

Class #13

ECONOMIC RESOURCES OF THE SEA FLOOR

Continental margin resources

Deep-sea floor resources (few)

PALEOCLIMATE RECORDS IN OCEAN SEDIMENTS

Economic considerations determine profitability/viability of each type:

Are extra costs of offshore production offset by profits???

In many cases, the answer is, "Not currently."

Continental margins

1) Building materials- inexpensive, but huge quantities

Sand and gravel- aggregate for concrete; other uses

Shells deposits- used as aggregate or to make "lime" (=CaO) for concrete

2) **Phosphate** deposits

For **fertilizer**

Cont shelf deposits, hydrogenous sediments- maybe exploited in the future

These occur as calcium-phosphate muds, sands, and nodules

3) Hydrocarbons (**fossil fuels**)- huge amount of activity, large profits

Present operations

30% of world oil output + some **natural gas**

Increasing, e.g., Indonesia

Origin of petroleum and natural gas:

Accumulation of **organic matter** in sediments

Need **high sedimentation rate**, or bacteria consume most or all of this

Burial, **heating (>100°C)**, **alteration** of molecules to form oil

Later **migration** of oil and gas upward into **"traps"**

Continental margins only

Poor preservation of organic matter in deep sea

Higher cost in deep water

Gas Hydrates:

Water and natural gas combine to form a dense material

Layers of this found in ocean sediments

Possible HUGE energy source if it can be extracted

Possible HUGE source of greenhouse gas if some gets released (e.g., by undersea landslide)

Deep-sea floor resources

Manganese nodules

Good source of metals, scattered on the ocean floor

Limitations now:

High costs vs. on-shore mines

Ownership of sea floor not yet worked out fully

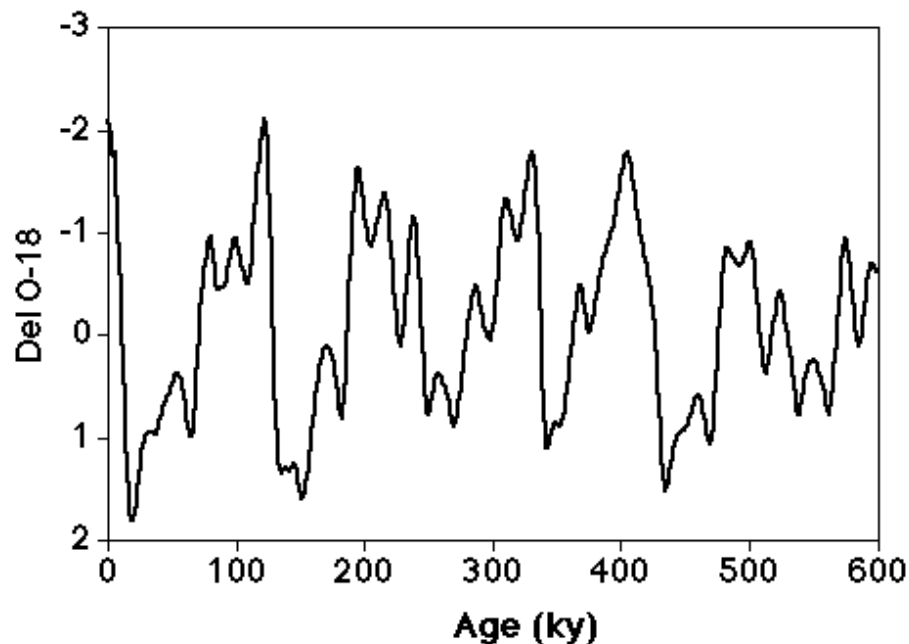
Ocean Sediments as Recorders of Earth History

- 1) Types of fossils give information about temperatures, ecosystems, etc.
 - 2) Chemical analysis tells us about temperature and chemistry of the water
- There are many chemical analyses that are used. Here's one as an example: Oxygen isotope ratio measurements....

^{16}O = oxygen with 8 neutrons (most common)

^{18}O = oxygen with 10 neutrons

- As CaCO_3 is formed from dissolved ions, $^{18}\text{O}/^{16}\text{O}$ ratio depends on temperature



The figure above gives the change in the $^{18}\text{O}/^{16}\text{O}$ ratio in the shells found in calcareous ooze over the past 600,000 years. Higher points on the curve correspond to times of warmer climate (interglacials), whereas lower points correspond to glacial times. Notice how the earth appears to descend slowly into ice ages (with some bumps along the way). In comparison, the ends of ice ages appear to be rather abrupt. Also notice how the ice ages are almost evenly spaced. This periodicity has been used by many to infer that slight changes in the earth's orbit around the sun, which create periodic variation in the solar input to various latitudes, drive the current periodic ice ages.

Paleoclimate Research seeks to answer questions such as....

Why does the earth have ice ages?

How does the earth's climate system work?

How will it respond to increased greenhouse gases?

Does it tend to resist change?

Does it tend to amplify the effects of changes (e.g., added greenhouse gases)?

Are there "thresholds" we should avoid?

Research such as this makes use of ocean sediments as one of our best records of climate change on earth.