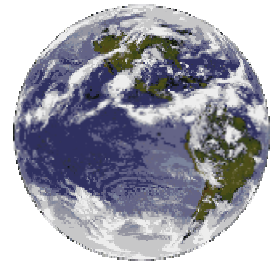


What is Physical Geology all about?

Physical Geology ...

- examines the earth materials, processes, surface morphology, internal structure, evolution, resources and environment, in order to
- understand the problems related to (i) earth hazards like earthquakes and volcanism and the processes that govern them, (ii) the issues like global warming, environmental and/or evolutionary impacts of catastrophic events, waste disposal, coastal habitat etc., and (iii) the earth resources and their potential exhaustibility.



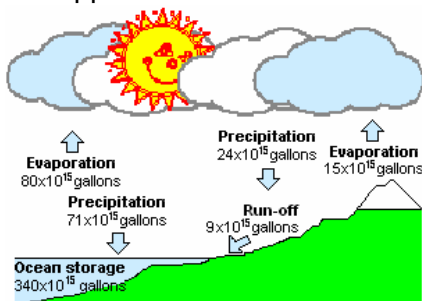
What makes the Earth unique?

- This “3rd Rock from Sun”, is called the “Lonely Planet” because, to our knowledge as yet, earth is the only planet with the evidence of life.
- It is also called the “Blue Planet”, because of abundance of water.

Visit <http://cs.ndsu.nodak.edu/~slator/htm/PLANET> to use “Geology Explorer: Planet Oit Information” being developed at North Dakota State University.

Two cycles have shaped the Earth’s surface

- The **hydrological cycle** continually recycles the water on Earth. It has a particularly intriguing implication, however. This cycle begins with the oceans and circulates water between the oceans and land by way of evaporation → precipitation → run-off. Indeed, without run-off from land which replenishes the net loss of water that the oceans suffer due to evaporation, oceans may well disappear over time.



- But this run-off also dumps eroded land materials in the oceans at the rate of ~20 billion tons per year – enough to fill the ocean in ~150 Ma, if the average sediment density is 2 g/cm^3 . This is also the

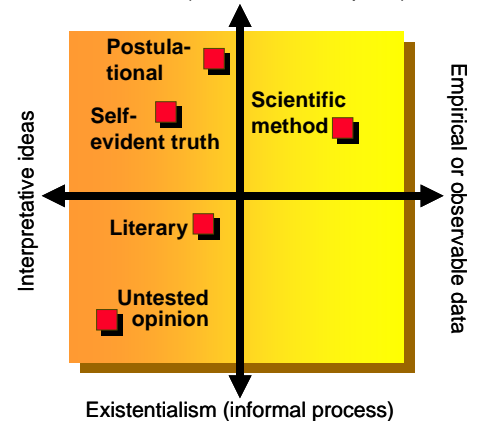
estimate of time needed to fill up the ~310 million km^2 of world ocean, whose average depth is ~4 km, if average sedimentation rate is ~2 cm/yr.

- Oceans have existed throughout the earth’s history, however, ever since they first formed ~3.5 Ga ago, although the present ocean floor has ≤ 200 Ma old rocks, compared to the ≥ 4 Ga ages on land, and earth’s surface area has remained unchanged. Also, the ocean floor rock is basalt, a volcanic product rich in Fe, Mg and Ti, whereas granite, a rock richer in K, Al and Si, forms the continental basement.
- **Plate tectonics** is the postulate that reconciles these evidences, and provides for the continuous creation of new ocean basins as hydrological cycle fills up the existing ones, to explain the continuous reconfiguration of continents and oceans over geologic time.

The Scientific Approach

Geology is perhaps the friendliest face of science that we encounter in daily life, whether at work, or at home, or when we visit a National Park! Science is a continuous quest for the basic rules that apply equally all over the universe. Discovering these rules over such a vast single system then becomes a process of rationalizing empirical observations and securing better observations to refine the resulting structural formalism – a process that requires amenability to falsification as the hallmark of any scientific proposal.

Rationalism (formal structural proof)



The limitations of space and time prevent laboratory modeling of earth processes, for instance. But then, the finding that San Andreas Fault is a boundary along which North American plate has slipped by ~600 Km relative to Pacific plate in the past ~25 Ma can be easily refuted by marshalling the evidence that rocks younger than this age are now found adjacent to one another, undisturbed, across the fault.

