SHAPE AND SURFACE RELIEF OF THE EARTH (MAJOR FEATURES OF THE EARTH)

The earth is not a sphere, but an ***oblate spheroid***. This shape is caused by the Earth's rotation around its own polar axis, which causes a slight bulge at the equator and a minor flattening at the poles.

The equatorial diameter of the Earth: **12,756.78 km**
Whereas the polar diameter is only: **12,713.82 km**

With the help of satellite measurement, the *equatorial* axis is found to be **42.8** km longer than the polar axis.

The polar axis is slightly longer from the centre to the N pole than from the centre to the S pole.

The mass of the earth has been computed to be: **$5.976X10^{27}$** gm
Volume: **$1.083X10^{27}$** gm/cu cm.

Because the mean densities of the surface rocks are less than 5.517 (they average about 2.7 gm per cubic centimeter on continents and about 3.0 gm per cubic centimeter for ocean-floor), we must infer that the density of the Earth's interior is greater than 5.517. This follows from the necessity of having a greater density at depth to counterbalance the lower-than-mean density of surface rocks in order to make the mean work out to be **5.517.**

COMPOSITION OF THE EARTH'S CRUST

Name	Element	Proportion	
		By wt.	By vol.
Oxygen	O	46.6	93.8
Silicon	Si	27.7	0.9
Aluminium	Al	8.1	0.5
Iron	Fe	5.0	0.4
Calcium	Ca	3.6	1.0
Sodium	Na	2.8	1.3
Potassium	K	2.6	1.8
Magnesium	Mg	2.1	0.3
All others	-	1.5	-
Total	-	100	-

MAJOR GEOLOGIC FEATURES OF THE EARTH'S EXTERIOR

The Lithosphere is divided into two main groups of first order relief features:

1. Continental Masses (between sea level and 1 km or 3,300 ft elevation)
2. Oceans Basins (3 to 6 km or 10,000 to 20,000 ft below sea level)

Scattered across parts of both are various volcanic edifices.

1. Continental mass

The major land areas of the world constitute about 29.2 % of the surface of the earth. If we take 100 fathom (or 180 m or 600 feet) below sea level as the continental boundary (continental shelf), this value will change to 35 % of the total earth's surface. Continental shelves may be considered as submerged outer border of the continents. Continental masses are the major high standing parts of the lithosphere, averaging about 800 m in altitude. In a general way the continents are broad, table like areas whose edges slope away rapidly to the deep ocean floor.
Continents can be best analyzed by organizing them into large natural regions called physiographic provinces where surface morphology and kinds of rocks form consistent association. They include:

Mountains
Plains
Plateaus
Shields

MOUNTAINS:

A mountain is considered to be any land mass that stands 400m or more higher than its surroundings. The great mountain belts of the earth have been named cordilleras (Spanish = strings). Individual parts of cordillera based on morphology include:

Mountain ranges
Mountain systems
Mountain chains

PLAINS

Features known as plains typically show small variations between the lowest and the highest parts or relief. Commonly plains are underlain by sediments, and the surface of the plains has grown upward by addition of new layers of sediments at the top.

Plains characterizes many:

Coastal areas
Interiors of continents
Smaller tracks within mountain belts

PLATEAUS

A plateau is a high standing area within which the rocks strata are generally horizontal. They may be also volcanic.

SHIELDS

Areas referred to as shields or continental shields are generally low lying regions whose rocks have formed by the joining together of numerous ancient mountain belts. They are usually thick and rigid. They have undergone erosion for long span of time, so have low relief.

They are composed of truly ancient rocks. Rocks as old as 3.8 billion years have been found in these areas.

2. Oceans and ocean basins

Ocean water and the hydrosphere

The Hydrosphere is the collective name of the water on and near the surface of the earth in a liquid or solid (frozen) state. They occur in the oceans and seas, lakes, rivers, and occupy pore spaces beneath the earth (groundwater). Solid water, in the form of ice is found in ice sheets, icebergs and glaciers.

Importance

1. As transporter of regolith and as shaper of Earth's surface
2. Oceans act as a collection reservoir for nearly all substances on earth
3. An essential ingrediant for all forms of life.

Sea water covers about 71 % of the earth's surface. But the aggregate area of the ocean basin is only 60 %. The ocean basin is thus more than full, and the overflow of sea water inundates nearly 26 million sq km of continental shelf. The North Sea, the Baltic and Hudson Bay are examples of shallow seas (epicontinental seas) which lie on the shelf. During the ice age much of the continental shelf was land. Mean water depth is about 4 km which is not so much compared to the diameter of the earth. If water is uniformly distributed over the surface of the earth, it would form an ocean of 2750m deep.

Ocean basins

Topography of the ocean basin floor

Continuously recording echo-sounding apparatus (precision depth recorder) was used after world war II. It makes use of sound emitting device at the bottom of the lship.

The reflected sound is picked up by the microphone. Automatic recoring device indicate the time. Reflections are plotted continuously by a writing instrument and gives the profile of the ocean bottom.

According to system of submarine landform classification by Bruce C. Heezen, Ocean basins fall into three major divisions:

a. The continental margins
b. The ocean basin floors with the trenches , and
c. The Mid oceanic ridges

a. Continental margins, It includes:

Continental shelves
Continental slopes
Continental rise
Submarine canyons

Continental shelves: They fringe the continets in width from a few km to more than 300km . Generally having very smooth and gently sloping floors, Mostly they are less than 600ft (180m) deep. Eastern coast of USA is the example.

Continental slopes: Along the sea-ward margins the continental shelves give away to the continental slopes. The actual inclination with horizontal is only 3-6 ^{0}, but compared to submarine relief, it is high. The continental slope drops from the sharply defined brink of the shelf to depths of 1370-3200m (4,500-10,500ft)

Continental rise: The continental slope lessens in steepness and is replaced by continental rise. A surface of much gentler slope, decreasing in steepness towards the ocean basin floor. Ranging in width from hundred to several hundred km, they have moderate to low relief. It reaches up to the depth of 5 km at its outer margin.

Submarine canyons: Notching the continental slope visualized as resembling gullies cut by water erosion in the side of a hill, but on a huge scale. They are scored by currents of muddy water (Turbidity flows)

B. The ocean basin floors:

Second of the major topographic divisions of the ocean basins is the extensive region of basin floor- generally lying in the depth range of 4600-5500 m (15,000-18,000 ft). It is divided into three catagories of forms:

1. Abyssal plains and hills
2. Ocenic rises
3. Sea mounts.

1. It is an area of the deep ocean floor having a flat bottom with very faint slope. Characteristically situated at the foot of the continental rise. It is found due to the deposition of sediments brought by the turbidity currents and all the irregularities are burried.

a. Mid oceanic canyons: They are found in abyssal planes also. It is due to branching turbidity channels like the river system on the land.

b. Abyssal hills: It is an area of hundreds of miles in breadth over which the surface rises several hundred feet above the surrounding abyssal plains. For example Bermuda Rise.

c. Sea mounts: They are isolated peaks rising 900m (3,000 ft) or more above the sea floor. They are found in continental rise but more commonly in ocean floors. They are also called guyots.

TRENCHES AND ISLAND ARCS

Trenches

The deepest points on the ocean floors occur in long, narrow trenches, also reerrd ot as foredeeps, commonly with mazimum depth of 7500 to 9000. Almost invariably, the trenches lie immediately adjacent to and on the oeceanward side of submarine ridges, the island arcs, or close to coastal mountain ranges of the continental margins, the mountain acrs. Trenches of the western North pacific ocean are particularly striking. Deepest of all may be the Marianas Trench, where a record depth of 11,033 m has been measured. At least five other pacific trenches have depths over 10,000 m.

The trenches have widths of 40 to 120 km and lengths of 500 to over 4500 km. Longest of all is the Peru-Chile trench, off the west coast of South America, extending for 5900 km.

Volcanic island arcs:

are built by magma rising from sources close to the upper surface of downbent plate margins plunging into the asthenosphere. The greatest development of volcanic island arcs is along the norhtern and western sides of the pacific Ocean basin.The Aleutian Islands, Arc-Trench system of Indonesian Islands of Sumatra and Java, japan Arc

MID OCEANIC RIDGES

It is 64,000km in length. The ridge runs down the middle of the North and South Atlantic oceans, into the Indian ocean basin, then passes between Australia and Antarctica to enter the South pacific basin.

Turning north along the eastern side of the pacific (East pacific Rise), the ridge contacts the north American Continent along the coast of Mexico.
The Mid-Oceanic Ridge also extends across the arctic ocean basin.

Mid-Atlantic Ridge: It is a belt of 2000 to 2400 km wide, in which the surface rises through a series of steps from abyssal plains on both sides toward the central, or median, line, where the ridge assumes mountaneous proportions. Since the higher points lie at depth of 1800 to 2700 m, the mid Atlantic ridge has a height of roughly 3700 m.