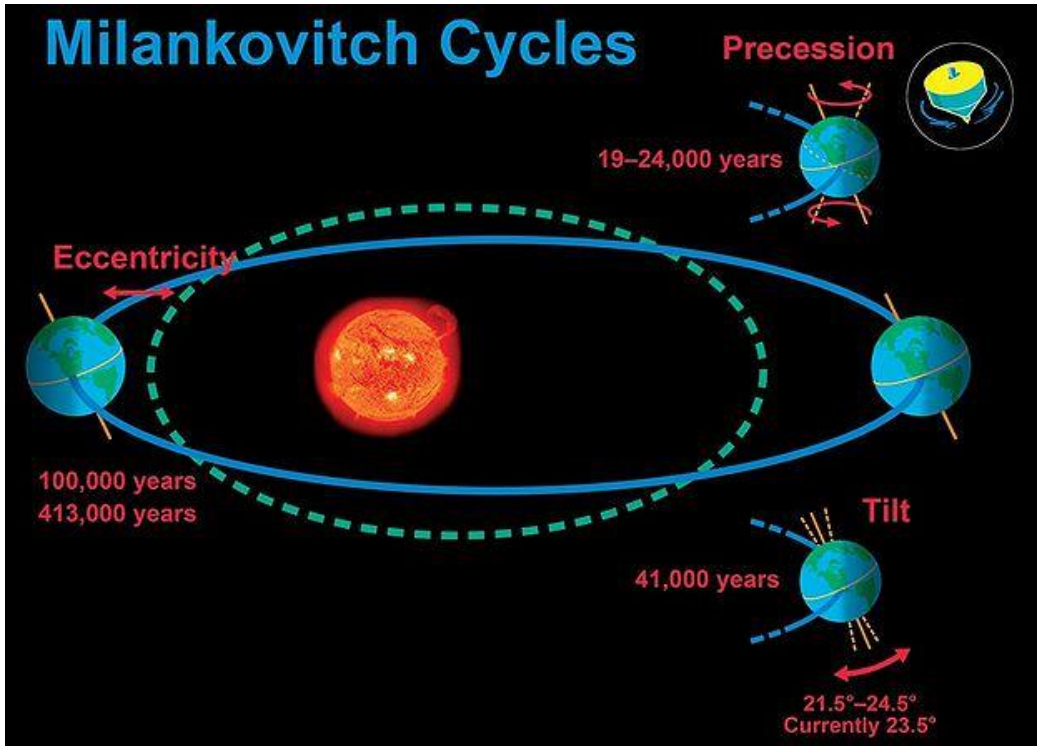
IN THREE VOLUMES.

Did I request thee, Maker, from my clay
To mould me man? Did I solicit thee
From darkness to promote me?—
PARADISE LOST.

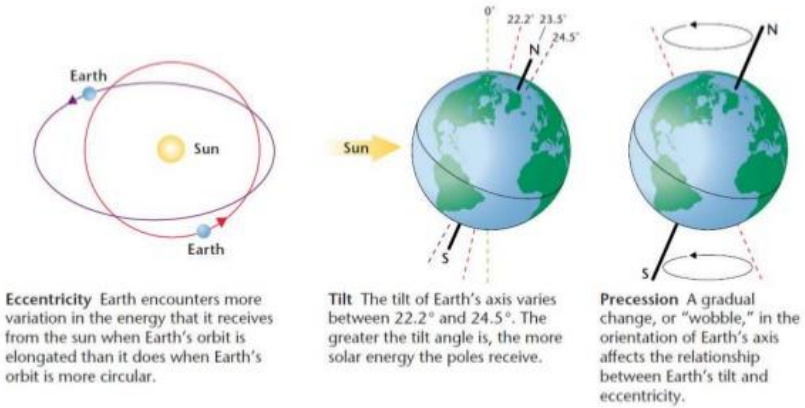
VOL. I.

London:
PRINTED FOR
LACKINGTON, HUGHES, HARDING, MAVOR, & JONES,
FINSBURY SQUARE.

1818.



Milankovitch Cycle

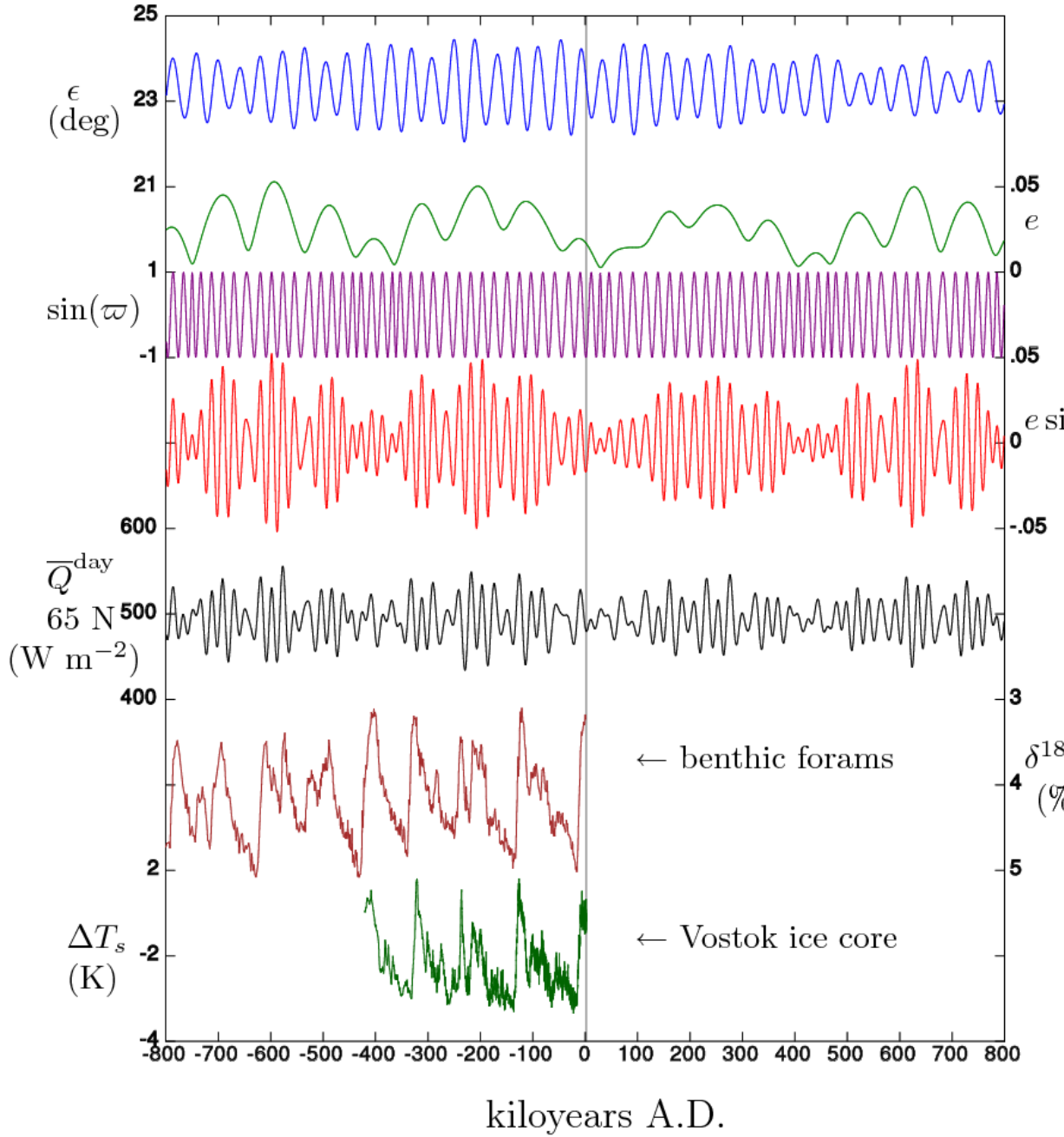


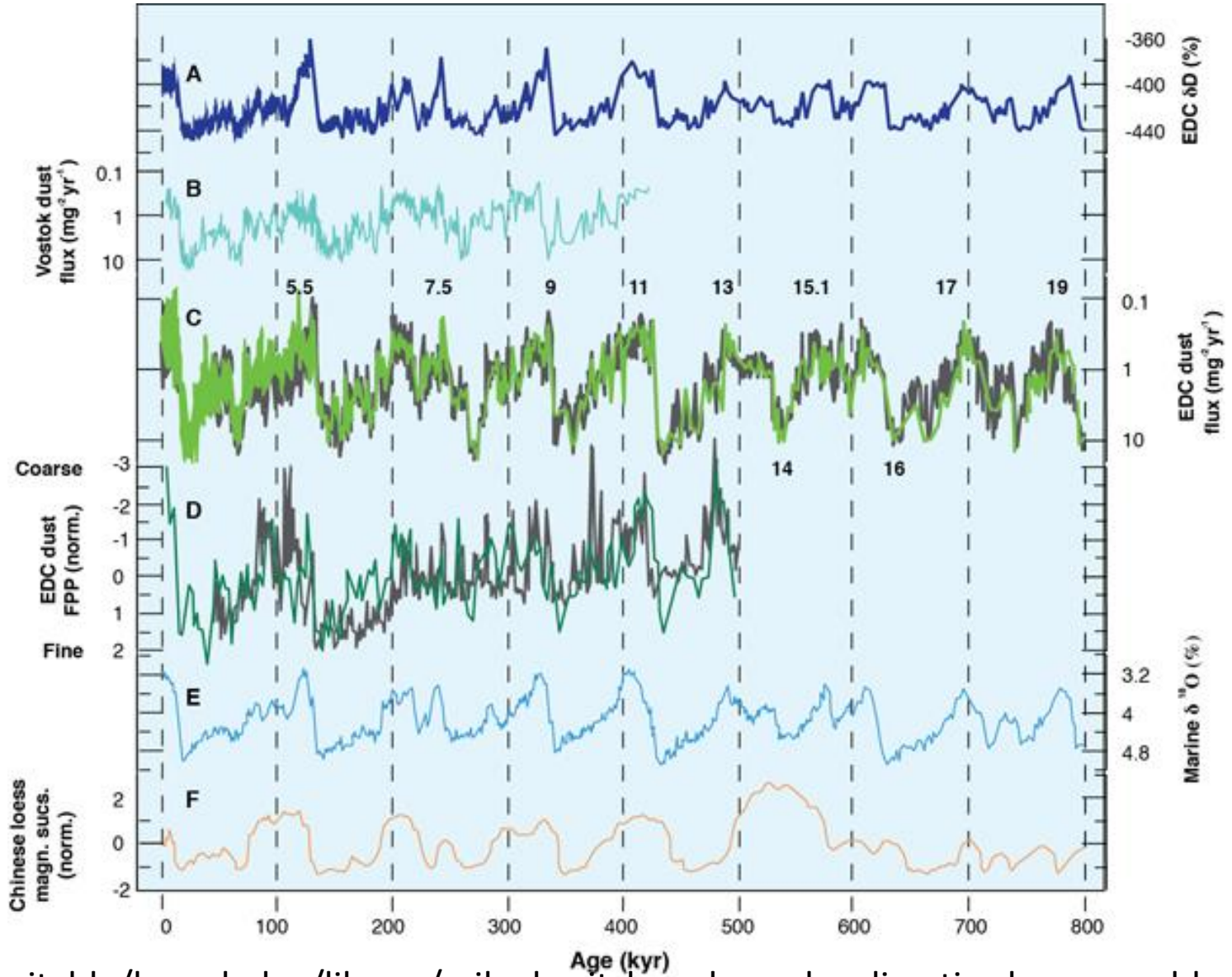
Eccentricity Earth encounters more variation in the energy that it receives from the sun when Earth's orbit is elongated than it does when Earth's orbit is more circular.

Tilt The tilt of Earth's axis varies between 22.2° and 24.5°. The greater the tilt angle is, the more solar energy the poles receive.

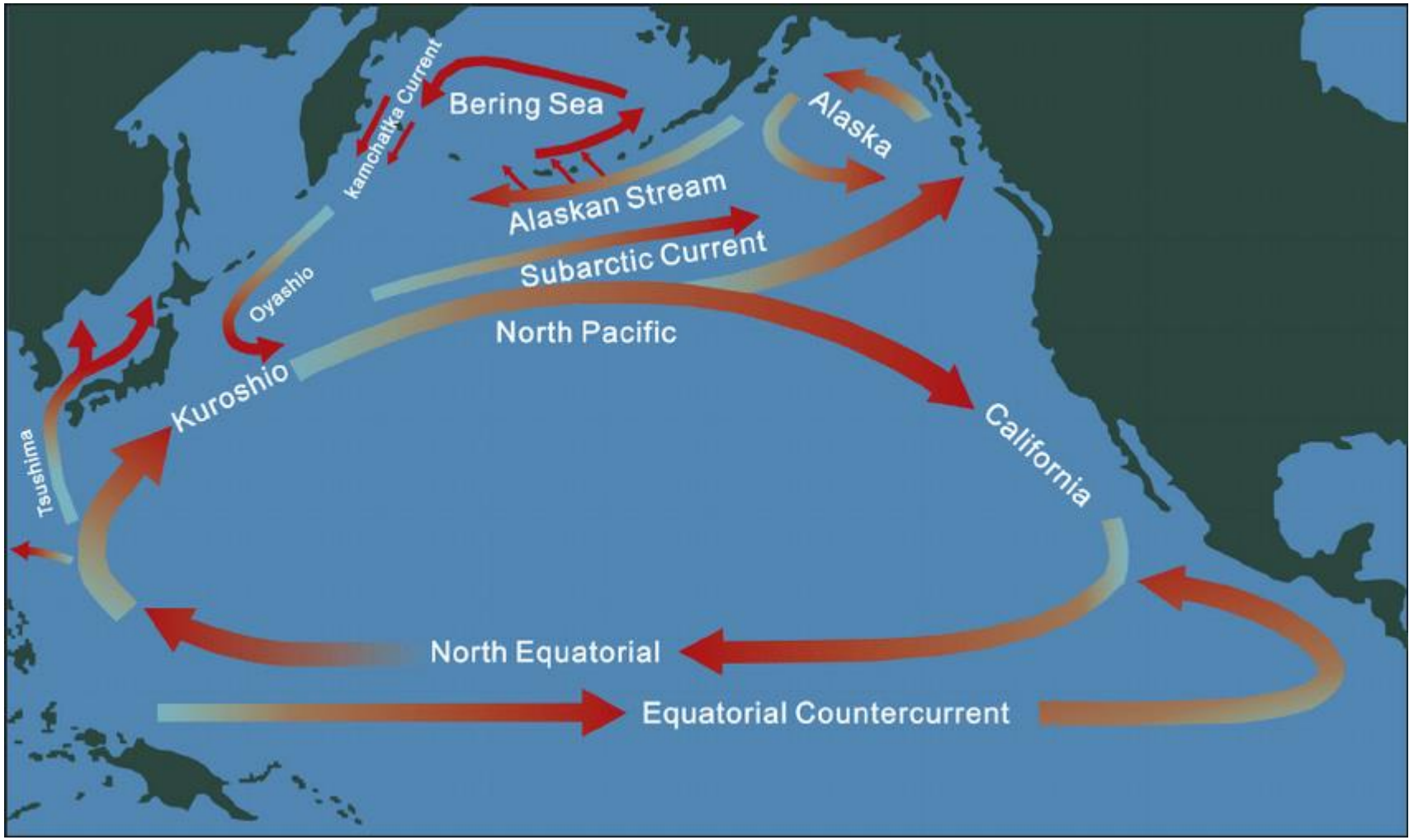
Precession A gradual change, or "wobble," in the orientation of Earth's axis affects the relationship between Earth's tilt and eccentricity.

Milankovitch Cycles





https://www.nature.com/scitable/knowledge/library/milankovitch-cycles-paleoclimatic-change-and-hominin-evolution-68244581/#:~:text=The%20three%20elements%20of%20Milankovitch,from%20circular%20to%20more%20elliptical.



https://www.google.com/search?q=north+pacific+ocean+currents&rlz=1C1CHBF_enUS887US887&tbm=isch&source=iu&ictx=1&fir=VzuJCgymVBaHgM%252CHoth2ChTa7E9sM%252C_&vet=1&usg=AI4_-kSgqtlMbrhxg2cXWejK23EFP9jF4Q&sa=X&ved=2ahUKEwjksuL31MHtAhUpneAKHU9xBswQ_h16BAgHEAE#imgrc=VzuJCgymVBaHgM

Scientific Ocean Drilling

- In the interest of time, we won't view this entire video, but go on to the httpS://earth2class.org/site at your convenience and watch
- https://www.youtube.com/watch?v=0nydKlpZdIU
- http://www-odp.tamu.edu/publications/citations/cite145.html

Global Proxies

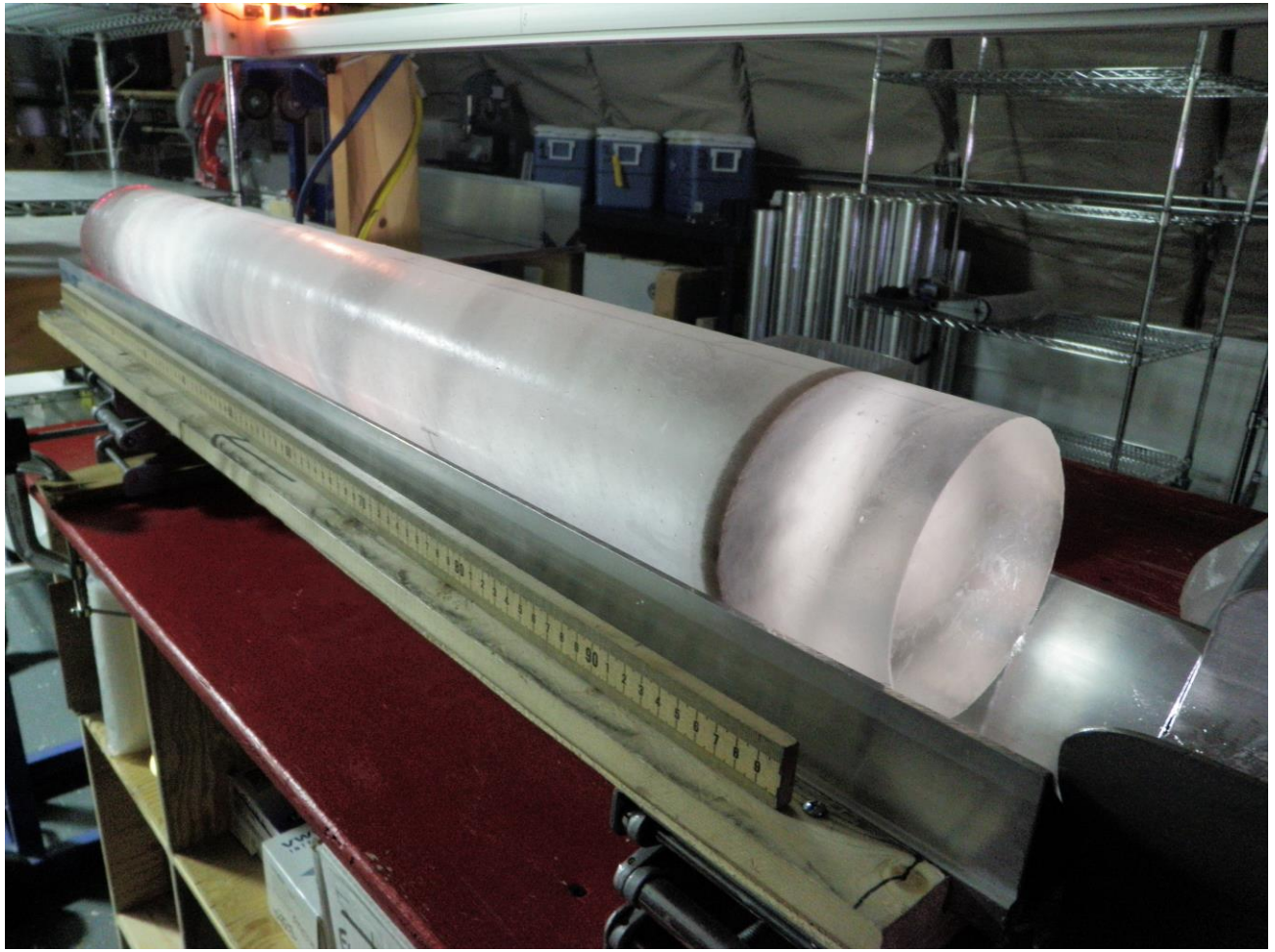
- Sea level
- Ocean sediment
- Ice cores
  - Layers (varves) in ice cores
  - Gases in ice cores
  - Stable Isotopes: O-16 to O-18 ratio in ice cores
  - Radiometric Isotopes:Carbon dating of sediment in the ice cores or glacial deposits

PPT - Climate Proxies PowerPoint Presentation, free download - ID:2251708 (slideserve.com)

Proxies

- Corals*
- Tree rings*
- Pollen*
- Fossils*
- Sea level
- Lake ice duration*
- Ocean sediments
- Ice Cores

*indicative more of local climate change than global climate change



https://icecores.org/about-ice-cores

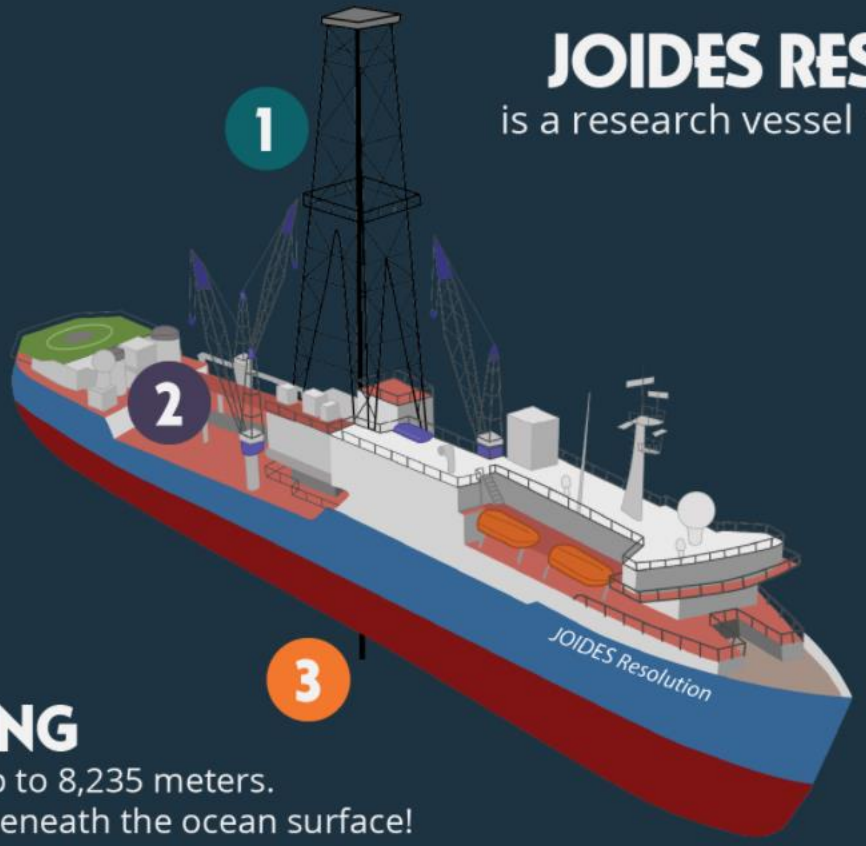
Glaciers form as layers of snow accumulate on top of each other. Each layer of snow is different in chemistry and texture, summer snow differing from winter snow. Over time, the buried snow compresses under the weight of the snow above it, forming ice. Particulates and dissolved chemicals that were captured by the falling snow become a part of the ice, as do bubbles of trapped air. Layers of ice accumulate over seasons and years, creating a record of the climate conditions at the time of formation, including snow accumulation, local temperature, the chemical composition of the atmosphere including greenhouse gas concentrations, volcanic activity, and solar activity.

https://icecores.org/about-ice-cores

ABOUT THE SHIP

JOIDES RESOLUTION

is a research vessel 143 meters long

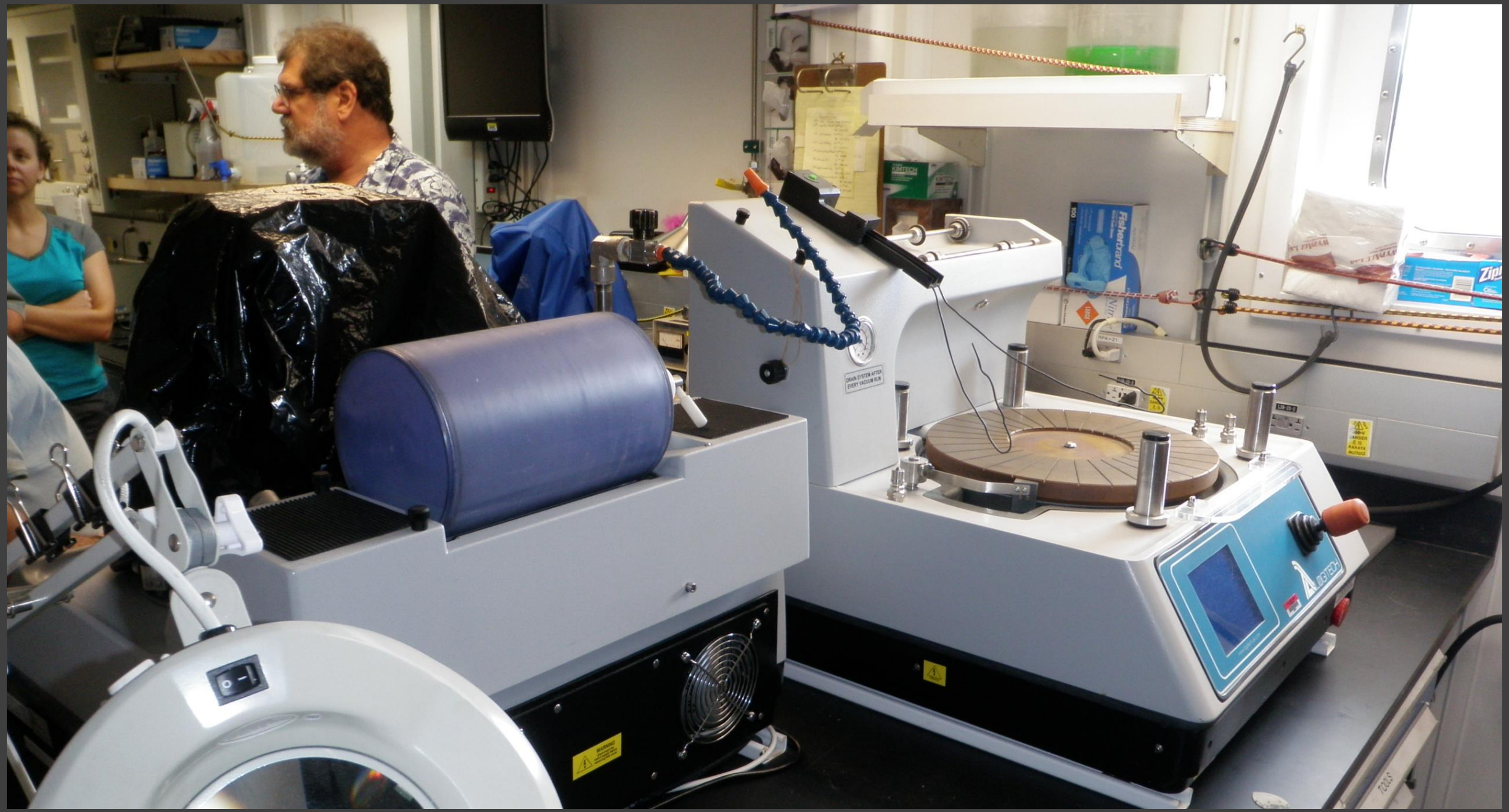


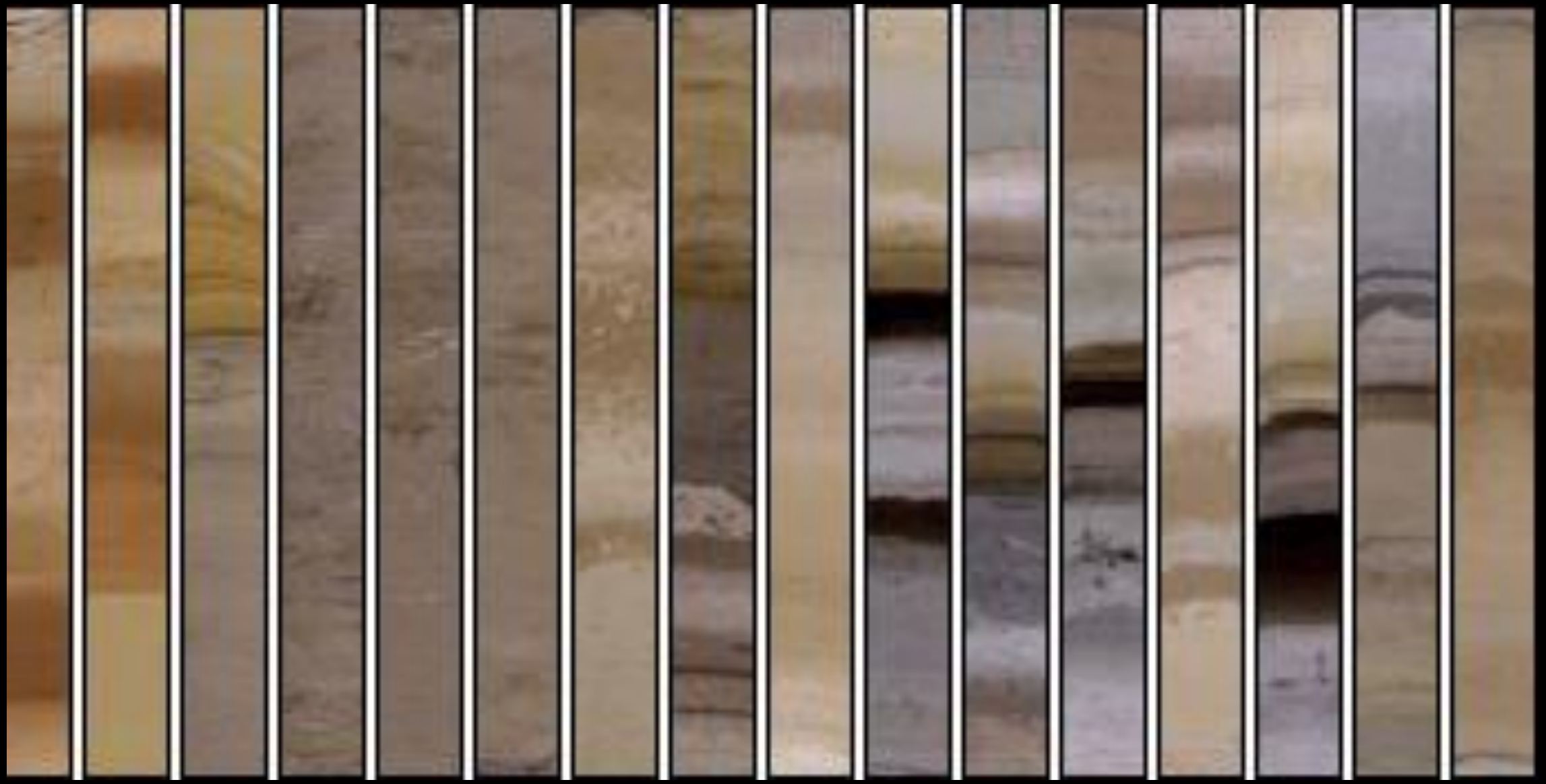
1 DERRICK
Is 62 meters above the water line

2 CATWALK
Where the cores are sent after drilling.

3 DRILL STRING
Can reach depths of up to 8,235 meters.
that's about six miles beneath the ocean surface!


Barnstead
Barnstead
KIMTECH
KIMTECH


DRAIN SYSTEM AFTER
EVERY VACUUM RUN
Fisherbrand
Ziploc



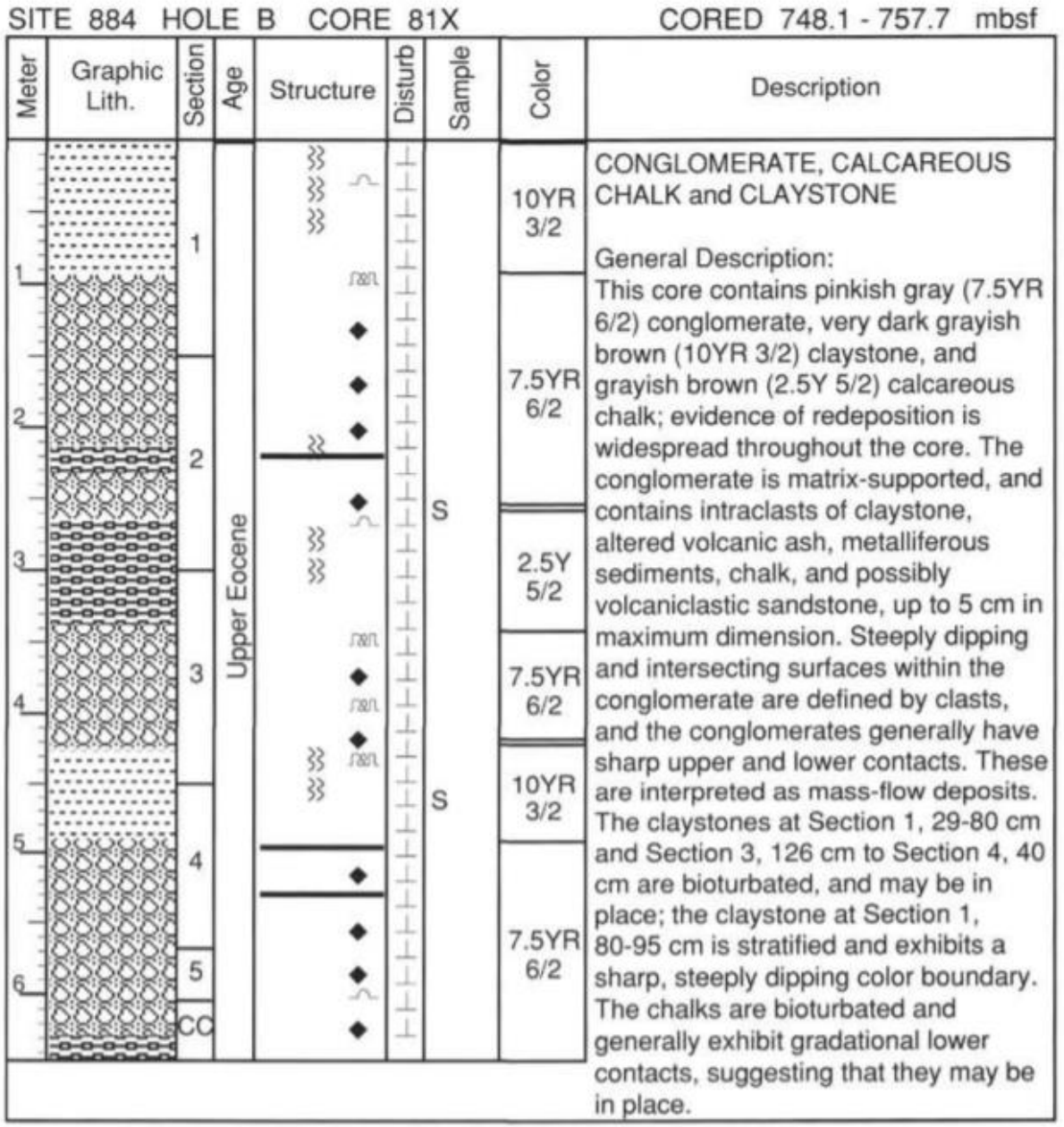


Figure 3. Example of core description form ("barrel sheet") used for describing sediments and sedimentary rocks.

has been specified in terms of meters below sea level (mbsl) and

logic Description" column of the barrel sheet. In an interval compris-

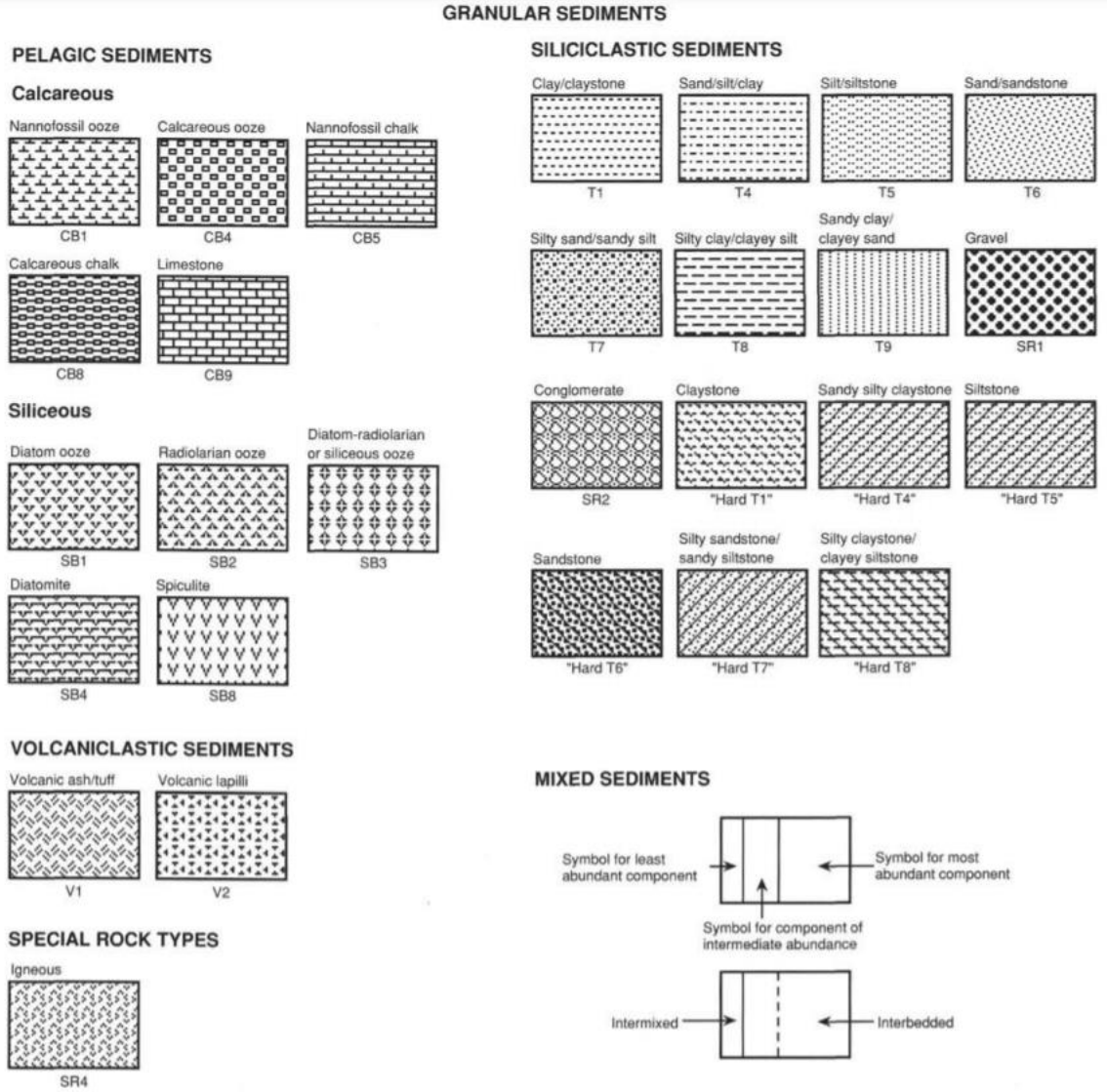
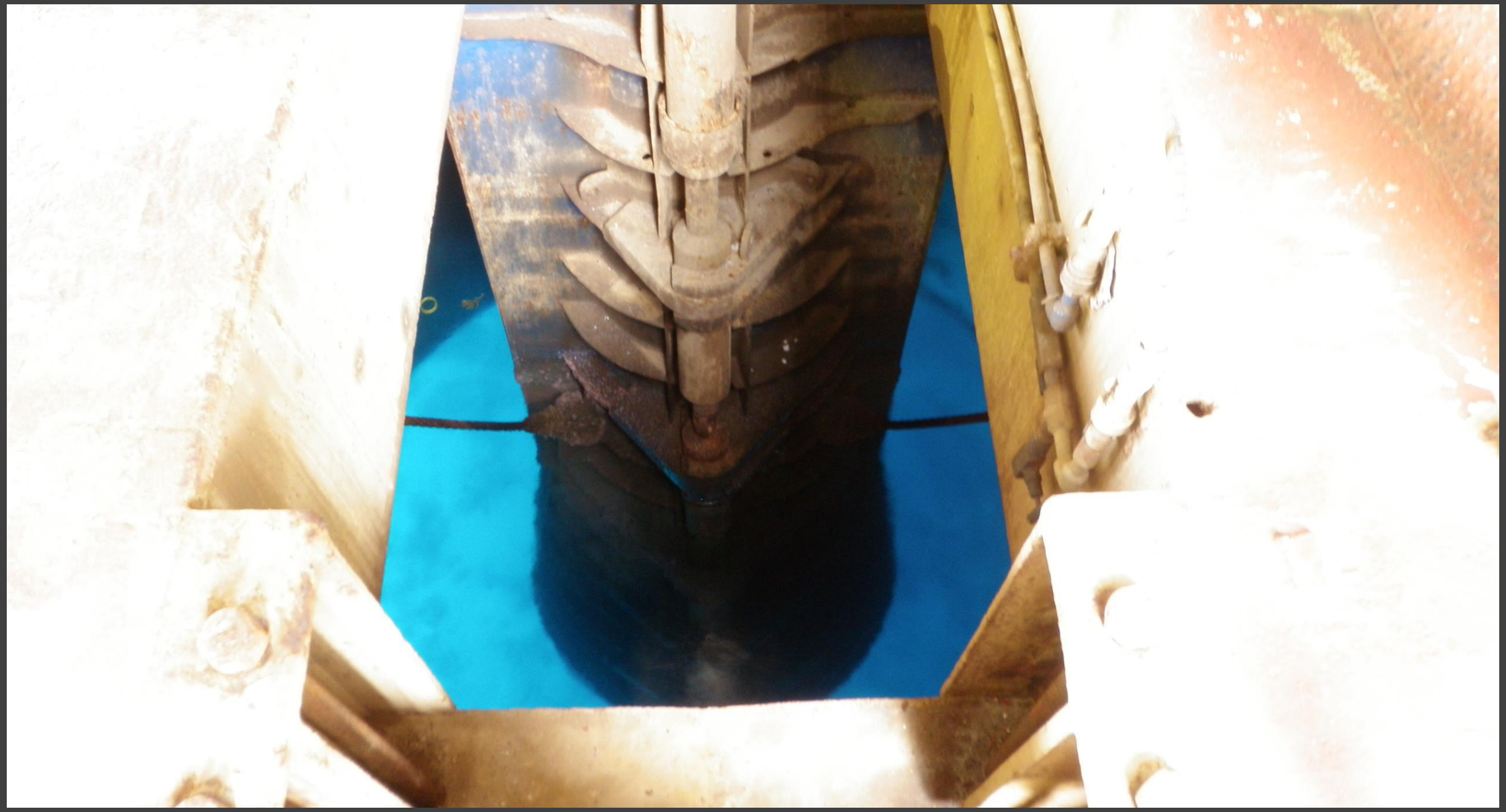
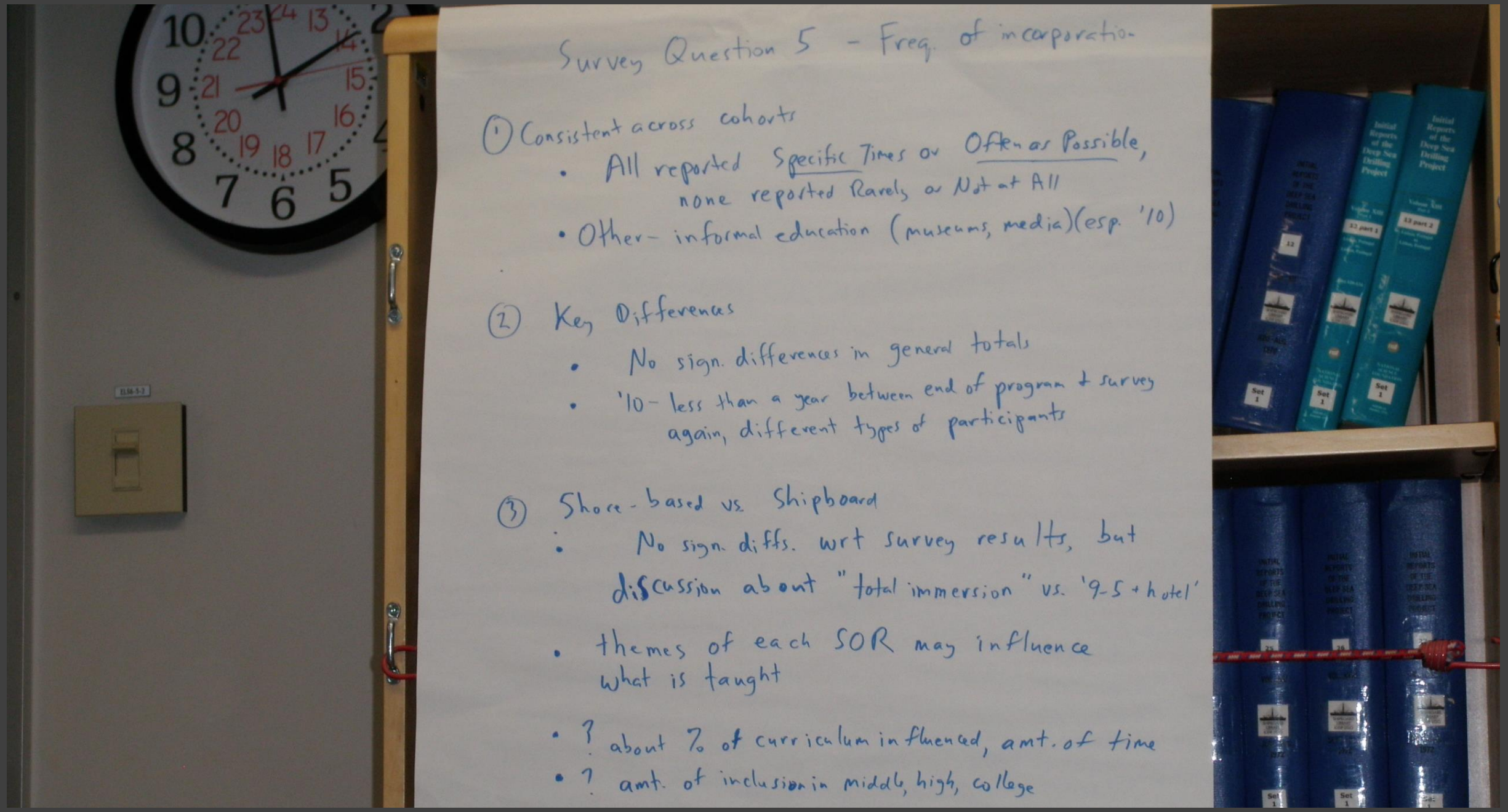
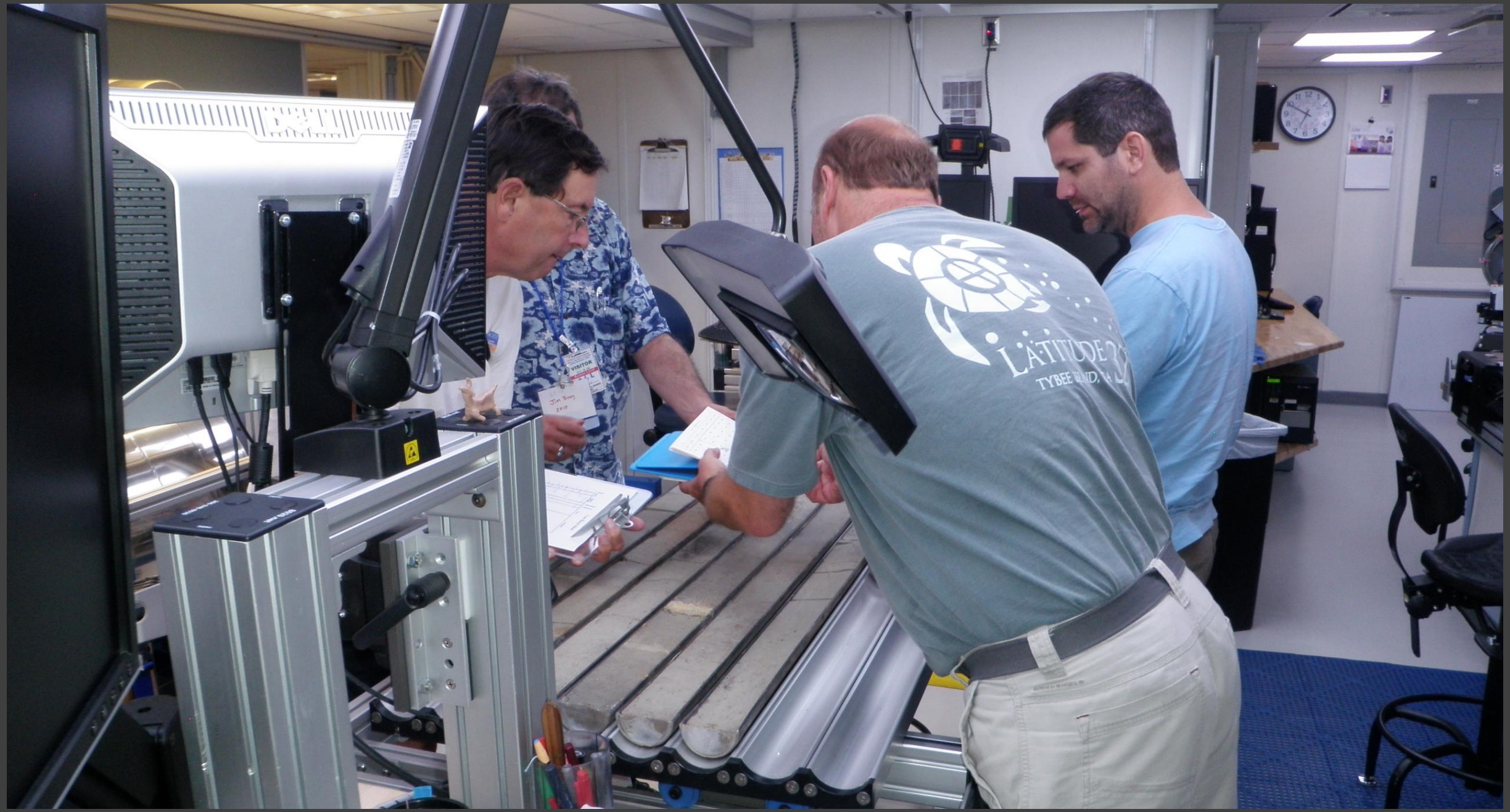


Figure 4. Sediment lithology/lithologic component symbols used in the "Graphic Lithology" column on the core description form shown in Figure 3.




Survey Question 5 - Freq. of incorporation
(1) Consistent across cohorts
• All reported Specific Times or Often as Possible, none reported Rarely or Not at All
• Other- informal education (museums, media)(esp. '10)
(2) Key Differences
• No sign. differences in general totals
• '10- less than a year between end of program & survey again, different types of participants
(3) Shore-based vs. Shipboard
• No sign. diffs. wrt survey results, but discussion about "total immersion" vs. '9-5 + hotel'
• themes of each SOR may influence what is taught
• ? about % of curriculum influenced, amt. of time
• ? amt. of inclusion in middle, high, college


VISITOR
LATITUDE

One or two last ones

How can you tell two geologists are in love?