

Department of Geography, Bidhannagar College

Study material by Shewli Shabnam

Paper –I

Outline of the study:

Geological Time Scale

The Geological Time Scale (GTS) is a calendar of earth's history. It is a system of chronological measurement that relates stratigraphy to time, and is used by geologists, geographers, palaeontologists and other earth scientists to describe the timing and relationships between events that have occurred throughout earth's history.

THE GEOLOGICAL TIME-SCALE

<i>Era</i>	<i>Period</i>	<i>Epoch</i>	<i>Date of commencement (millions of years ago)</i>	<i>Major mountain-building episodes in Europe</i>	
CAINOZOIC	QUATERNARY	HOLOCENE	10,000 years ago	Alpine	
		PLEISTOCENE	2		
	TERTIARY	NEO-GENE	PLIOCENE		7
			MIOCENE		26
		PALAEO-GENE	OLIGOCENE		38
			EOCENE		55
			PALAEOCENE		65
MESOZOIC	CRETACEOUS		136		
	JURASSIC		190		
	TRIASSIC		226		
PALAEOZOIC	PERMIAN		260	Hercynian	
	CARBONIFEROUS		340		
	DEVONIAN		400	Caledonian	
	SILURIAN		430		
	ORDOVICIAN		500		
	CAMBRIAN		580		
PRECAMBRIAN		Oldest rock	3,300		
		Origin of Earth	4,500		

Continental Drift

Proponents of Continental Drift

Early proponents were Sir Francis Bacon (1620), Antonio Snider (1858), F.B. Taylor (1910). However the first comprehensive study of continental drift was made by German Meteorologist Alfred Wegener in 1912 and his work was translated in English in 1924. He was trying to explain the changes in climate of different regions in geological past and proposed continental drift hypothesis.

Basic Premises

1. Theory of isostasy
2. Three layers of the earth's interior

Distribution of continents and oceans at different periods

Pangaea (comprising Gondwanaland and Laurasia) & Panthalassa, Opening of Tethys, Breaking of Gondwanaland, Drifting of North America from Laurasia.

Forces responsible for the drift

Tidal force – westward movement

Gravitational force and force of buoyancy – movement towards equator

Shifting of the position of poles and the equator

Polar wandering

Explanation for the formation of fold mountains and island arcs

Evidences in favour of continental drift

1. Jig-saw-fit
2. Geological and structural similarities
3. Palaeontological evidences
4. Palaeoclimatic evidences
5. Palaeomagnetic evidences

Criticism

1. Direction in drift
2. Inadequacy of forces of drift
3. Time of breaking of Pangaea
4. Problems regarding mountain building
5. Less perfect Jig-saw-fit

Conclusion

This theory paved the postulation of plate tectonic theory.

Sea Floor spreading

Proponent

Harry Hess in 1960

Main Concept

Creation and destruction of oceanic crust

Supporting evidences

1. Continental drift
2. Age of the rocks of the ocean floor
3. Age of the oceanic sediments
4. Location of the earthquake foci
5. Stripped pattern of magnetic anomalies
6. Transform faults
7. Deep Sea drilling Projects

Plate Tectonics

Proponents

The theory of plate tectonics is based on the works of D.P. Mckenzie, R.L. Parker, W.J. Morgan, J. Tuzo Wilson, le Pichon and many other scientists.

Name of the major and minor plates

Characteristics of Plates

Types of Plate boundaries and associated landforms

1. Divergent plate boundaries – formation of mid-oceanic ridge and new earth crust
2. Convergent plate boundaries – subduction and obduction
 - Collision between two continental crust – formation of fold mountains
 - Collision between two oceanic crust – formation of island arc
 - Collision between continental crust and oceanic crust – formation of cordilleras (fold mountain)
3. Conservative plate boundaries – transform fault
4. Triple junctions

Concept of Benioff zones

Causes of plate movement

1. Convection current hypothesis
2. Hot spot
3. Forces of injecting magma pushing the plates
4. Pulling effects of the subducting plates

Criticism

1. Discrepancy in the amount of creation and destruction of crust
2. Subduction zones are not found in every ocean
3. Presence of numerous small plate fragments makes the simple theory appear inadequate

Conclusion

It is called global tectonics as it can explain many features and processes of the earth's crust.