

DYNAMIC EARTH AND VOLCANOS

MOVEMENT OF THE CONTINENTS:

Dr. S.W. Navaratne

Senior Lecturer, Department of Geology, University of Peradeniya

The present distribution of continents results from the break up and joining together of previous continents. The process of breaking and joining was probably active ever since the Earth first had a crust. The Continental Drift was one of the greatest geological controversies of all time. Today almost all the geologists believe in continental movements.

In studying continental drift we investigate:

1. geometrical similarities between the margins
2. geological similarities between the margins
3. geophysical characteristics that can be correlated
4. flora and fauna that can be correlated

GEOMETRICAL SIMILARITIES:

One of the best examples for this is South America and Africa. Actual coastlines of the two continents do not fit significantly. The reason for this is sea erosion of coastlines and change of shape due to rise and fall of the sea level. Over the last few million years the coastline has been a very unstable feature. The real edge of a continent lies about 1000m down the continental slope and the similarity of the shape of the join at this level is significant.

GEOLOGICAL SIMILARITIES:

Similarly the geological features across the join older than the time at which separation occurred. We look for significant geological features e.g. 1. Stratigraphic 2. Flora and Fauna and 3. Orogenic belts that cut across the join. On top of the eroded remnants of these orogenic belts lie some glacial deposits formed sometime between 350-250 my ago. These glacial deposits occur both in Africa and South America and also indicate that the 2 continents broke up between 200 - 50 my ago.

Climatic belts of the world have changed their positions with respect to one another. South America and Africa moved from high pole latitudes near South Pole to equatorial latitudes, sometime between Pennsylvanian-Carboniferous glaciation and U-Triassic deserts.

GEOPHYSICAL EVIDENCE:

The earth's magnetic field today is very similar to the field that would be produced by a bar magnet at the center of the earth aligned parallel to earth's spin axis. The field behaves in such a way that the lines of force emerge at the earth's surface at angles that are unique for a particular latitude. When sediments containing Fe mineral

are deposited or when magmas crystallize they take on a weak magnetization whose direction parallels that of the earth's magnetic field at the time. by assuming that this field resembles that of a bar magnet parallel to the earth's spin axis, it is possible to determine the paleo-latitude and pole position from the direction of magnetization in a rock. These evidence show that the present sea floors are younger than 200my.

THE SUPER CONTINENTS:

The reconstruction of the ancient continents indicate that more than 180 my ago there was a single super continent which is called Pangea. This super continent Pangea broke up to form two giant continents about 180 my ago. These two giant continents

were known as Laurasia, the northern continent and Gondwanaland, southern continent. They started to separate about 135 my ago to form present continents. All the pieces of the Gondwanaland are recognizable today. The Pieces include South America, Africa, Arabia, Madagascar, India, Sri Lanka, Australia, New Zealand and Antarctica. Laurasia contained Europe, North America, and most of the Asian continent.

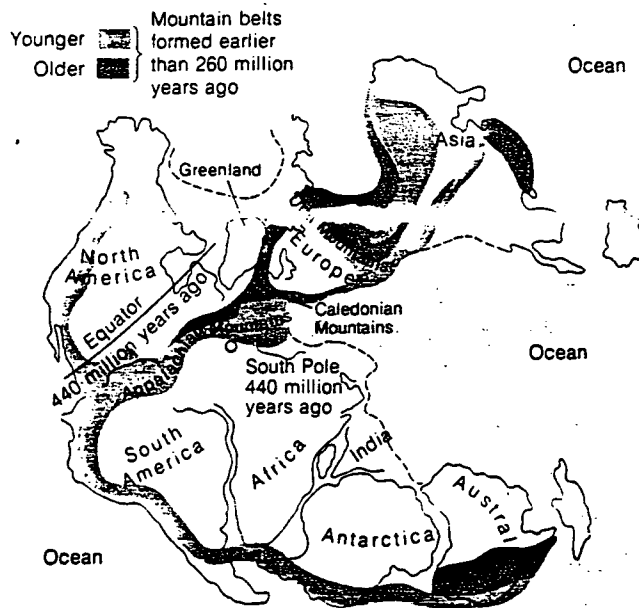


Fig. 1 The super continent Pangea as it looked more than 200 M.Y. ago

THE INTERIOR OF EARTH

The Earth is a layered sphere. The outer most part is the earth's crust which is 0-10Km thick. Then there is a thicker layer called earth's mantle (see Fig.). The most inner part of the earth is the core of the earth. The core has a liquidous and solid parts.

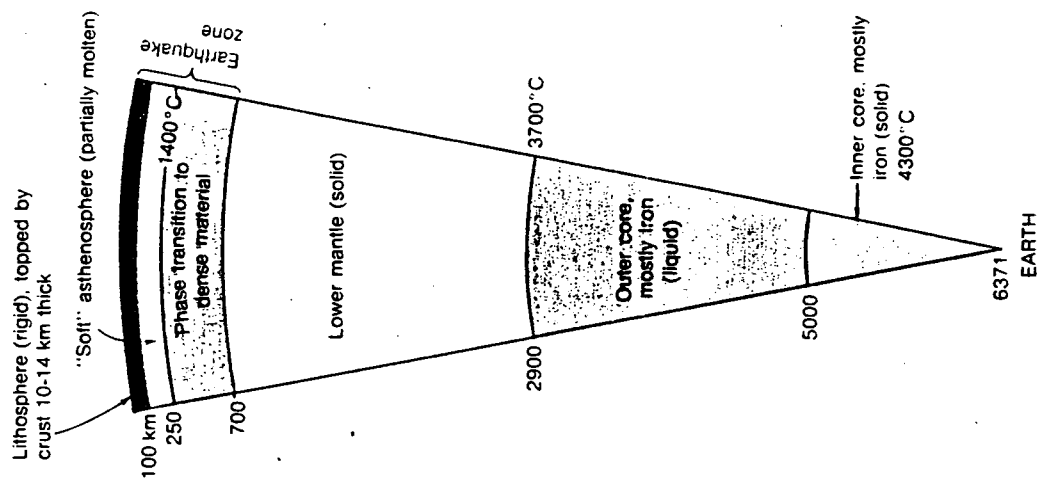


Fig. 2 Interior of the Earth

The earth's crust and the upper part of the upper mantle are made of solid material, the rocks. The rest of the mantle is made of plastic like material, molten rocks. The outer part of the core is made of liquid Fe and Ni and the inner part of the core is made of solid Fe and Ni.

THE PLATES

The solid rocky part of the earth is the lithosphere which floats over the semi liquidous asthenosphere. The lithosphere includes the crust and the most upper part of the mantle. The lithosphere includes sometimes only the oceanic crust and some other times the oceanic crust and the continental crust. The whole lithosphere is broken into several parts which are called plates.

The drift or the movement of the continents is resulted due to the relative movements of these plates. Some plates separate from each other and some move towards each other. The plates that move towards each other make highly destructive zones by one plate going under the other.

The friction between subducting plates create great pressures and temperatures which lead to melting of rocks in that zone. The zones will be highly deformed and the molten rock material come out under high pressure doming the floor upward. This is how the continental movements are related to the volcanic activity.