المحاضرة التاسعة

Basic structural units of Iraq and basis of zonation

The two basic tectonic units of Iraq are :-

A- Arabian Shelf

B-Zagros Suture Zone

The two major units of the Arabian Shelf are:-

1- The Stable Shelf

2- Unstable Shelf (Fig. 4-14).

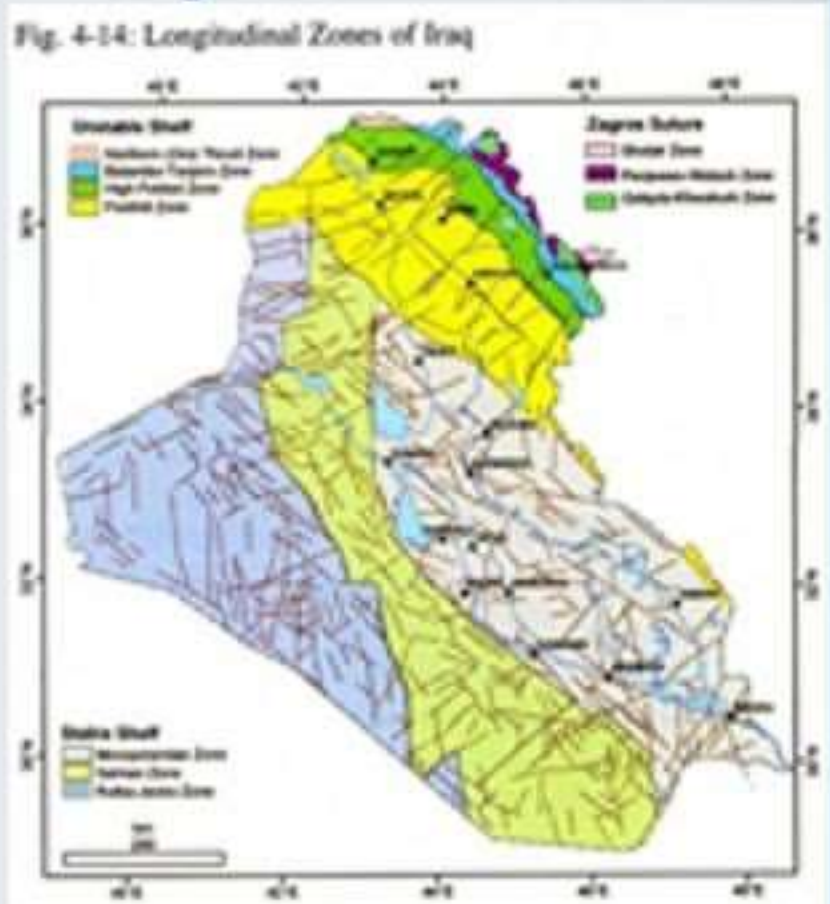


Fig. 4-14: Longitudinal Zones of Iraq

The boundary between them was located at the western boundary Of the Mesopotamian depression.

It continues along the Euphrates River near Nasiriya, 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 boarder.

The definition of the boundary of the Stable Shelf has been changed : the Mesopotamian Zone is now considered to be part of the Stable Shelf.

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

-In the stable shelf the zone boundaries generally follow N-S trending lineaments; subzones are delineated by transversal faults.

**The Stable Shelf which covers most of Central, S&W Iraq extends westwards into Syria & Jordan & southwards into Kuwait.*

It is divided in Iraq into three major tectonic zones :-

a-The Rutba-Jezira Zone in the W,

b-The Salman Zone,

c- The Mesopotamian.

THE RUTBA-JEZIRA ZONE

- THE RUTBA-JEZIRA ZONE IS AN INVERTED PALAEOZOIC BASIN; THE INVERSION BEGAN IN THE LATE PERMIAN.
  ITS BASEMENT WAS RELATIVELY STABLE DURING MESOZOIC-TERTIARY TIME AND MORE MOBILE DURING INFRACAMBRIAN AND PALAEOZOIC TIMES.
  - BASEMENT DEPTH RANGES FROM 5 KM IN THE JEZIRA AREA TO 11 KM S OF RUTBA .
  -THE JEZIRA AREA WAS PART OF THE RUTBA UPLIFT DOMAIN IN LATE PERMIAN TO EARLY CRETACEOUS - TIME. FOLLOWING THE CRETACEOUS *THE JEZIRA AREA SUBSIDED* WHILE THE RUTBA AREA REMAINED UPLIFTED; *THESE TWO AREAS ARE THUS DIFFERENTIATED AS SEPARATE SUBZONES*.
- The Rutba Uplift dominates the Rutba-Jezira Zone.
  - It has previously been linked to the wider Hail-Rutba-Mardin High.
  - However the thickness and facies of its Mesozoic sequences suggests it has often acted as a separate block sometimes affecting NW Saudi Arabia and NE Jordan but mostly affecting E Syria and Wand NW Iraq.
- -The Hail Uplift, based on gravity data, is a N-S trending Hercynian uplift that terminates in SW Iraq; it was later partially affected by Mesozoic arching.
  -The Mardin High is an E- W trending uplift that affected SE Turkey and persisted from Triassic to Albian time.

-The eastern boundary of the Rutba-Jezira Zone lies along the W slopes of the Sinjar-Sharaf gravity high. The previously established boundary of Buday and Jassim (1984 and 1987) has been modified. The western boundary can be traced along the Iraq-Jordan border, along a N-S gravity and magnetic high. In Jordan the Stable Shelf belongs to the Risha -Tabuk Zone which represents a Hercynian easterly-tilted monocline; the Rutba Jezira Zone represents a syn-Hercynian depression.

- The Anah-Qalat Dizeh Fault divides the Rutba-Jezira Zone into the more stable Rutba Subzone in the S and the Jezira Subzone in the N; the latter being more mobile since the Late Cretaceous.
Both subzones contain large basement highs: the Rutba-Ga'ara high in the S and the Deir Al Zor - Khlesia high in the N.
The unit between the two highs is the Anah Trough (Anah Graben).

The Rutb a-Jezira Zone contains thick Palaeozoic sediments. *Upper Permian, Lower to Middle Triassic and pre Albian Lower Cretaceous sediments are absent.*

-The Jezira sub - zone was uplifted and eroded during Mid -Devonian (Caledonian) time; the Rutba Subzone was mostly not affected by this deformation.

-The Jezira Subzone also subsided during Late Eocene to Miocene time when the Rutba Subzone was uplifted.

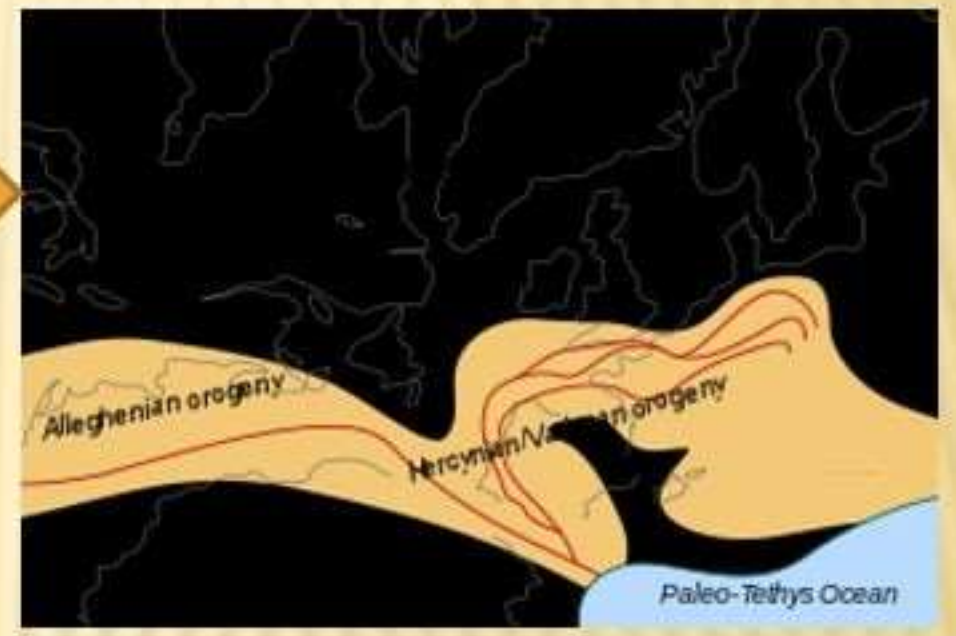
A NW-SE cross section from Syria t o the Rutba area is shown in Fig. 5-1.

-The Tanf- Khlesia Zone of Getech and Jassim (2002) shown in the cross section is a continuation of the Jezira Subzone of Iraq; the Silurian sequence has been deeply eroded .

The Upper Permian and most of the Triassic section is absent in both subzones.

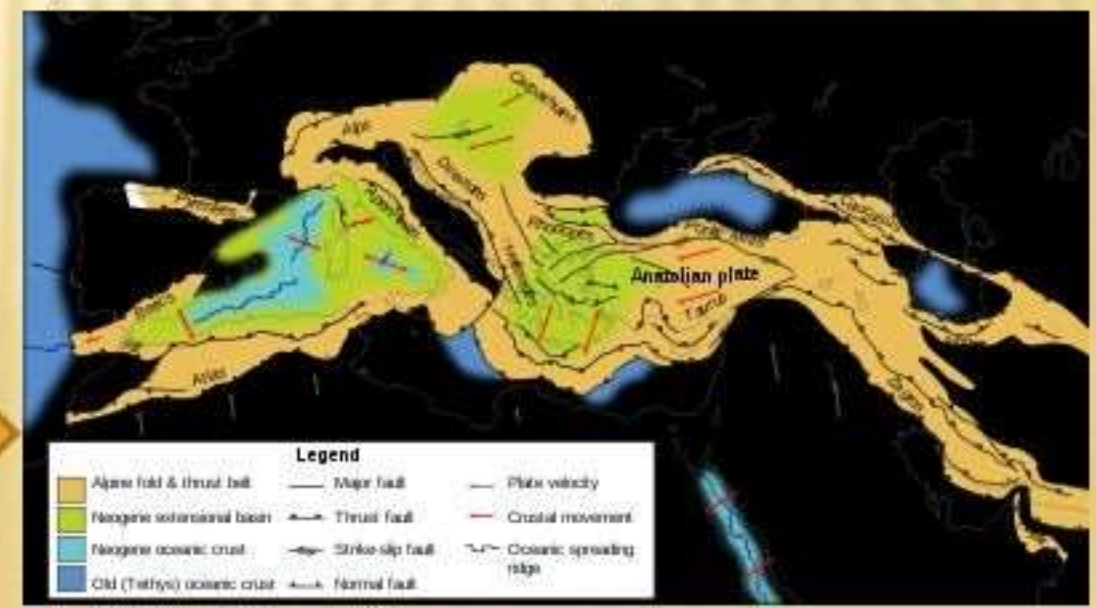
*The Caledonian orogeny was a mountain building era recorded in the northern parts of Ireland and Britain, the Scandinavian Mountains, Svalbard, eastern Greenland and parts of north-central Europe.
The Caledonian orogeny encompasses events that occurred from the (**Ordovician** to ***Early Devonian)***, roughly 490–390 million years ago (Ma).

*The Variscan or Hercynian orogeny is a geologic mountain-building event caused by Late Paleozoic continental collision between Euramerica (Laurussia) and Gondwana to form the supercontinent of Pangaea.(Silurian)



*The *Laramide orogeny* was a period of mountain building in western North America, which started in the Late Cretaceous, 70 to 80 million years ago, and ended 35 to 55 million years ago.

*The *Alpine orogeny* or Alpide orogeny is an orogenic phase in the Late Mesozoic[1] (Eoalpine) and the current Cenozoic that has formed the mountain ranges of the Alpide belt.



The Rutba Subzone

The Rutba Subzone is the most *extensive and uplifted part* of the Rutba-Jezira Zone, dominated by :_

*the huge Rutba Uplift active in Late Permian- Palaeogene time,

*the Cretaceous Ga'ara anticline and

* the ENE- WSW trending Hauran anticlinorium .

The sedimentary cover of the Rutba Subzone starts with the Infracambrian section (3 00-1500 m thick).

The Palaeozoic section thickens from 3500 m in the N to 8500 m in the S.

Triassic, Jurassic and Lower Cretaceous sediments are absent in the northern part of the subzone; they are up to 800, 1000 and 300 m thick respectively in the SE. Upper Cretaceous sediments are up to 800 m thick.

Palaeogene and Neogene sediments are up to 500 and 200 m thick respectively in the SE.

Geological an d geomorphological characteristics

The Rutba Subzone contains the Ga'ara depression which is located above the broad N-S trending Rutba Uplift, and the E-W trending Ga'ara anticline. Numerous unconformities occur within the Mesozoic and Palaeogene section.

The Lower Permian Ga 'ara Formation is unconformable Overlain by Upper Triassic carbonates that form the cliffs on the southern rim of the depression.

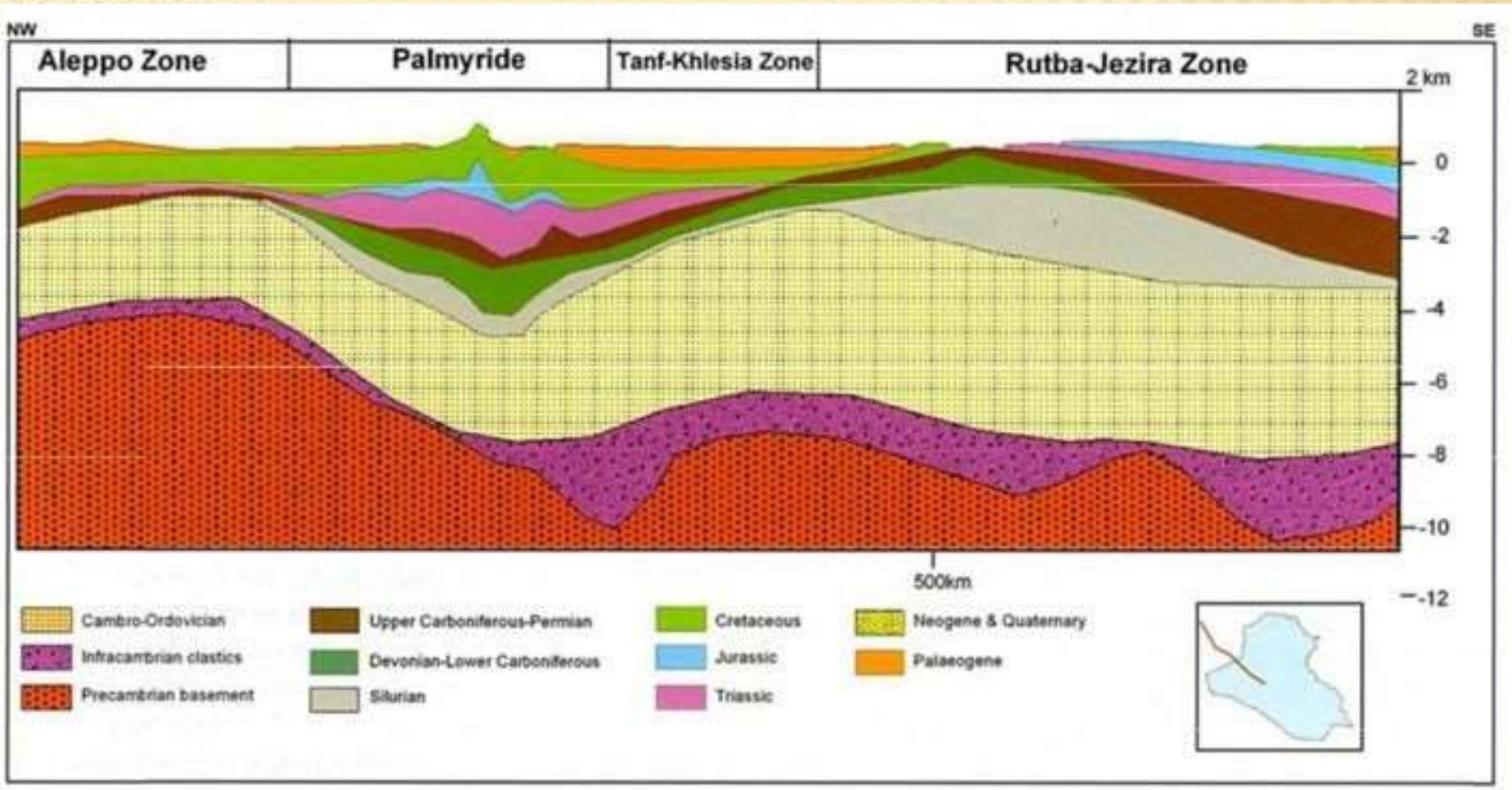


Fig. 5-1: Cross section within the Stable Shelf of Western Arabia starting from Aleppo in the NW and terminating at the Nukhaib Graben in the SE

- Along the W, N and E side of the depression, the Lower Permian sediments are unconformably overlain by Upper Cretaceous, Palaeocene and Eocene beds.
- To the SE, the Triassic carbonates are unconformably overlain by *Jurassic cyclic* sequences; each sequence comprises fluviatile and shallow marine clastics which pass transitionally up into neritic carbonates.
- The Jurassic strata strike NE-SW; the Lower Cretaceous beds strike ENE-WSW and the Upper Cretaceous beds strike E- W. Numerous NW-SE trending normal faults were mapped in the outcropping Jurassic sequences. They were probably active in Tithonian to Early Senonian time.
-*The area W of Rutba is dominated by N-S trending Campanian-Palaeogene strata that are characterised by relatively deep water phosphorites.*
-On the SE flank of the Rutba High, Lower Miocene transgressive shallow water carbonate and clastics outcrop. Quaternary gravel deposits fill surface depressions.
- A profile through Iraq (connecting the Risha area in NE Jordan and Naft Khaneh in the Foothill Zone in E Iraq indicates the subzone is mainly an inverted Palaeozoic basin with an almost complete Palaeozoic sequence compared to the neighbouring zones to the E and W.
-The western desert of Iraq has a NE-inclined land surface with a gradient of 10-20 m per kilometer from the Iraq Jordan-Saudi border point (980 m elevation) to the Euphrates River (l00-200 m elevation).
- *it is usually a plane surface mostly covered by desert pavement (Serir) but locally it is very rocky where dissected by active wadis producing the Hamada land surface (Central and SE parts).*

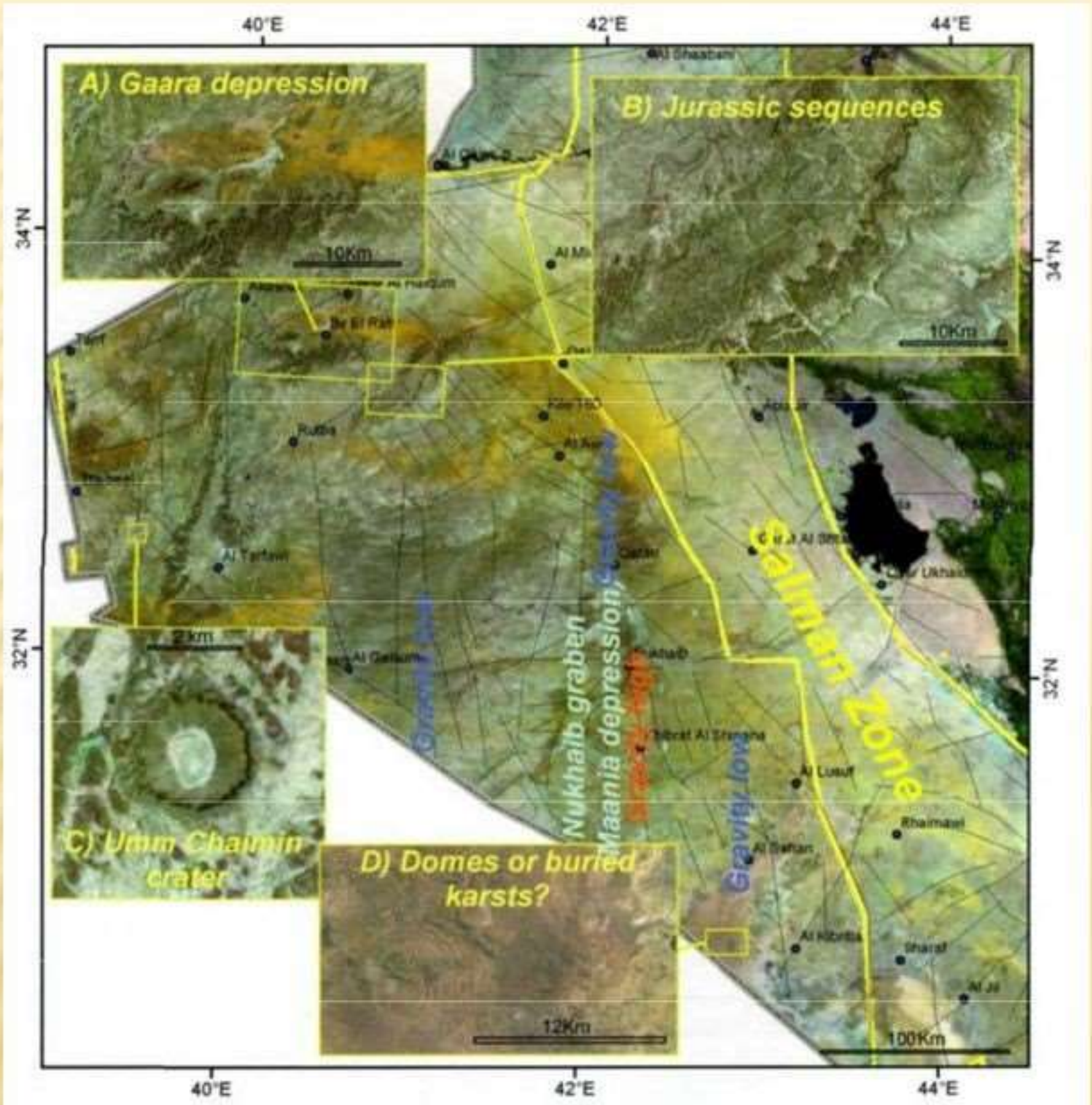


Fig. 5-4: Satellite image of the Rutba Subzone with inset for the Ga'ara depression (Inset A), the Jurassic system exposure area (Inset B), the Umm Chaimin crater (Inset C), and the contorted Palaeogene sequence east of the Nukhaib graben (Inset D)

Desert pavement

There are four distinct drainage systems:

1) a strongly incisive E- W wadi system to the S and SE of Rutba.

2) the incisive NE-SW trending Wadi Hauran and its tributaries which are controlled by the strike of the Triassic and Jurassic sequences that contain alternating softer clastics and relatively harder carbonates

3) a shallow, broad N-S trending system W and SW of Rutba controlled by the N-S strike of Palaeogene strata and 4) a moderately incisive NNE-SSW trending system north of the Ga'ara area flowing through Miocene outcrops to the Euphrates River.

Important depressions within the Rutba Subzone comprise:-

1-the Ga'ara depression (a structural-denudational unit),

2- the Umm Chaimin crater (formed by an impact or gas explosion) and

3-the Ma' ania depression (a structural depositional unit).

The Ga'ara depression formed by erosion of thin carbonate beds which overlie softer less resistant Permocarboniferous clastics.

The Ma'ania depression which lies above the Nukhaib Graben is over 100 km long, 20 km wide and 20 m deep.

-Palaeocene rocks outcrop on both sides of the depression; Middle Eocene limestones occur in isolated outcrops protruding through -20 m of gravel (Nukhaib Gravel) in the middle of the depression.

All the E- W wadis SE of Rutba drain into the depression forming coalescing fans which lead into one exit drainage point (Wadi Ubayidh).

-The depression is structurally controlled by the Nukhaib Graben. Al-Bassam et al. (1992) *indicated that 50 m of extension has occurred in the graben.*

They noted that a gravity low in the northern part of the graben is associated with a major dome at Top Cambrian level .

They suggested that the gravity low may indicate the presence *of Infracambrian salt*. Getech and Jassim (2002) modeled the gravity low to the east of the Nukhaib Graben and also concluded that Infracambrian salt is probably present.