Geology of Iraq

Lecture-3

(Structural Units of Iraq)

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Basic structural units of Iraq and basis of zonation

The two basic tectonic units of Iraq are;-

A-Arabian Shelf

B-Zagros Suture Zone.

*Henson (1951) placed the boundary between these units along the eastern border of the folded zone.

*Jassim et.al.(,2006), mentioned that the boundary of the Arabian Shelf with the Zagros Suture units is simply defined as the thrusted contact of the allochthonous Cretaceous radiolarian chert, Tertiary volcanosedirnentary units, or metamorphosed Mesozoic units with the underlying autochthonous platform carbonates, flysch & molasse.

*The Balambo-Tanjero Zone and the Ora Zone, which were included within the "geosynclinal" units by Buday and Jassim (1984 and 1987), are now considered to be an integral part of the Arabian Shelf.

The main structural elements recognized and described before the zonation of (Buday and 1987) related to structures caused by Alpine orogeny vents.

*The principle tectonic units thus trend parallel to the Alpine chain (**NE- SW** in **NE** Iraq or **E-W** in **N** Iraq.

*Tectonic units of other orientation include the Ga 'ara (or Rutba) and Mosul uplifts and the Anah Graben.

The two major units of the Arabian Shelf are the :-

1-Stable Shelf

2-Unstable Shelf

*According to Buday and Jassim (1984 and 1987), the *boundary* between these two units Was located at the western boundary o f the Mesopotamian depression.

. It continues along the Euphrates River near Nasiriya.

It then follows the Euphrates Boundary Fault to Razzaza Lake, and the Abu-Jir Fault line to Hit.

To the north of Hit it swings along a transversal fault system towards the E and then swings N, running along the Tharthar Line until Hatra.

From Hatra it swings NW towards the Sinjar-Herki Fault changing direction towards the Syrian border along a WSW trend.

The definition of the boundary of the Stable Shelf has been changed by Jassim et.al.,(2006): the Mesopotamian Zone is now considered to be part of the stable shelf.

*The SW boundary of the Stable Shelf is now taken at the limit of the Tertiary deformations defined by long anticlines of Makhul-Hemrin- Peshti-Kuh.

*The Mesopotamian zone is now considered to contain N- S structural elements that dominate all the units of the Stable shelf.

*The N-S trending units of Stable shelf are truncated by E-W (Tauride) and NW-SE (Zagros) trend.

* *The Alpine longitudinal units of the Unstable Shelf define the zones and subzones*.

* *In the stable shelf the zone boundaries generally follow the N-S trending lineaments , the subzones are delineated by transvers faults*.

Longitudinal Zones

Iraq can be divided into three tectonically different areas:

1-the ***Stable Shelf*** with major buried arches and antiforms but no surface anticlines,

2-the ***Unstable Shelf*** with surface anticlines,

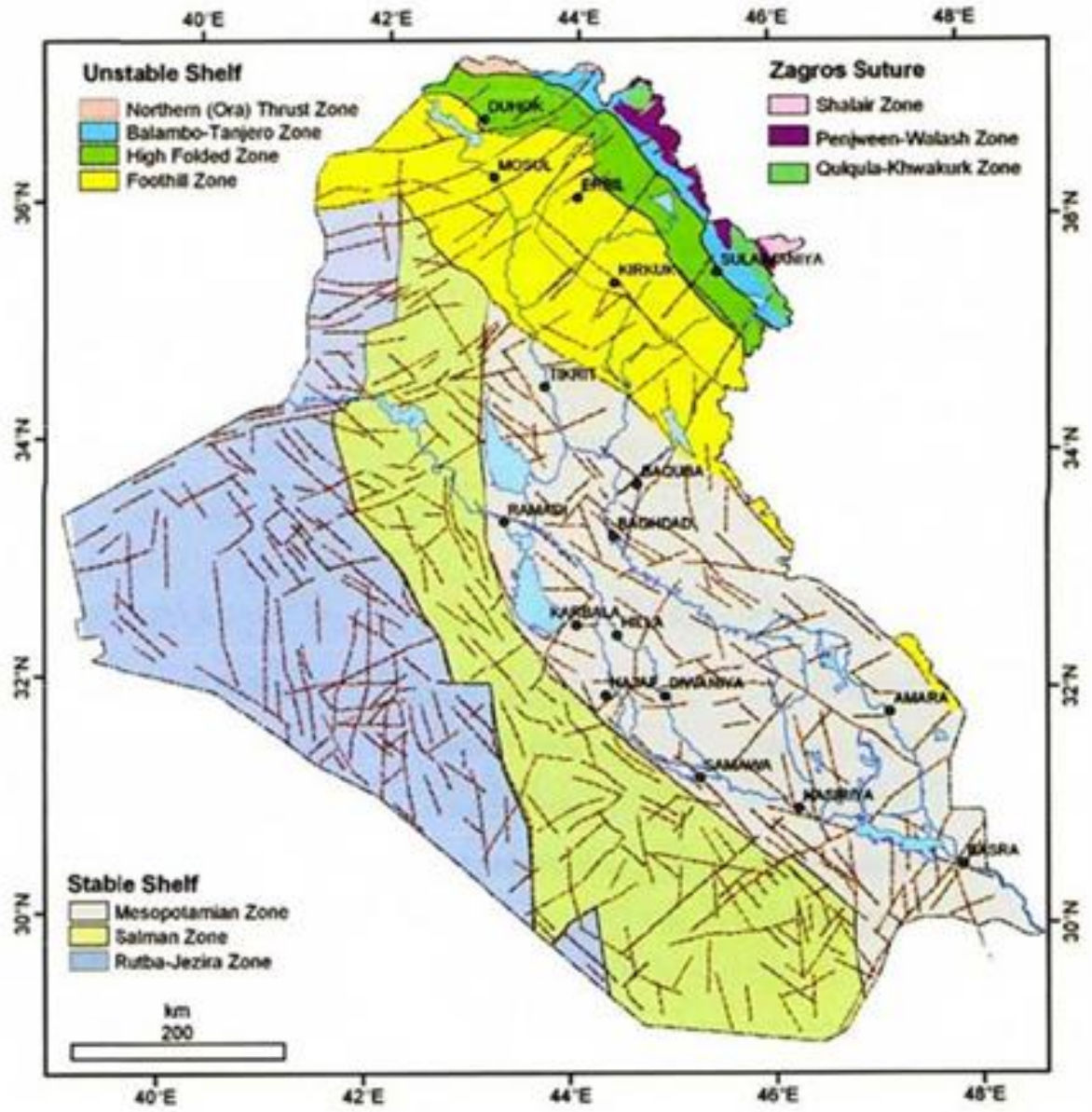
3- and the ***Zagros Suture*** which comprises thrust sheets of radiolarian chert, igneous and metamorphic rocks.

*These three areas contain tectonic subdivisions which trend **N-S** in the Stable Shelf and **NW-SE or E-W** in the Unstable Shelf and the Zagros Suture.

*The **N-S** trend is *due to Palaeozoic tectonic movements*; the E- W and NE-SW trends are *due to Cretaceous-Recent Alpine orogenesis*.

*The longitudinal tectonic units are shown in (below Fig.).

Fig. 4-14: Longitudinal Zones of Iraq



*The ***Stable Shelf*** which covers most of central,**S** and **W** Iraq extend westwards into Syria and Joudan, and southwards into Kuwait and Saudi Arabia.

It is divided to three major tectonic zones in iraq:-

1- ***Rutba- Jezira zone*** (in the west)

2-***Salman zone***

3-***Mesopotamian zone***

* ***The Rutba Jezira Zone*** is an *inverted Palaeozoic basin with a Syn-Hercynian basin.*

*It is ***dominated*** by the Rutba Uplift which is a major dome.

*The flanks of the dome dip to the **E** and **SE** towards the Euphrates River and to the **W** and **NW** towards Jordan and Syria.

* ***The Salman Zone*** is a *syn-Hercynian high*.

* It subsided strongly in latest Palaeozoic-Triassic time.

*It forms ***'a monocline***; the Tertiary section dips towards the Euphrates River.

* ***The Mesopotamian Zone*** contains the Tigris and Euphrates rivers in central and **S** Iraq and is covered with Quaternary sediments which overlie a complete Mesozoic and Cenozoic section.

The Unstable Shelf **can be divided into 4 tectonic zones.:-**

1-The Foothill Zone is characterized by long anticlines with Neogene cores and broad synclines containing thick Miocene-Quaternary molasse.

2-The High Folded Zone is characterized by anticlines of high amplitude with Palaeogene or Mesozoic carbonates exposed in their cores.

The zone was uplifted in Cretaceous, Palaeocene and Oligocene time but was also the site of an Eocene molasse basin.

3-The Balambo- Tanjero Zone formed a basin near the plate boundary, which subsided strongly from the Tithonian onwards.

It was filled in by thick fluvial and marine clastics from Maastrichtian time onwards.

It is characterised by imbricated structures with overriding anticlinal structures.

4-The Northern Thrust (Ora) Zone is an uplifted zone which developed along the plate margin during the Cretaceous and is characterized by thrusted anticlinal structures.

The ***Zagros Suture*** can be divided in Iraq into **3** tectonic zones.:-

From SW to NE these are the (Qulqula-Khwakurk, Penjween- Walash and Shalair zones).

1-The ***Qulqula Khwakurk Zone***

*is characterized by isoclinally folded radiolarian cherts with volcanics and occasional ultramafic rocks (Coloured Melange) with imbricates of the underlying Arabian Shelf carbonates (Permian to Jurassic).

* It is overthrust in the SE by Triassic carbonates. Its sediments were deposited on the margin of the Southern Neo- Tethys Ocean during the Tithonian-Cenomanian and obducted onto the Arabian Shelf in Late Cretaceous time.

2-The ***Penjween Walash Zone***

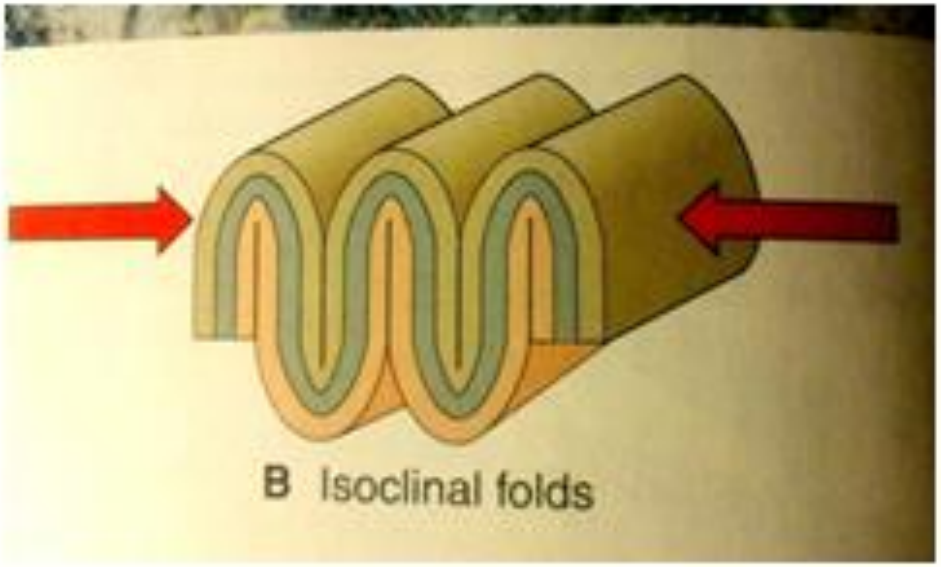
*comprises metamorphosed volcanic and sedimentary rocks of Cretaceous age derived from the NeoTethys, and Eocene arc and fore-arc units.

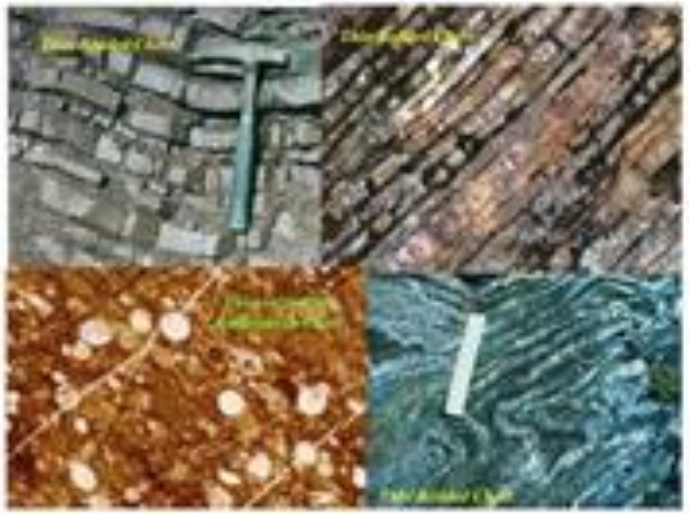
3-The ***Shalair Zone***

* is part of the Sanandaj-Sirjan Zone of Iran.

*It is characterized by metamorphosed Palaeozoic sequences of the Sanandaj-Sirjan microplate, overlain by Triassic to Cretaceous low grade meta-sediments and meta-volcanics formed at the margin of the Neo-Tethys, including Upper Cretaceous arc volcanics.

Radiolaria





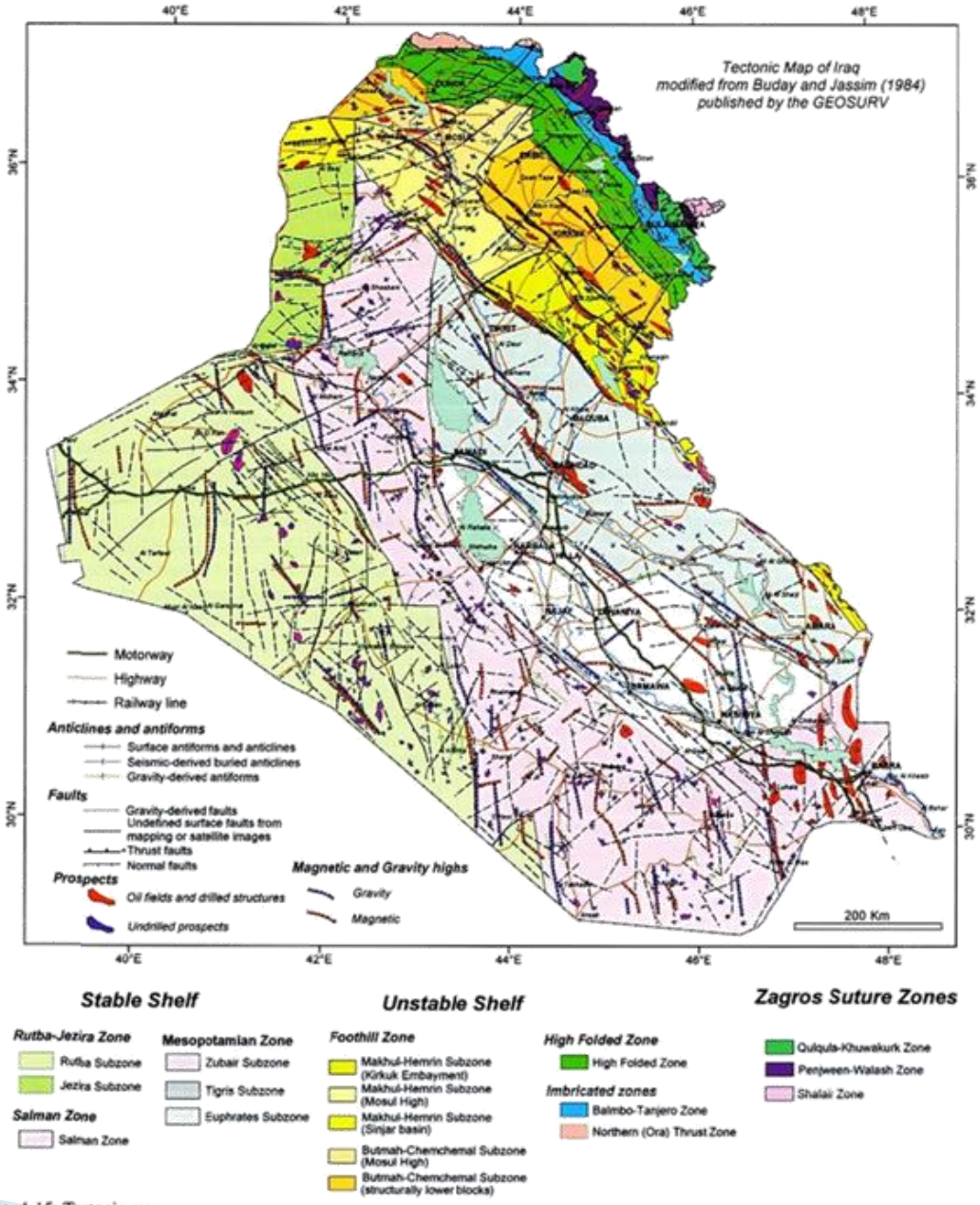


Fig. 4-15: Tectonic map

Units of the Stable Shelf

*The ***Stable Shelf*** is a tectonically **stable monocline** little affected by Late Cretaceous and Tertiary deformation.

* ***The orientations of the structures in this tectonic unit were influenced by*** **the geometry of the underlying basement blocks and faults, Palaeozoic epirogenic events and Mesozoic arching**.

*The depth of the Precambrian basement varies between 5 km in the centre of the shelf to 11 km in the **W** and 13 km in the **E**.

*The original definition of the Stable Shelf (Buday and Jassim, 1987) has been modified to include the Mesopotamian Zone.

*The **E** boundary of the Stable Shelf is now located along the **SW** flank of the long anticlinal range of Makhul- Hemrin- Pesht I -Kuh.

* ***The Stable Shelf is now divided into three major tectonic zones, from the west, these are:***

1-Rutba-Jezira

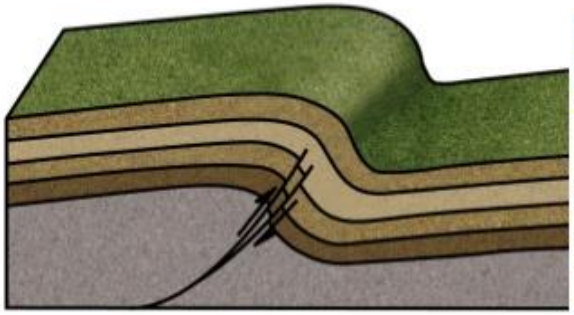
2-Salman Zone

3-Mesopotamian Zones.

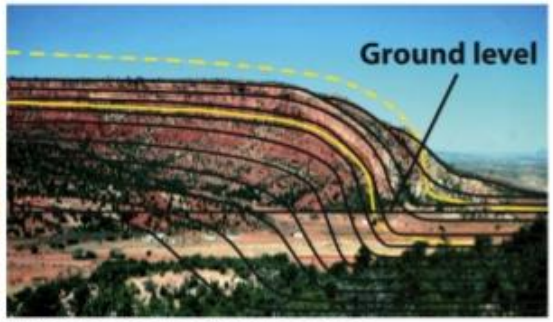
3 Fold Types

Monocline – like a carpet draped over a stairstep.

- Fold with only 1 steep limb- "a ½ fold"
- Due to "blind" faults in subsurface rock
- Displacement folds overlying rocks



Monocline



What a geologist imagines

Terms

Orogeny

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

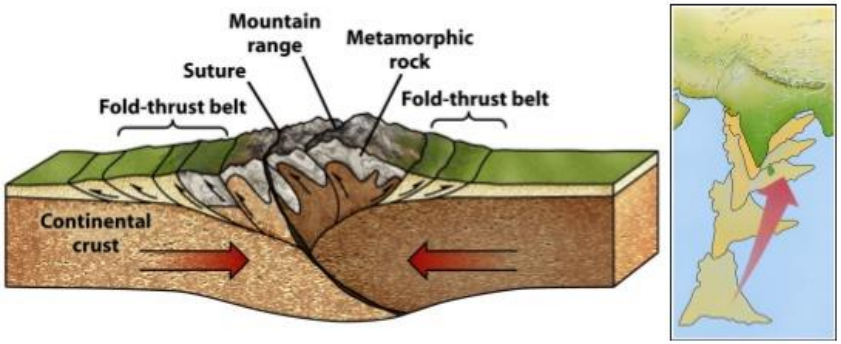
Epirogeny

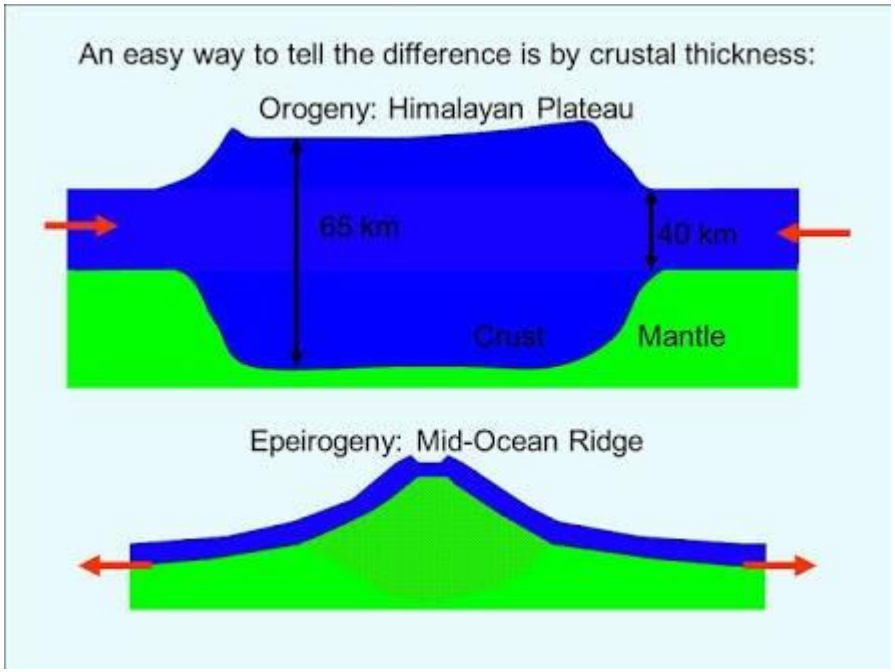
1- long term processes.
2- slow rate of deformation happen.
3- occupies large area of the earth.
4- results is the generation of continents.

Causes of Orogenesis

Continent-continent collision…

- Creates a belt of crustal thickening
  - Due to thrust faulting and folding
  - Belt center > high-grade metamorphic rocks
- Fold-thrust belts extend outward on either side





Reference:-

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

-https://en.wikipedia.org/wiki/Orogeny