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….

\[ ^{16}\text{O} = \text{oxygen with 8 neutrons (most common)} \]
\[ ^{18}\text{O} = \text{oxygen with 10 neutrons} \]

- 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.