

Geology of Iraq

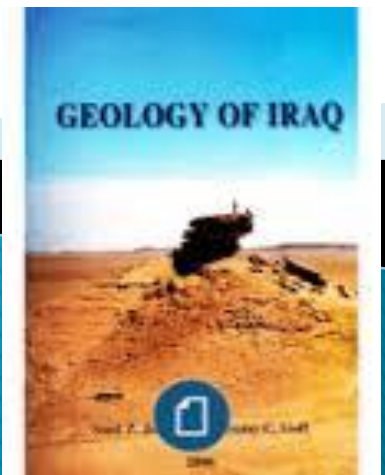
Lecture-1

(Introduction)

Prof. Abed Fayyadh

Applied Geology Department
College of Science
University of Anbar

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Morphology

Iraq is near the centre of the so-called "Fertile Crescent" which is characterized by a topographically-low, generally cultivated area (central depression) which extends from central Syria to the Arabian Gulf (Fig.1-1).

*This NW-SE oriented trough contains the youngest sediments in Iraq and is flanked by a gently-inclined plateau to the W and SW, and by a series of ridges and depressions passing into mountainous area in the NE.

*The highest elevation in W Iraq is near the Iraq-Saudi Arabia-Jordan triple border junction (936 m), from which the ground slopes towards the Euphrates River at a gradient of 10-20 m/km.

This western inclined plain is a **desert** with rainfall ranging from 50–100 mm/year and can be divided into ***two sectors***;

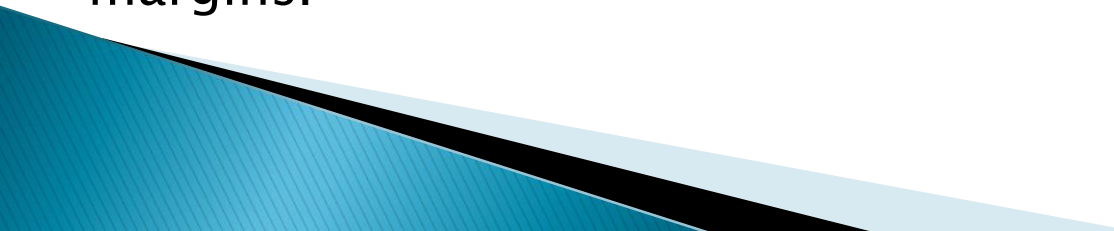
- The Western (Widyan) Desert** lies N of latitude 32° and is characterized by numerous wadis of E–W, NW–SW and N–S orientation.

- The Southern Desert** lies S of latitude 32° and WSW of the Euphrates River.

*The central depression (Fertile Crescent) is divided into ***two regions***;

- 1–Mesopotamian Plain** in the SE.

- 2– the Jezira Plain** in the NW lacks the active drainage often seen in the Mesopotamian plain contains widespread Quaternary deposits of the Tigris and Euphrates rivers. The northern part of the plain is elevated and dissected, revealing older Pleistocene river fans which also characterize its eastern and western margins.



*The *jezira Plain* area lies at a surface elevation of about 250 m; it lies between the Mesopotamian Plain and the Euphrates depression of E Syria.

*To the E of the central depression lies an area with *lines of hills*, separated by broad depressions, forming the foothills of N and NE Iraq.

These hills are associated with long anticlinal structures; the depressions correspond to broad synclines (Fig. 1–1).

The boundary between the foothills and Mesopotamia Plain is abrupt and is defined by the SW flank of the Makhul–Hemrin–Pesh–i–Kuh anticlinal range.

*Further to *the NE*, anticlines become more frequent and their elevation increases.



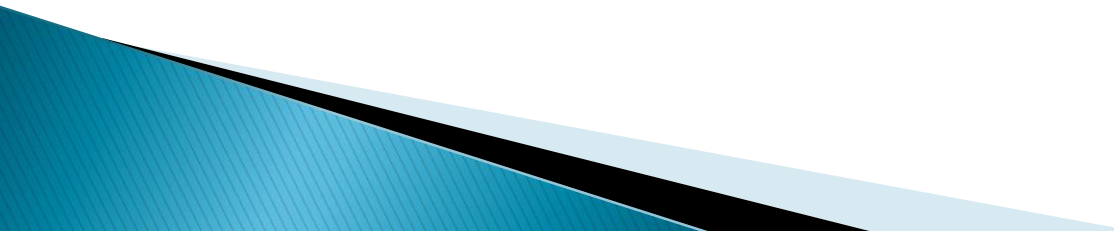
High anticlinal mountains to the **E** of Kirkuk and **N** of Mosul form well-defined surface features.

They are generally of whale back character, built by Eocene limestone in their cores and flanked by Miocene and Pliocene clastics.

*Further to the **N and N E** the mountains are built by Cretaceous limestone cores flanked by Palaeogene clastics.

*Further **E** they are built by Upper Cretaceous and Jurassic limestones and flanked by **Cretaceous** clastics.

*Along the **NE** border of Iraq with Iran and Turkey the mountainous area is structurally more complex and comprises a series of thrust sheets which reach 3000 m in elevation and contain metamorphic and igneous rocks.



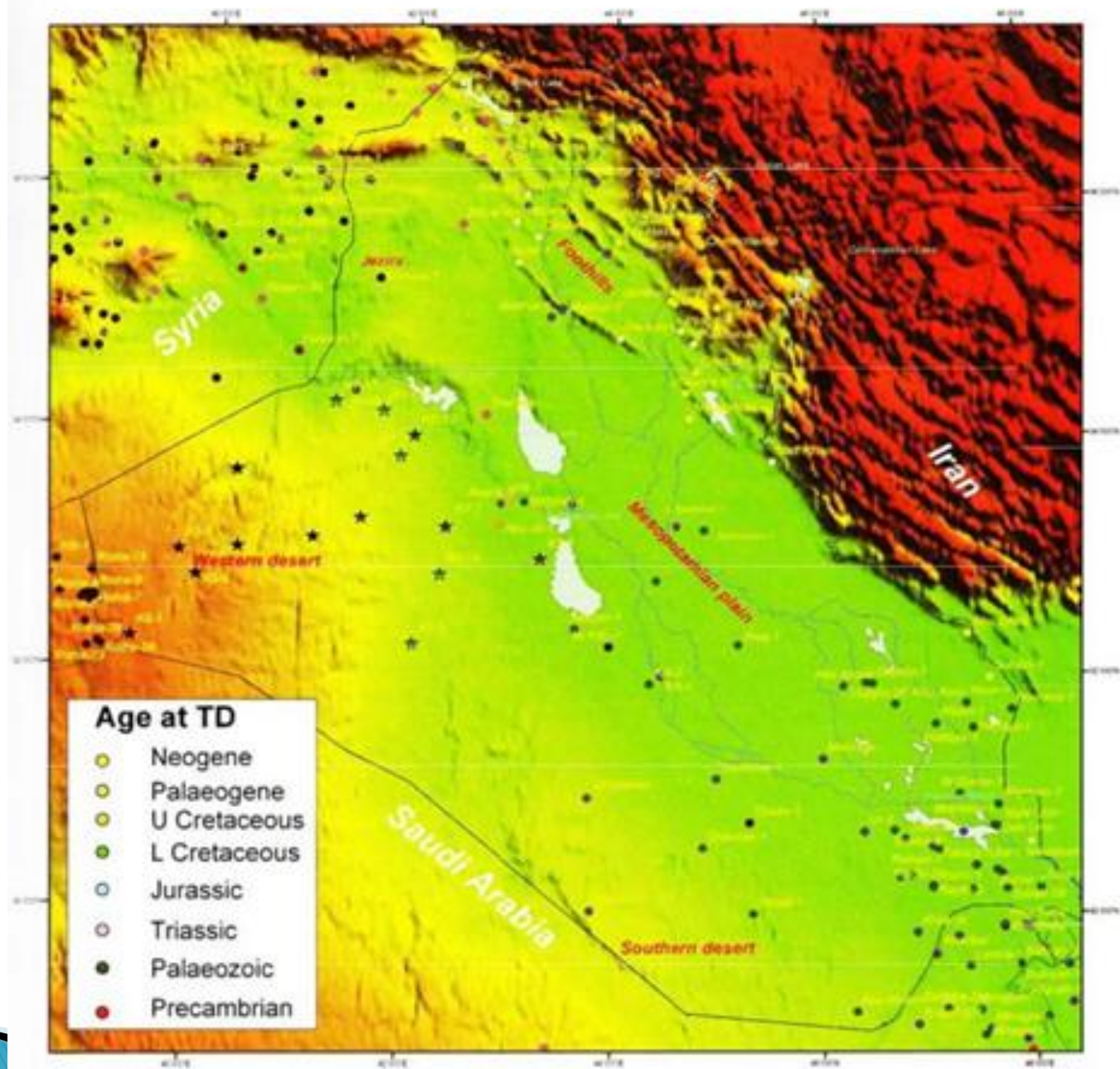
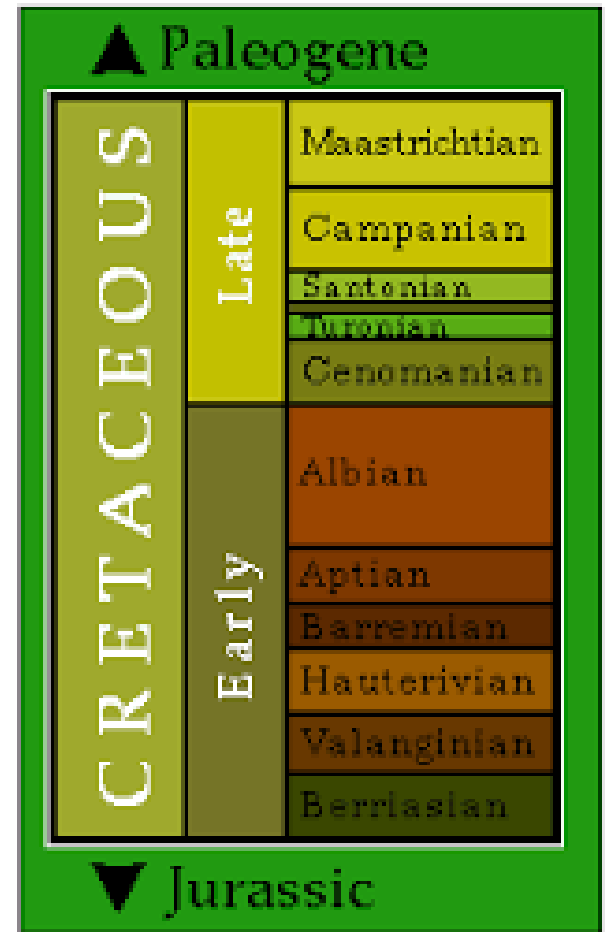
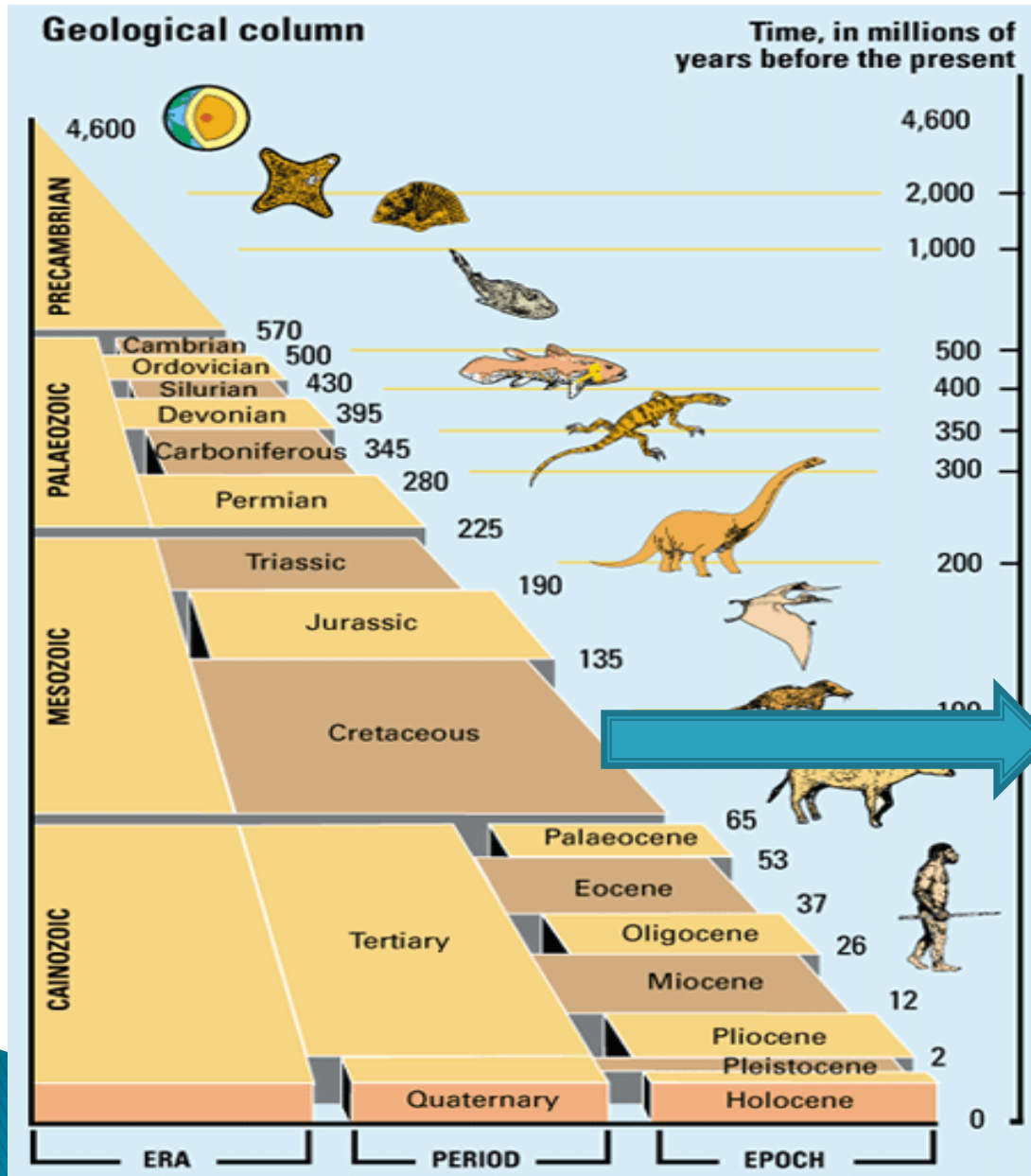


Fig. 1-1: Topography of Iraq with location of wells used in the book (oil wells as circles and deep water wells as stars)

Geological Time Scale



Surface geology

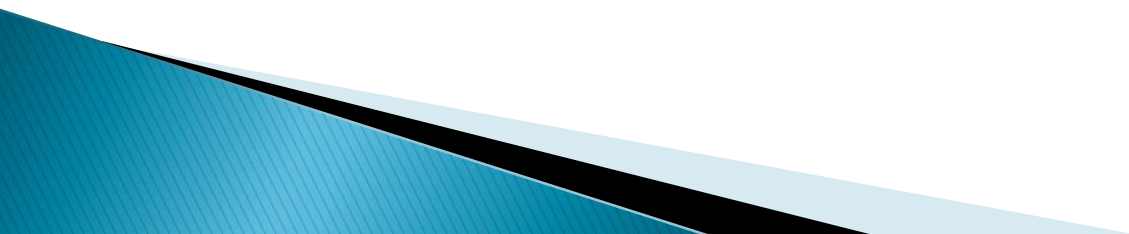
The surface geology of Iraq roughly reflects its morphology.

*Generally, the youngest sediments (Quaternary and Neogene) lie within the central depression while the flanks expose older strata of Palaeogene to Palaeozoic age (Fig. 1–2).

*The geology of the **desert** area to the SW of the Euphrates River is generally characterized by NE-dipping strata which are slightly more inclined than the land surface.

*However, in W Iraq near Rutba Town the strata dip to the west away from the axis of a major ENE–WSW trending anticlinorium in which rocks as old as Permian outcrop (Fig. 1–2).

*The erosion of the crest of the anticlinorium has created the Ga'ara depression.



--The geology of the **Mesopotamian** depression is produced by a complex system of river channels, levees, flood plain, marshes, sabkha and deltas, bordered on both sides by alluvial fans.

–The **Jezira** area in NW Iraq is dominated by a massive uplift (Tayarat). Middle Miocene sabkha deposits, exposed in the core of the uplift, are flanked in the E, N and W by Upper Miocene clastics.

*To the south erosion by the Euphrates River has exposed Oligocene and Lower Miocene carbonates along tight anticlinal structures controlled by E– W faults

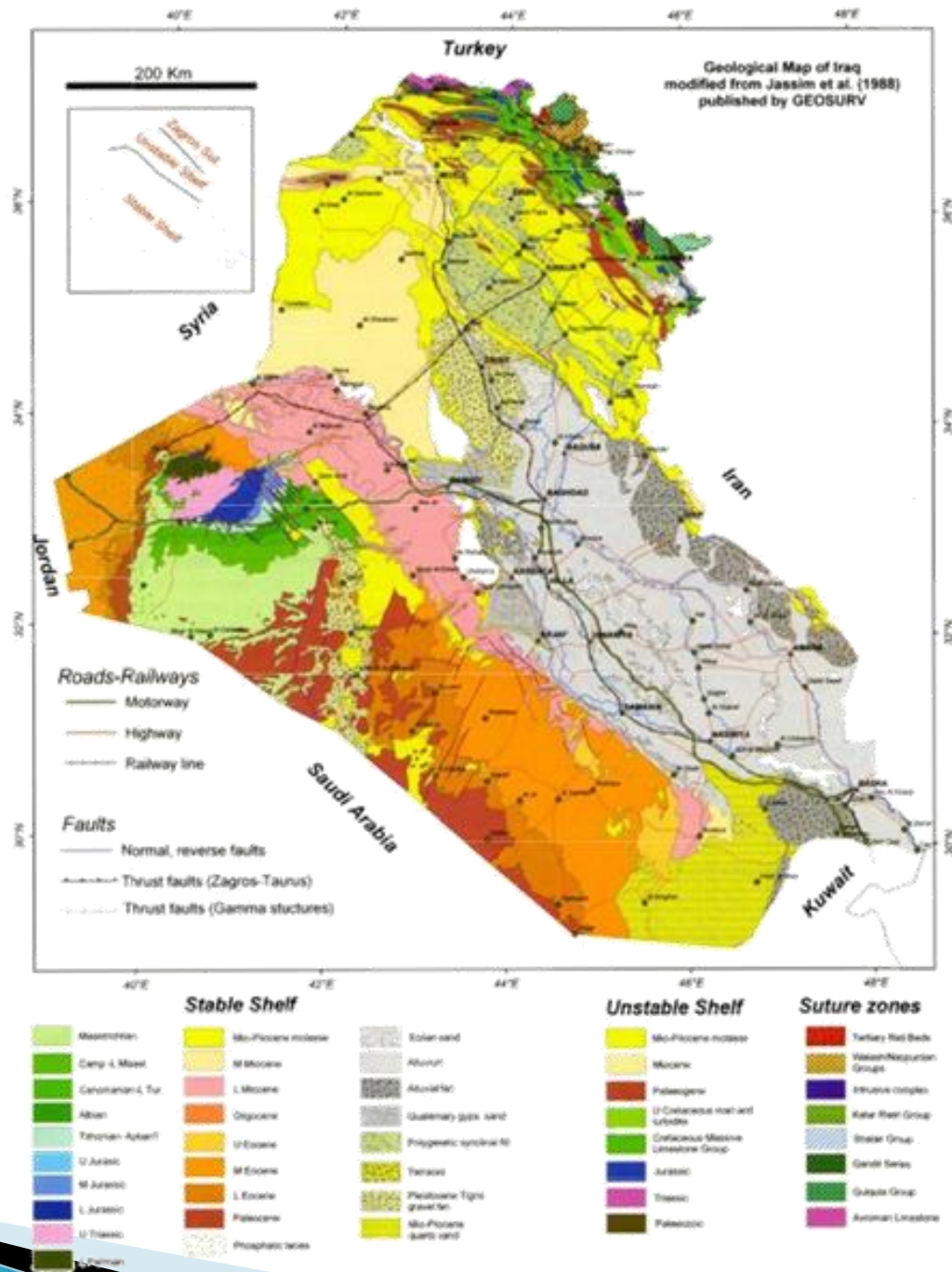


Fig. 1-2 Geological map (after GEOSURV) Geological maps of Iraq

–The foothills **NE** of the Mesopotamian depression comprise narrow (roughly 5–10 km wide) anticlines; Upper Miocene to Pleistocene molasse sediments or Middle Miocene evaporites are exposed in their cores.

*Some higher amplitude anticlines within the zone such as **Sinjar and Qara Chauq** have exposures of Palaeogene and locally Upper Cretaceous formations in their cores.

***The foothill anticlines are usually asymmetrical** towards the SW and are often associated with decollement thrust faults (controlled by Middle Miocene evaporites) in the area south of the Lesser Zab River (Fig. 1–2).

--The **mountainous region** to the NE of Kirkuk is characterized by harmonic folds. Cretaceous or older rocks are exposed in their cores; Palaeogene and Neogene rocks form the adjacent synclines.

*The amplitude of the folds increases towards the NE until the anticlines override each other due to thrusting with elimination of the intervening synclines.

*In N Iraq along the Turkish border, Palaeozoic to Cretaceous rocks are exposed in the cores of tight anticlines bounded by thrust faults.

*Along the Iranian border there **are thrust sheets** of sedimentary and igneous rocks which were formed in the Neo- Tethyan oceanic domain.

*The lowest of these comprise radiolarian chert and volcanics which were thrust over the shelf carbonates of the Arabian Plate during the Late Cretaceous.

*These thrust sheets were later peneplaned and covered by onlapping Upper Maastrichtian to Palaeogene clastics and carbonates.

*These clastics were often structurally overridden during Late Neogene deformation by thrust sheets of calc-alkaline volcanics and associated clastics and carbonates of Palaeogene age.

*Cretaceous **metamorphics and volcanics**, intruded by large basic and ultrabasic plutons, form separate thrust sheets overlying the Tertiary volcanics.

*The structurally highest thrust sheets in Iraq are composed of metamorphic and igneous rocks and represent the extension of the Sanandaj Sirjan Zone of Iran into Iraq.

General Definitions

1- Tectonic: A branch of Geology dealing with the architecture of the outer part of the earth, that is the regional assembling of structural or deformational features, a study of the mutual relations, origin and historical evolution.

So tectonics in general term can be divided in to two categories:

A- Uplift

B- Subsidence

A- Uplift: Is the product of the tectonic processes in which the earth crust uplifted above the base level. Usually divided in two types:

1- Orogeny

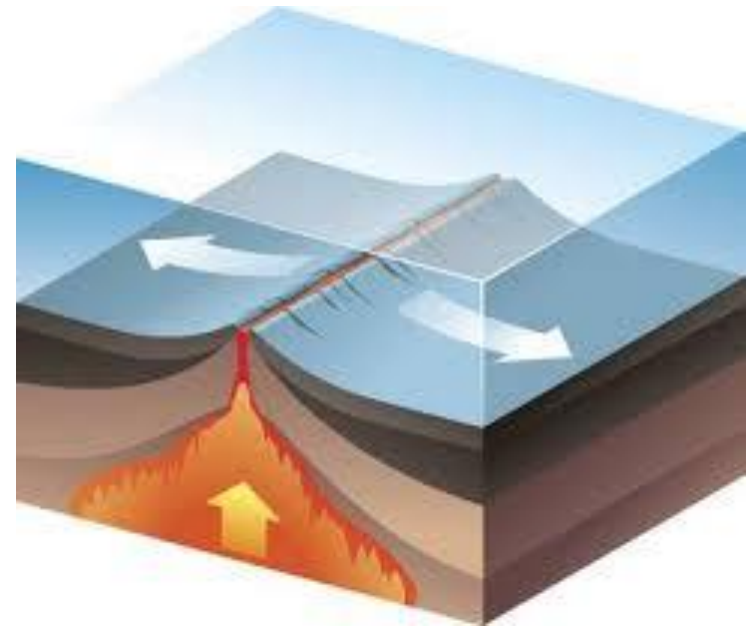
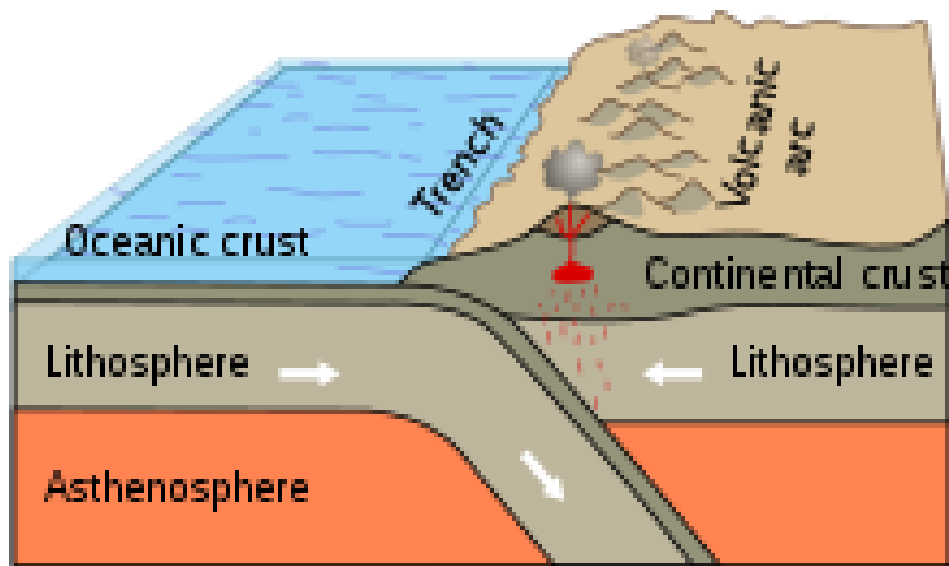
2- Epirogeny

Orogeny

- 1- Short term processes
- 2- Intensive deformation happen
- 3- Occupies local area crust
- 4- Results are generally building mountains

Epirogeny

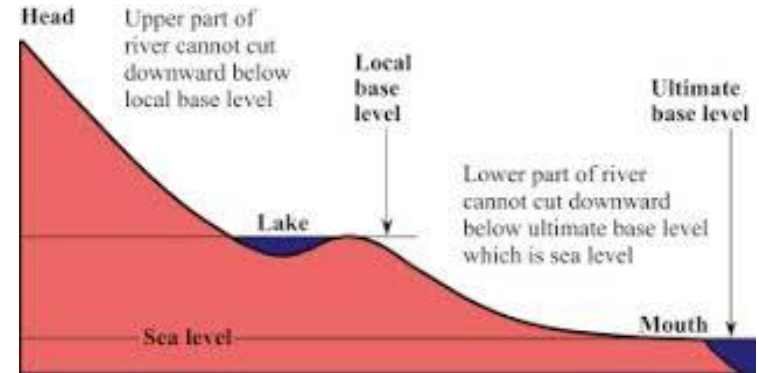
- 1- long term processes
- 2- slow tare of deformation happen
- 3- occupies large area of the earth
- 4- results is the generation or extinction



Subduction of an oceanic plate beneath a continental plate to form an accretionary orogen. (example: the Andes)

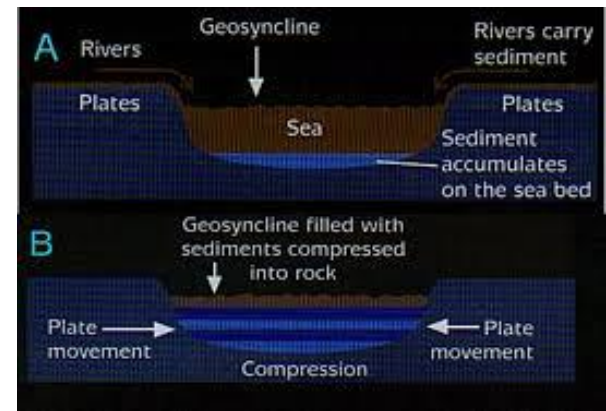
B- Subsidence: Is the product of the tectonic processes in which the earth crusts drawdown below the base level.

2- Base level: Is a surface in which below it there are sedimentation and above it erosional processes.

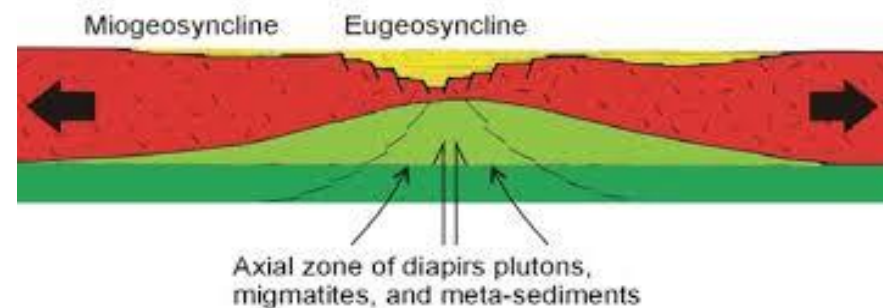


3- Geosyncline: A mobile part of the crust of the earth, in which sedimentary and volcanic rocks accumulate to thicknesses of thousands of meters.

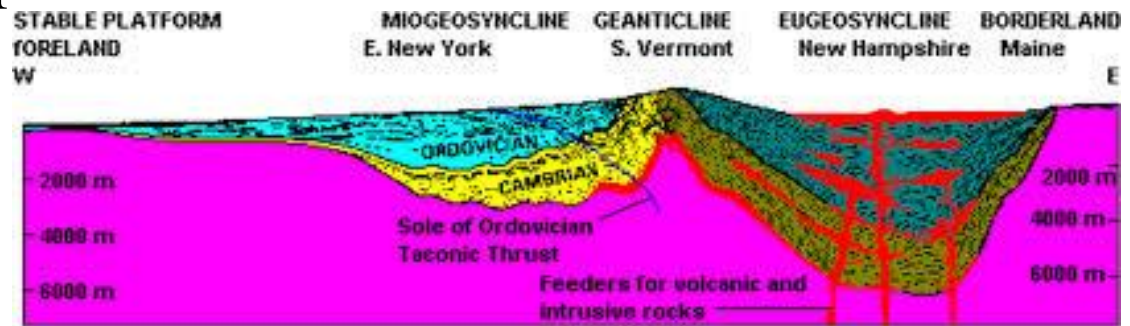
A geosyncline may form in part of a tectonic cycle in which orogeny follows.



4- Eugeosyncline: A geosyncline in which volcanism associated with clastic sedimentation, characterized by great depth mostly more than bathyal and abyssal zone, long and huge stratigraphic column, supplies by sediment from high land or positive area.



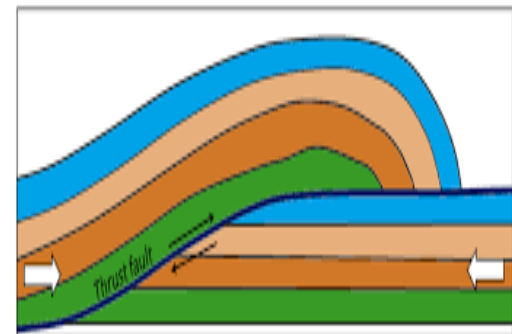
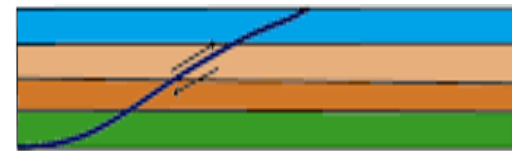
5- Miogeosyncline: A geosyncline in which volcanism is not associated sedimentation, characterized by shallower depth less than bathyal zone. The thickness of the stratigraphic column is less relative to eugeosyncline part.



6- Thrust: An overriding movement of one crustal unit over another.

- is a break in the Earth's crust, across which older rocks are pushed above younger rocks.

- A thrust fault is a type of reverse fault that has a dip of 45 degrees or less



Reference:-

Jassim,S.Z.& Goff,J.C. (ed.). Geology of Iraq,2006.DOLIN, Prague.

