المحاضرة الرابعة

3- UNITS OF FLUVIAL ORIGIN

Six landforms are developed within this type:-

1- Terraces

River terraces are developed along the Euphrates River and some of the main wadis.

Tyracek (1981) studied the terraces of the Euphrates River in seven localities.

-He identified eleven terrace levels and grouped them in five groups.

The groups are (233 – 218, 216 – 205, 205 – 200, 185 and 175) m a.s.l.

-The first three levels are missing in Anah area because of Anah anticline.

- In Heet area there are four terraces stages; (100, 70, 50 and 20) m above Euphrates river level (Hamza, 1975).

- The materials of the terraces are composed of loose and cemented, pebbles of chert and carbonates with rare, igneous and metamorphic rocks.

-The pebbles are of variable shapes and range in size from gravel to cobble.

Tyracek and Youbert (1975) have mapped two terrace levels along wadi Hauran. --- The highest level is in H1; it covers large area and is 50 m above valley floor.

The second level is 7 m above the floor of the wadi.

-The pebbles of the terrace are composed of chert, carbonates and sandstones with conspicuous amount of geodes.

Al-Mubark and Amin (1983) termed the deposits of the highest level as Hauran Gravel and mapped them as old flood plain.

Terraces are also formed in Ga`ara Depression, restricted to the main ephemeral streams of Wadi Mulussa and Wadi Shaib Al-Oja.
Tamer-Agha (1993) has mapped three terrace levels in the depression.
-The highest level is about 20m above the alluvial plain.
-In Abu Jir and Kubaisa vicinities, valleys have their own terraces, covering both banks.
The pebbles are mainly of carbonates and silicates, their sizes range from (1 – 15) m, with different shapes.

The dating of terraces is not accurate, because of the absence of paleontological and archeological data or other relevant methods.

-Tyracek (1981) gave approximate age to the terraces of the Euphrates River on the basis of their altitudes.
He expected the highest level (90 m a.w.l.) to be Early Pleistocene age, the second level (60 m a.w.l.) of late Early Pleistocene age, the third level(35 m a.w.l.) of Middle Pleistocene age and the lowest level of Late Pleistocene.

□□ ALLUVIAL FANS

Alluvial fan topography is common in the Western Desert.

The fans were collisced together in form of bajada.

- *The surface of the bajadas shows local breaks in slope indicating stages of fans.*

The stages are consequence of climatic changes.

-A very large belt of bajada is developed west of Al-Habbariyah, Shinana and Al-Birreet Depressions.

It extends from Wadi Ghadaf, in the north to Iraqi – Saudia Arabian borders, in the south.

The bajada is laid down by the wadies Thumail, Tabbal, Al-Ubaiydh, Hamir and Ar`ar.

-The bajada consists of poorly sorted clastic sediments, usually gravels with subordinate amount of sand.

The pebbles consist of limestone with less amount of chert and are poorly cemented.

*In Al-Habbariya Depression, ***three stages*** of alluvial fans are developed (Fig.6).

The stages differ from each other in degree of dissection.

-The higher two stages are highly dissected and separated from each other by a cliff.

*-The **two stages** are probably of Pleistocene age.*

*-The **third stage** (youngest) is of smooth surface and might be of Early Holocene age.*

A belt of bajada (1 – 6 Km wide) is formed along the base of the southern rim of the Ga`ara Depression, because many large wadis, like Al-Oja, Ujrumiyat, drain in the depression from the south. Almost all of them are still active.

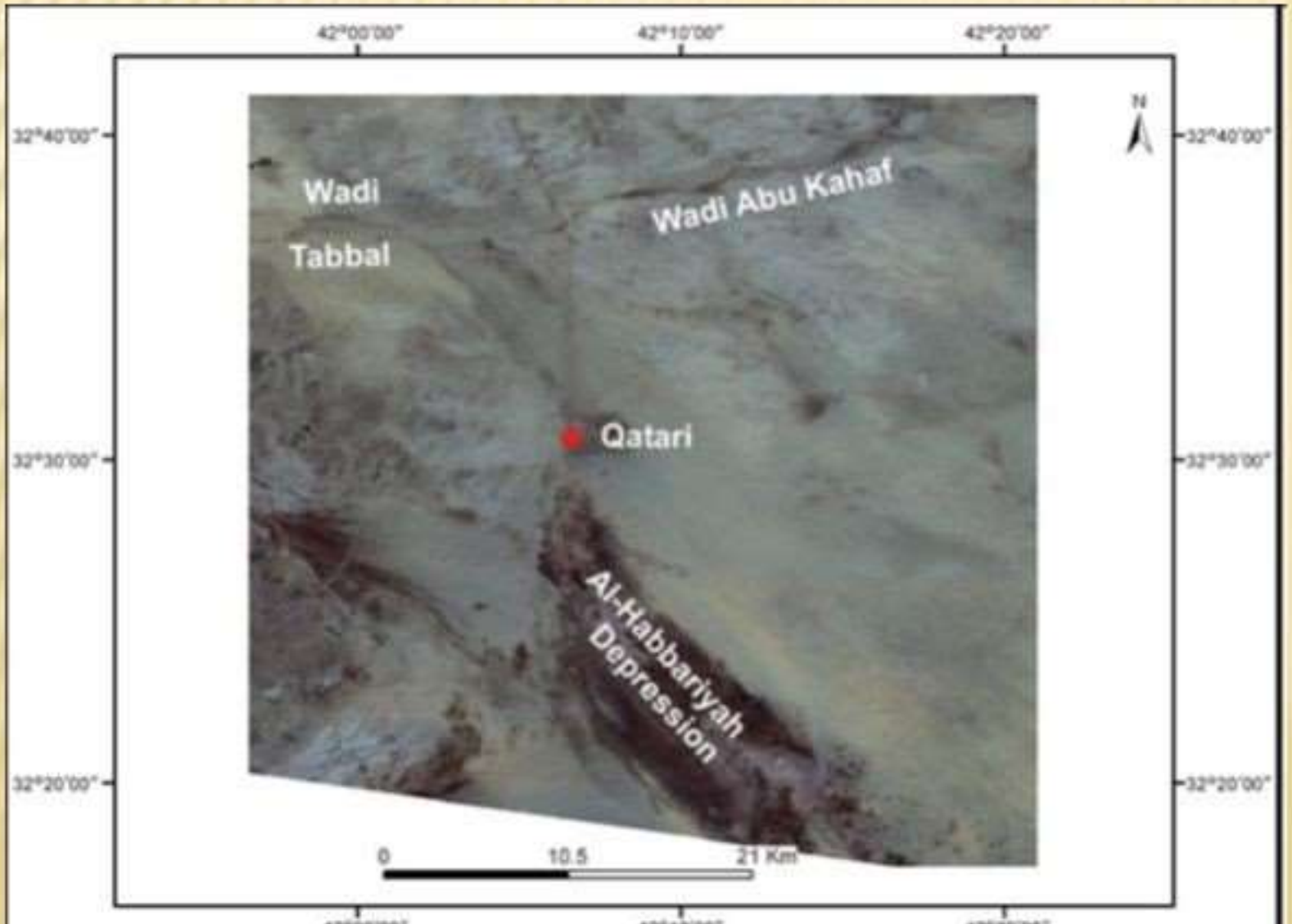


Fig.6: Alluvial fan stages of Al-Habbariyah Depression

Scree

Scree slopes are formed along the base of most of cliffs in the Western Desert.
The slopes are gentle to steep in inclination.

- ***Degree of inclination depends on type of their materials***.

Slopes formed of fine material are gentle, while large fragments tend to accumulate in slopes exceeding 30°.

-Along the base of the cliffs of Ga`ara Depression, a (1 – 2) Km wide scree slope is described by Tamer-Agha (1993).

-The materials of the scree slopes are the result of denudation processes, where disintegrated rocks fall down slopes by gravity and rain water.

-The materials consist of mixture of fragments and blocks of limestone and sandstone, moderately to well cemented by calcareous and sandy cement.

Another example is Al-Kherish cliff, where large rock blocks are toppled down.

Usually the scree slopes are partly covered by eolian sand, like in Al-Kherish and Qasir Al-Khabaz vicinities.

Infilled Valleys

Infilled valleys are represented by main wadies and their tributaries like; Al-Walaj, Swab, Akash, Hirri, Mulussa, Hauran, Hussainiyat, Amij, Thumail, Tabbal, Aghari, Ubaiyidh, Ghadaf, Hamir and Ar`ar. The drainage system of the tributaries of these wadis is dendritic with some local change into rectangular. The wadis trend almost parallel to each other, because of the main slope direction, towards the north and northeast.

The infilling of the wadis are either ***fine*** (loam) or ***coarse*** (gravel and sand).
The thickness is variable. According to Al-Bassam et al. (1990) the thickness in Ga`ara area ranges from few centimeters to 40 m, in wadi Al-Ubaiyidh reaches up to 70 m in thickness (Al-Mubarak and Amin, 1983).

☐☐ Infilled Depressions

Infilled depressions are common on surfaces of all plateaus.
-They are of variable sizes, ranging from few square meters up to few hundred square kilometers.
-The depressions vary also in age.
-They have started to develop since Late Cetaceous.
-The depressions are either ***erosional*** or ***solutional*** in origin.
-The infilling materials of the depressions consist generally of fluvial materials with subordinate influence of eolian activity.
-The old depressions are infilled by collapsed material, from the surrounding rims, consists of rock fragments and blocks mixed with soil.

☐☐ Flood Plains

Flood plains are restricted to the Euphrates River and are subjected to periodic flood.
They form flat plains, cultivated and composed of laminae of variable thicknesses of sand, silt and clay.
The main valleys have developed their own flood plains, which have the same composition.
The thickness varies from less than one meter to few meters.

4. UNITS OF EVAPORATION ORIGIN

The units represent products of advanced chemical weathering on surface.
They are developed under climatic conditions marked by alternating *wet* and *dry seasons*.
During the dry season, capillary action brings to the surface the solutions formed during the wet season and concentrate them as gypcrete, calcrete or silcrete, depending on the type of the material and chemistry of water.
These features cause induration of the surface layer and weathering products.
Depending on the stratigraphic position, the units are more likely of Pleistocene –Holocene.

☐☐ Calcrete

Calcrete is locally preserved in the Western Desert.

- It consists of heterogeneous rock fragments of variable composition cemented by silty, sandy calcareous materials.
- According to Tamer-Agha (1993) in wadies of Ga`ara Depression, like Nijili, Luwaiziyyah, Shaib Al-Oja, Soofi and Um Idiyyah, a fairly uniform blanket of calcrete ranges in thickness between (1 – 4) m is developed.
- At Marbat AL-Hissan a 5 m thick bed of calcrete is formed.

-The bed is compacted and inclined between 5 and 10 degrees.

-The inclination might indicate incision of the depression floor directly after the formation of the calcrete.

Sabkha

Calcrete

Caliche - Photo by Jonathan DuHamel

☐☐ Gypcrete

Gypcrete is well developed on surface of the plateaus on ***Euphrates*** and ***Nfayi***l formations, west of Al-Habbaniyah and Razaza Lakes (Al-Mehaidi et al., 1975) the gypcrete is locally massive and fairly to well compacted.

The gypcrete reaches up to few meters in thickness, locally it is covered by gravel lag indicating remnant of very old terraces.

☐☐ Sabkha

Sabkha is well developed in Hit area along Abu Jir Fault Zone and Razaza and Habbaniyah Lakes, along their banks.

The sources of the brine in the former locality are springs water and in the latter is the lake's water.

5. UNIT OF SOLUTION ORIGIN

The basic factor of karst formation in the Western Desert is the presence of soluble rocks (limestone and dolomitic limestone) associated with concentrated water circulation along highly permeable zones (joints, fractures, faults or bedding planes).

-Karst features are developed on surfaces of most of the plateaus.

They are rounded, oval or elongated shapes and developed individually or in colonies (Fig.7).

-Some of them are connected with each other forming karst valley.

-They are generally oriented reflecting the role of structural features in their development.

Qasir et al. (1992) described karst forms of variable shapes and dimensions on surfaces of the plateaus on Zor Hauran, Ubaid, Hussainiyat and Amij formations.

-Qasir et al. (1993) mentioned that the sinkholes on Ubaid Plateau extend from the junction of Wadi Hauran and Wadi Al-Hussainiya, in the east to Al-Hussainiya Iron quarries, in the west.

-Karst features are also developed on surfaces of Damam, Umm Er Radhuma and Euphrates formations.

-Al-Mubarak and Amin (1983) referred the karst development to solution of gypsum and salts of Russ Formation, which underlies the Dammam Formation.

-Karst depressions cover a very wide area on both sides of Wadi Hauran.

In vicinity of Kilo - 160, dense small size in filled depressions were formed on surfaces of the plateaus on Ms`ad, Euphrates and Zahra formations.

In the area north of the Wadi Hauran the karst unit extends over a wide area around H1 pump station. Sissakian et al. (1986) described tens of sinkholes in Anah – Haditha – Hit vicinity. They are developed on the top of the Euphrates Plateau with, circular and oval shapes, with diameters of (1 – 100) m and depths of (1 – 35) m. Ma`ala et al. (1999) described many karst forms in Ashwa vicinity on top of the Ms`ad Plateau.

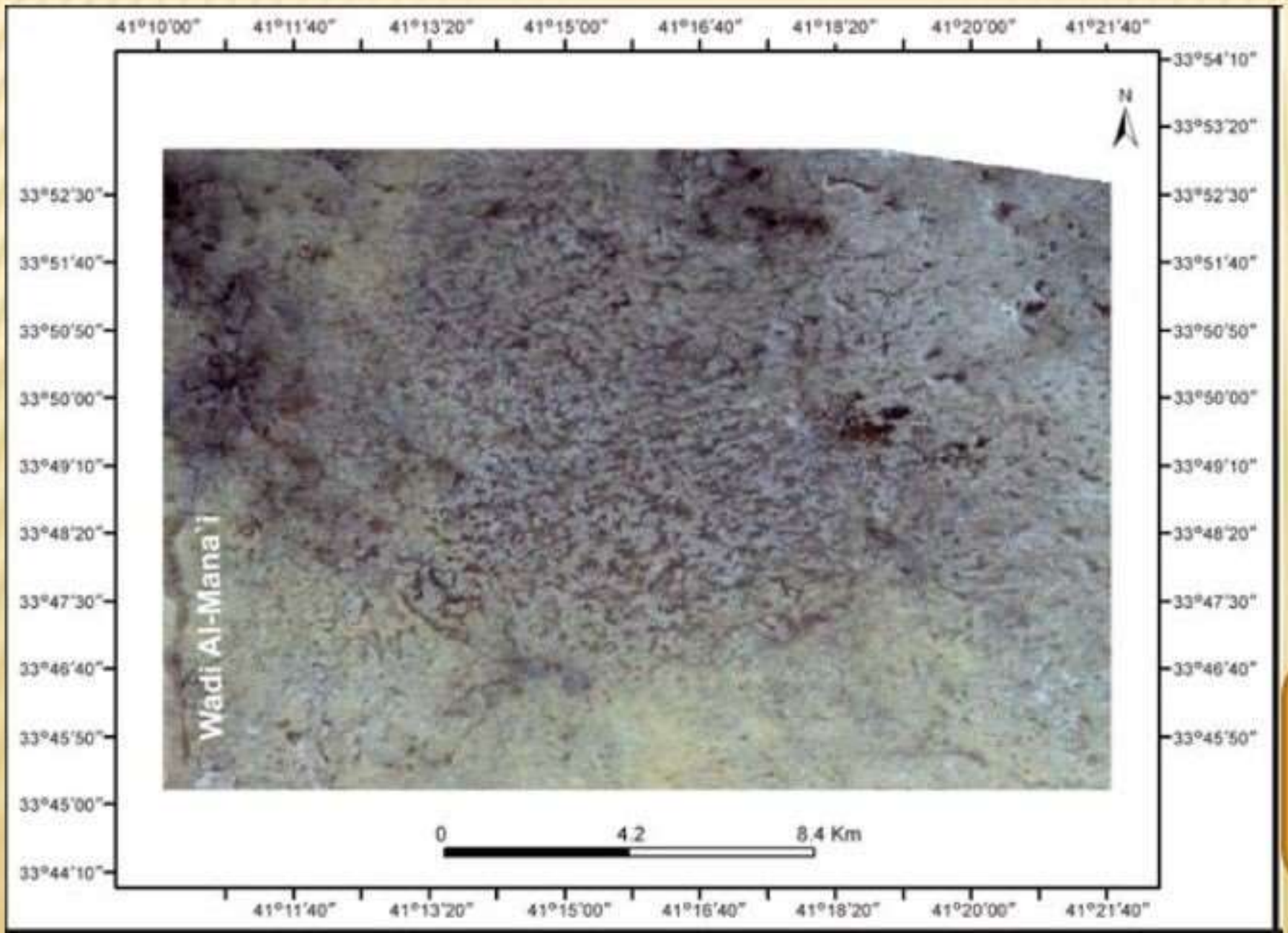


Fig.7: Karst topography (west of H1)

6. UNITS OF EOLIAN ORIGIN

Locally, due to eolian activity different forms are developed and are represented by small fields of ***sand dunes***, ***sand sheets*** *and* ***Nabkhas****.*

-In the eastern part of Ga`ara Depression the three types of eolian landforms are developed, composed of quartz sand (Tamer-Agha, 1993).

-South of Razaza Lake low sand dunes (maximum height 2 m) are scattered in a strip of NW – SE direction, indicating the main trend of wind.

-Fields of sand sheet and sand dunes are developed in three localities; on both sides of Wadi Al-Mana`i, Al-Awaj Depression and Qasir Amij Depression.

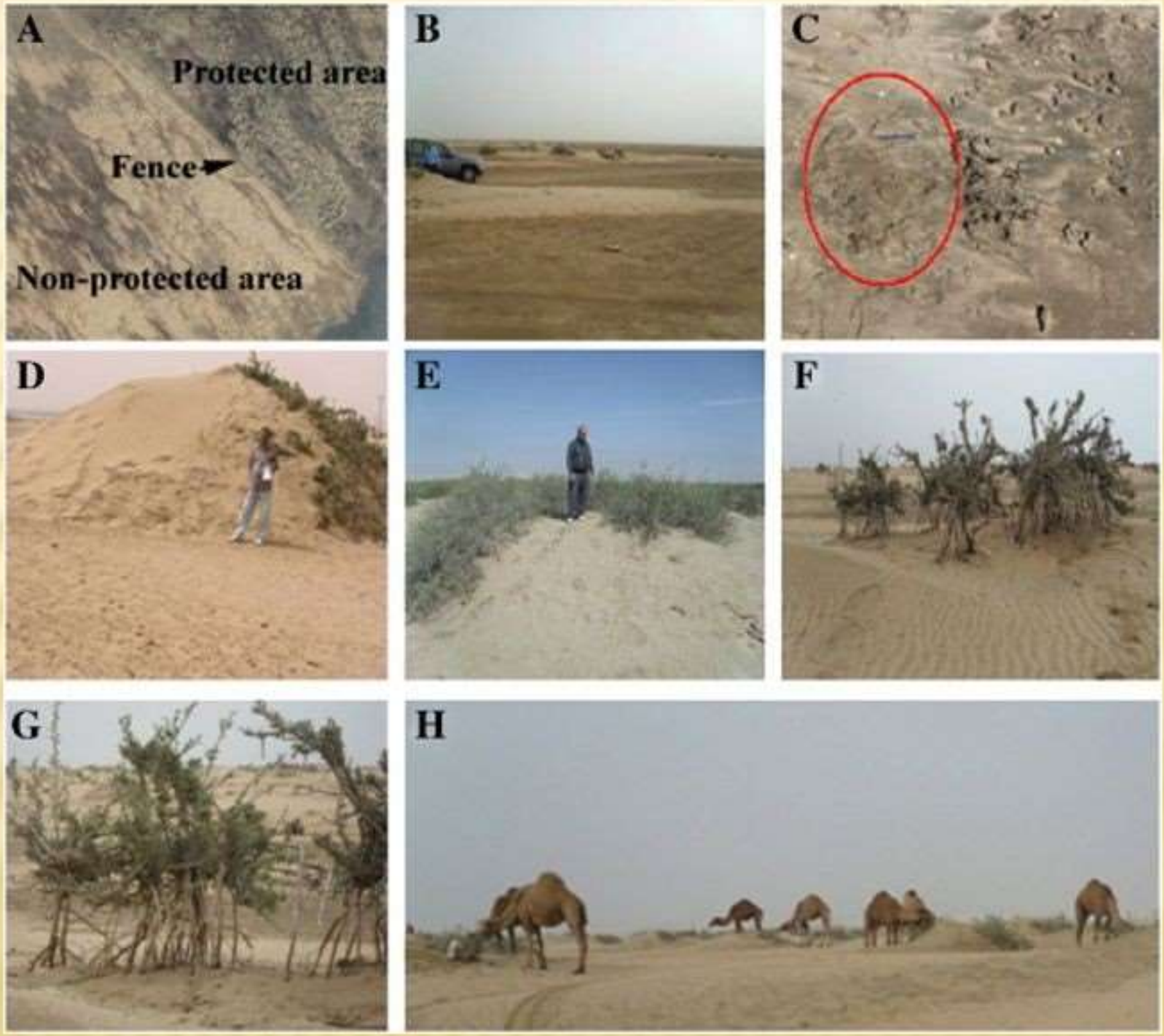
The sheets composed of grains of quartz and carbonate.

-Scattered Nabkha covers a wide belt in Al-Birreet area along Iraqi – Saudi Arabian borders.

Sand sheets are also developed in the western parts of the Western Desert, with height of (0.2 – 1) m.

In shallow valleys and depressions, Nabkha is very well developed, with height of (10 – 50) cm.

SATELLITE IMAGE SHOWING THE DIFFERENCE IN NABKHA DENSITY .



GEOMORPHOLOGICAL UNITS

SIX UNITS DEPENDING ON THEIR ORIGIN(POWER MADE IT):-