

Name: _____

Introduction to Oceanography 112 - M. Yasuda
Date: September 24, 2009
Assignment 5

Reading – Week 4 Mapping

Chapter 1 – All; Appendices: I, III, IV

Vocabulary list

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|-------------------------|--|-----------------------------|
| 1. Sea level | 13. Multibeam sonar | 22. Prime meridian |
| 2. Surface relief | 14. Swath | 23. Parallel |
| 3. Morphology | 15. Global positioning satellites (GPS) | 24. Meridian |
| 4. Elevation | 16. Geographic information systems (GIS) | 25. Chronometer |
| 5. Topographic map | 17. Satellite altimetry | 26. Greenwich |
| 6. Bathymetry | 18. Gravitational field | 27. International date line |
| 7. Chart | 19. Latitude | 28. Color-contour map |
| 8. Bathymetric map | 20. Longitude | 29. Data visualization |
| 9. Sonar | 21. Equator | 30. Map projection |
| 10. Acoustic wave | | 31. Map scale |
| 11. Two-way travel time | | |
| 12. Echo-sounding | | |
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Websites related to lecture

USGS FAQ about the Earth's magnetic field
<http://geomag.usgs.gov/faqs.php>

GEBCO World Map - Bathymetry
http://www.gebco.net/data_and_products/gebco_world_map/

Space weather
<http://helios.gsfc.nasa.gov/weather.html>

GOALS

Plate tectonics

1. Be able to explain how significant features of the seafloor formed
2. Know the key differences between lithosphere and crust
3. Be able to identify the types of crust that lie underneath the continents vs. oceans
4. Know what constitutes a tectonic plate
5. Distinguish between active and passive continental margins, and identify significant characteristics
6. Be able to identify tectonic features associated with divergent, convergent, and transform plate margins
7. Be able to describe and illustrate the key processes of plate tectonics - seafloor spreading and subduction
8. Know the approximate age of the oldest oceanic crust and the overall age pattern of the seafloor
9. Be familiar with the pattern of seafloor paleomagnetic anomalies and why it supports modern plate tectonic theory
10. Know the relative age of oceanic crust vs. continental crust
11. Know the approximate scientific age of the Earth
12. Be able to describe the relationship between the age and depth of the seafloor
13. Be able to explain how layers of sediment are used to interpret the Earth's history
14. Know which oceans are currently closing or opening

Shape of the Earth and Mapping

1. Be able to find a location on the earth by latitude and longitude
 2. Be able to identify significant features of the ocean floor – by map, image or written description
 3. Know the average depths of the ocean, mid-ocean ridges and continental shelf edge
 4. Know how to use the principle of sonar to measure bathymetry AND be able to estimate depth from a cross-section of two-way travel time data
 5. Be able to describe general ways that shoreline position changes over time – including causes, rates of change, and degree of change
 6. Be able to cite ways in which the volume of seawater in the world oceans can change
 7. Be able to identify modern vs. historical methods of determining location
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ACTIVITIES

A. Tectonics and the real world

1. If the Pacific Plate is moving to the northwest at a rate of 5cm/year, what will be different about the geography of “southern” California in 20 million years? State your answer and explain your thinking.
2. Some of you may have seen the cable program, called “Deadliest Catch”, about crab fishing in the Bering Sea
 - a. Where is the Bering Sea?
 - b. Is the crab fishing taking place on continental or oceanic crust? Explain how you came upon your answer.
 - c. What is the maximum depth and thus the longest rope that needs to be attached to a crab pot?

See map: http://www.gebco.net/data_and_products/gebco_world_map/images/gda_world_map_small.jpg

For more info about this map: http://www.gebco.net/data_and_products/gebco_world_map/

About the Deadliest Catch: <http://dsc.discovery.com/fansites/deadliestcatch/deadliestcatch.html>

B. Continental shelf and the real world - methane clathrates

1. What is a methane hydrate? Name the chemical compounds and indicate which is trapped within the other?
2. What are the two major settings in which methane hydrate is found?
3. What are the two environmental conditions that cause its constituent compounds to form the methane hydrate structure?
4. Why is there such interest in methane hydrate?
5. What are the hazards associated with methane hydrate?

The National Methane Hydrates R&D Program

All About Hydrates

http://www.netl.doe.gov/technologies/oil-gas/FutureSupply/MethaneHydrates/about-hydrates/about_hydrates.htm

Is Earth’s Methane a Time Bomb?

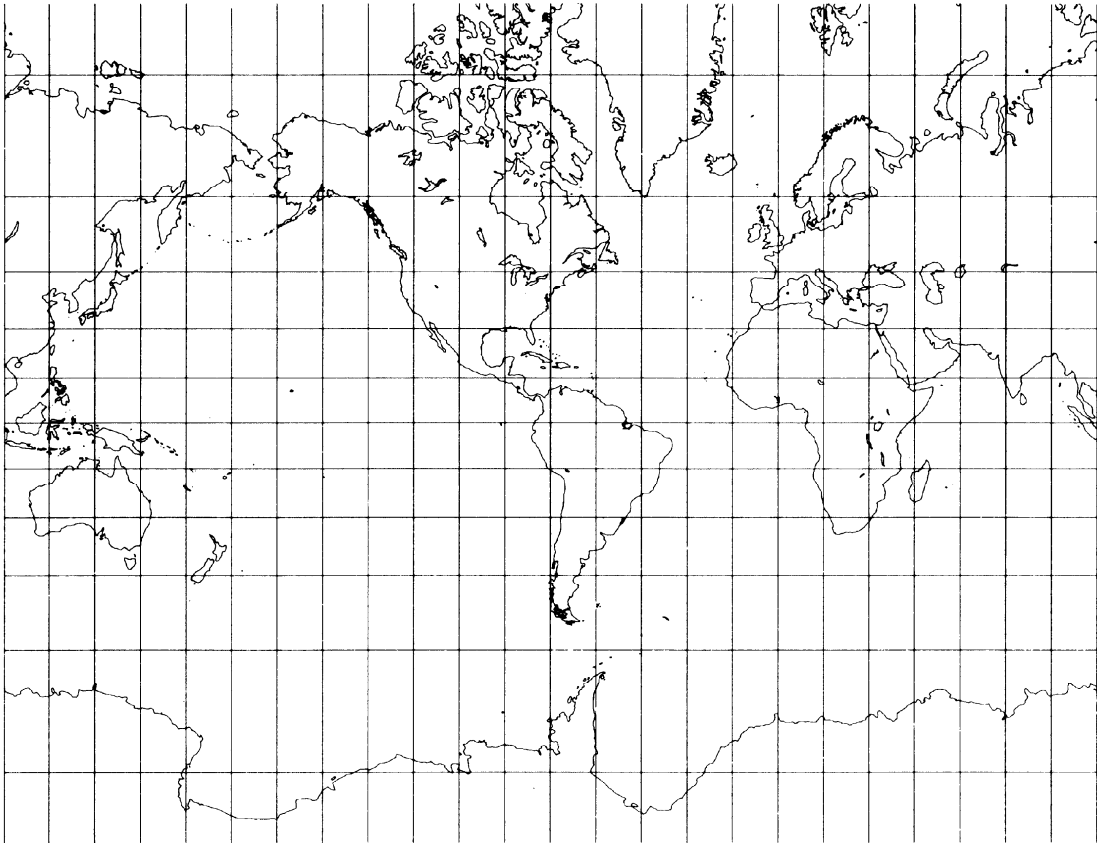
<http://search.japantimes.co.jp/cgi-bin/eo20090922mr.html>

C. Finding a place by latitude & longitude coordinates

Your main task is to mark the following location on the map below by answering the following questions. This will be on the next midterm so make sure you can do this.

150°E 60°N

- a. Find the Prime Meridian and label it.
- b. Find the Equator and label it.
- c. Mark the location indicated by the above latitude and longitude with a circled "x". Count carefully.



- d. The lines of longitude are spaced 15 degrees apart on this map. Usually scales are marked off in 10s, 5s or some even number. What is the significance of 15 degree spacing?
- e. You are Captain Cook and it is 1778. You go on your third voyage and sail around Hawaii. How are you plotting your travels?
 1. What ship-based method could you have used to determine latitude?
 2. What time of day could you have made the determination of latitude?
 3. What ship-based method could you have used to determine longitude?
 4. What time of day could you have made the determination of longitude?
 5. Once you have a paired set of longitude and latitude coordinates, you plot your location on a base map. You do the same thing the next day and the next. Do you anticipate any source of inaccuracies in your map? Explain.
 6. How would you do things differently today? Explain. Pretend you have infinite funds but current

technology.

* If you like maps and drawing, Geographic Information Systems (GIS) may be a field for you. Check out the Department of Labor projection for jobs in this field at: <http://www.bls.gov/oco/ocos040.htm>

- f. The map shown above is a Mercator projection. On a Mercator projection, the world is drawn with lines of longitude parallel to each other.
1. On the Mercator projection, does Greenland appear larger or smaller than South America?
 2. Which of the two continents has greater actual area?
 3. Do areas appear abnormally large towards the poles or equator?
 4. Can you use a fixed distance scale to interpret distances across an entire Mercator map? (for example 1 inch = 1,000 miles)

NOTES

Plate Tectonics

A theory that assumes that the Earth's surface is reshaped by the motion of thin, yet laterally extensive and rigid pieces of the surface called "plates", which move relative to each other, driven indirectly by convection currents in the underlying mantle.

The concept that describes and explains how the most significant features on the Earth's surface are produced by processes within the Earth when they act on units at the surface called plates. The plates move around, and change in size and number over time.

Note:

1. Plates are pieces of lithosphere.
2. Plates change size over time.
3. Most plates include both oceanic and continental crust.
4. Most of the change in plate size involves oceanic parts of the plate.
5. Earthquakes and volcanoes occur most often at the margins or edges of plates.
6. Oceans and continents change over geologic time.

How scientists use the term "theory"

"A general explanation of a characteristic of nature consistently supported by observation or experiment."

"A well-substantiated explanation of some aspect of the natural world."

-WordNet, Princeton University

"In scientific usage, a theory does not mean an unsubstantiated guess or hunch, as it often does in other contexts. A theory is a logically self-consistent model or framework for describing the behavior of a related set of natural or social phenomena. It originates from and/or is supported by experimental evidence (see scientific method). In this sense, a theory is a systematic and formalized expression of all previous observations that is predictive, logical and testable. In principle, scientific theories are always tentative, and subject to corrections or inclusion in a yet wider theory."

-Wikipedia

"Theory" In everyday conversation

An unproved assumption, conjecture or speculation.