

## MINERAL RESOURCES AND INDUSTRIAL DEPOSITS IN THE MESOPOTAMIA PLAIN

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### ABSTRACT

The Mesopotamia Plain represents about 25% of the total area of Iraqi territory; it is a part of Arabian Platform, which is divided into Stable and Unstable Shelves, being a part of the Unstable Shelf. The sediments within the Mesopotamia Plain are fluvial, lacustrine, deltaic and Aeolian in origin. The sediments of each type are intercalated, horizontally and vertically.

The Metalogeny of the Mesopotamia Plain is almost entirely related to the Quaternary sediments, which have a thickness that exceeds 180 m. There is very limited information on the pre-Quaternary economic deposits. The main economic deposits in the Mesopotamia Plain are fluvial gravel and sand, clay, continental evaporites represented by salt pans and gypcrete, and partly the Aeolian sand. Peat is also recorded in many locations. The gravel and sand are used as a source for building material; they represent river terraces and alluvial fans, range in gravel to sand proportions and composition according to the source and distance of transportation. The Nuba'i, Chlat, Safwan and Chwaibda are the main localities for such deposits. The Aeolian sands are limited in use only in one area as a raw material for cement industry that is in Samawa vicinity.

The clays are of fluvial and fluvio – lacustrine origin and are widely spread in the central and southern parts of the Mesopotamia Plain. According to their use; they are classified into two major groups: one is for brick industry and the other as a raw material for cement industry. Nahrawan deposit is the best example for brick clays and Samawa deposit as for cement industry.

Continental evaporites are mainly represented by salt pans and gypcrete. The salt pans are formed by evaporation of saline water yielded by springs, then evaporate due to sun heating, leaving a veneer crust of salts. Samawa Salt Pan represents the best example for halite mineral production and Shari Salt Pan represents other type of salt minerals; mainly of glauberite. Other small salt pans are distributed in the middle parts of the Mesopotamia Plain. Gypcrete is also formed by evaporation of sulphate water raised by capillary action forming a fibrous texture with clay and sand. This type of deposits is commonly used as a mortar for brick. Peat deposits are recorded within different areas and they may be used as a source for fertilizer.

### الموارد المعدنية والترسبات الصناعية في السهل الرسوبي

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#### المستخلص

السهل الرسوبي يمثل ما يقارب 25% من المساحة الكلية للعراق، ويعتبر جزء من الدرع العربي الذي يقسم إلى جزئين: الرصيف المستقر والرصيف غير المستقر، ويقع السهل الرسوبي ضمن الجزء غير المستقر. طبيعة الأرض في السهل منبسطة، تمتد من منطقة بيجي في الشمال الغربي إلى الخليج العربي في الجنوب الشرقي. الترسبات الموجودة في هذا السهل من أصول متعددة، نهريّة وبحيريّة ودلتاويّة وريحيّة وتبخيريّة، وأن كل نوع من هذه الترسبات تتداخل أو تحل محل بعضها أفقياً وعمودياً.

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للسوبيات الحمولة في انهار دجلة والفرات وديالى والعظيم دور كبير في تغذية السهل الرسوبي بالترسبات. تعود الترسبات والترسبات الاقتصادية في السهل الرسوبي إلى وحدات الرصيف غير المستقر، ومعظم الترسبات المسجلة فيه تعود إلى العصر الرابع الذي يزيد سمك رسوبياته عن 180 متر.

أهم الترسبات الاقتصادية في السهل الرسوبي هي الحصى والرمل والأطيان والمتبخرات التي تتمثل بالممالح السطحية والجبريت، والكثبان الرملية والخث (Peat). الترسبات الحصى المهمة هي عبارة عن شرفات نهريّة ومراوح فيضية تعود إلى عصر البلايستوسين، وتعتبر مروحة فتحة الفيضية والمكونة من نهر دجلة من أكبر هذه الترسبات، حيث تغطي مناطق تكريت – سامراء – فلوجة، وتعتبر المصدر الرئيسي الذي يغذي المنطقة الوسطى من العراق. تختلف نسبة الحصى والرمل ومكوناتها المعدنية حسب المصدر والمسافة التي انتقلت منها، ويعتبر مواقع النبايع وجوييدة وجلات من أهم الأمثلة على مثل هذه الترسبات. تقع أكبر الترسبات الرملية ضمن السهل الرسوبي في صفوان، وهي عبارة عن مراوح فيضية ترسبت في عصر البلايستوسين.

تتكون الأطيان الحديثة من ترسبات نهريّة وبحيرية وتنتشر بشكل واسع في الجزء الجنوبي والأوسط من السهل الرسوبي، وتصنف حسب استعمالها الصناعي إلى مجموعتين رئيسيتين: الأولى في صناعة الطابوق والثانية في صناعة السمنت. وترسبات موقع النهروان أفضل مثال عن أطيان الطابوق وترسبات السماوة مثال على الأطيان الصالحة لصناعة السمنت.

تتمثل المتبخرات من الأصل القاري بالمنخفضات الملحية والجبريت، وتتكون الأولى من تبخر المياه المالحة الصاعدة من الينابيع أو المناطق المحيطة بالمنخفضات مخلفة قشرة ملحية، وتعتبر مملحة السماوة أفضل مثال لملاح الهالايث، وتشكل المصدر الرئيسي لإنتاج ملح الطعام في العراق، وكذلك مملحة الشاري في إنتاج كبريتات الصوديوم والغلوبرايت والهالايث. هناك ممالح صغيرة تنتشر في المنطقة الوسطى من السهل الرسوبي تغطي الاحتياجات المحلية من الملح. يتكون الجبريت من تبخر مياه سلفاتية صاعدة بالخاصية الشعرية، مكونة أنسجة أبرية يشوبها رمال وأطيان، وتستعمل كمادة رابطة في البناء.

تنتشر الكثبان الرملية في ثلاثة أنطقة ضمن السهل الرسوبي، واستخداماتها محدودة، فهي تنتشر في الجزء الشمالي والشرقي من السهل على امتداد بيجي، طيب، عمارة، والجزء الأوسط ما بين نهري دجلة والفرات، وفي الجنوب على امتداد نجف – سماوة – ناصرية. ترسبات الخث مسجلة في عدد من المناطق ويمكن الاستفادة منها في تخصيب التربة.

## **INTRODUCTION**

The Mesopotamia Plain is a part of the Unstable Shelf and is located east of the Stable Shelf. It is bounded in the northeast by folded range of Himreen Range, in the east, and Makhoul Range, in the north. The southwestern boundary is controlled by faults. According to Jassim and Goff (2006), this plain was probably uplifted during the Hercynian deformation, but it subsided from Late Permian time onwards. The thickness of the sedimentary column is about 17 Km (Jassim and Goff, 2006), and the Quaternary sediments are up to 180 m thick (Yacoub, 1981).

## **GEOLOGICAL SETTING**

### **▪ Stratigraphy**

The main sediments of the Mesopotamia Plain were deposited by influence of the Tigris, Euphrates, Diyala and Adhaim Rivers. They comprise flood plain sediments, which include channel sediments and alluvial fans, derived from rivers passing through the Low Folded Zone (Fig.1). Yacoub *et al.* (1981) classified the sediments of the plain according to their age into three main divisions:

- The Pleistocene, which includes terraces and alluvial fans
- The Pleistocene – Holocene, which includes fluvial and evaporitic sediments.
- Holocene sediments, which include: **a)** flood plain, **b)** crevasse splay, **c)** depression fill, **d)** inland sabkha, **e)** marshes, **f)** valley fill, **g)** estuaries, **h)** tidal flat and **i)** Aeolian accumulations.

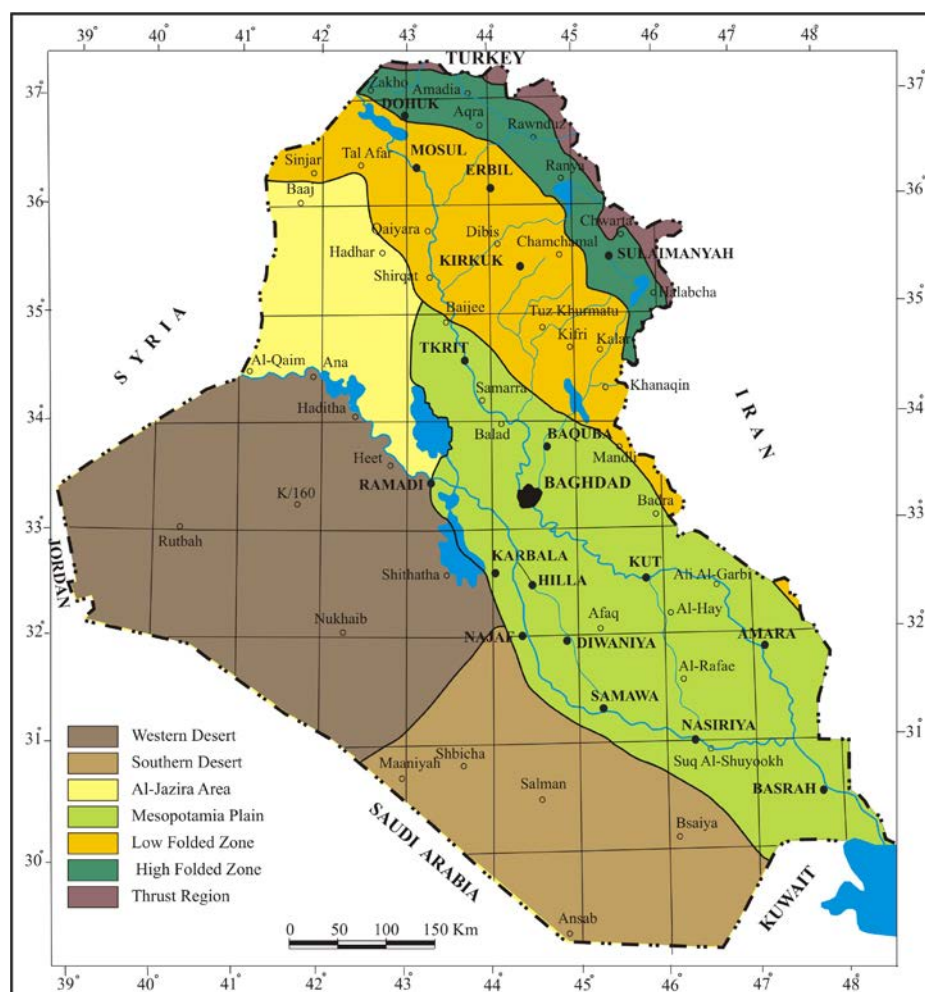


Fig.1: Location map of the Mesopotamia Plain

The Mesopotamia Plain is a relatively flat terrain extending from Baiji, in the northwest to Arabian Gulf, in the southeast. The major geomorphological features were formed by sediments accumulation. The most prominent feature is a complex system of natural levees following the courses of each river, which gradually passes into a flood plain and finally to flood basin. Natural levees of the Euphrates River begin near Falluja and those of the Tigris River near Dujail.

#### ▪ Structural Geology

The Mesopotamia Plain is a part of the Unstable Shelf, which belongs to the Arabian Plate. The main trends of the structures are NW – SE and N – S (Al-Kadhimi *et al.*, 1996 and Fouad, 2010).

#### MINEROGENIC ZONES OF THE MESOPOTAMIA PLAIN

A new minerogenic zonation proposed by Al-Bassam (2007) includes the Mesopotamia Zone within the shelf units (Fig.2). The available data on the mineral deposits within this plain are poor, due to rare systematic mineral investigation executed by GEOSURV, and the only available data is concerned with the Quaternary sediments cover. The deposits within this plain are of sedimentary origin, mainly represented by alluvial gravel, sand, secondary gypsum, clay, salt pans and peat. There is very limited information about the pre-Quaternary mineral deposits in this zone (Fig.3).

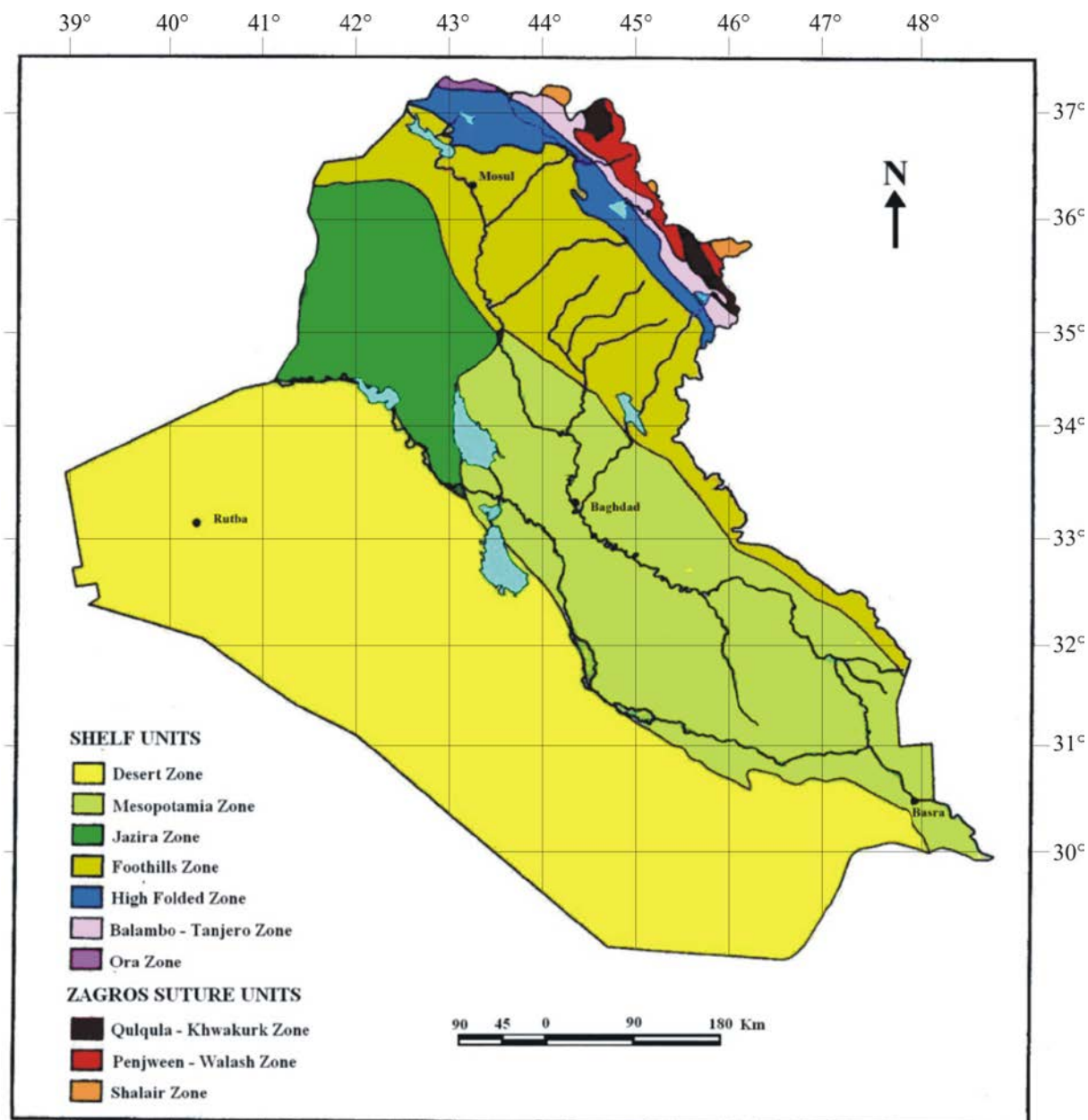


Fig.2: Minerogenic zones of Iraq (after Al-Bassam, 2007)

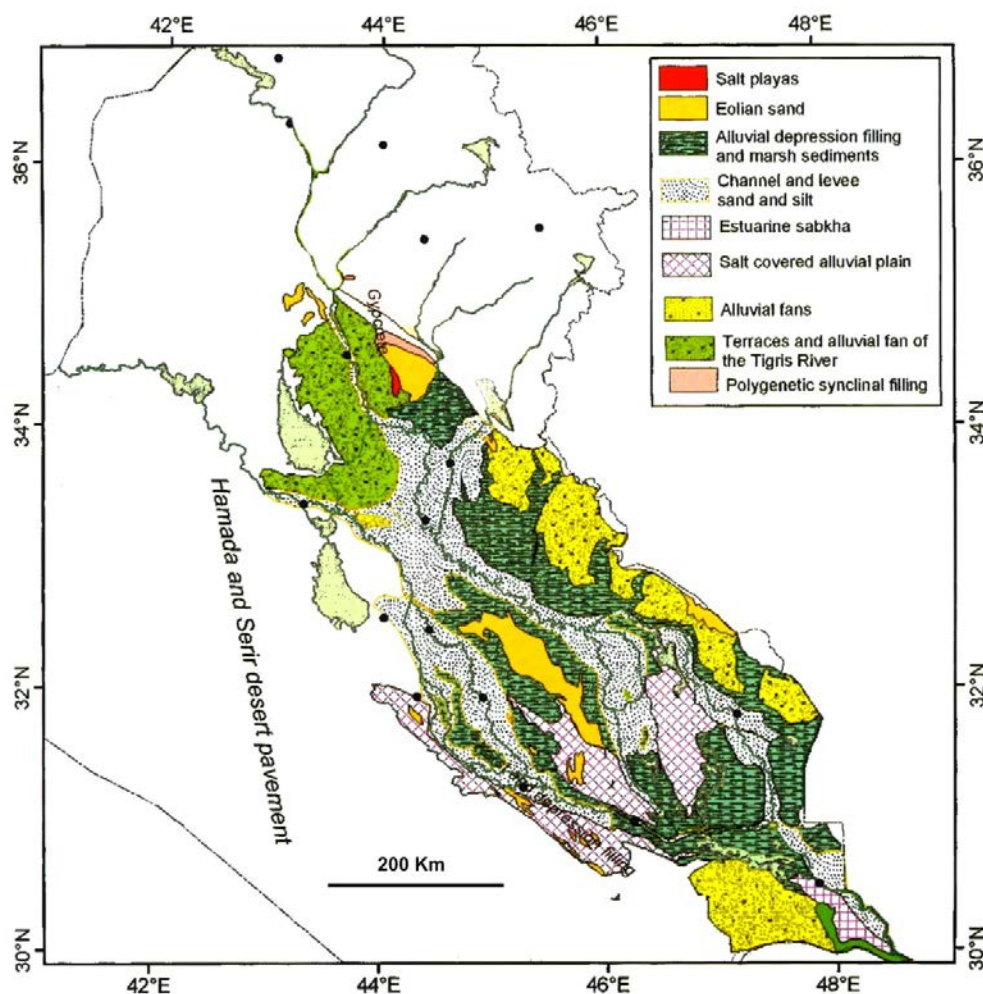


Fig.3: Distribution of major Quaternary units (Aqrawi, 2006 in Jassim and Goff, 2006)

The minerogenic zones of the Mesopotamia Plain almost consist entirely of Quaternary sediments. Until now, only mineral and industrial deposits, which are related to the Quaternary cover, have been studied, however, the subsurface sequence has not been studied yet.

The common examples of the aforementioned deposits are described hereinafter and their locations are illustrated in Fig. (4).

#### ▪ Sand and Gravel

Sand and gravel deposits in Iraq, from genetic point of view, are related to the alluvial fans and river terraces (Pleistocene). Their main use is in construction materials. Three subtypes can represent them, alluvial fans, river terraces and Aeolian sand (Dimitrov, 1979). The most important types are: the alluvial fans and river terraces, as they have great industrial and economic importance; such deposits are located in different parts of the Mesopotamia Plain. The main sites are mentioned hereinafter.



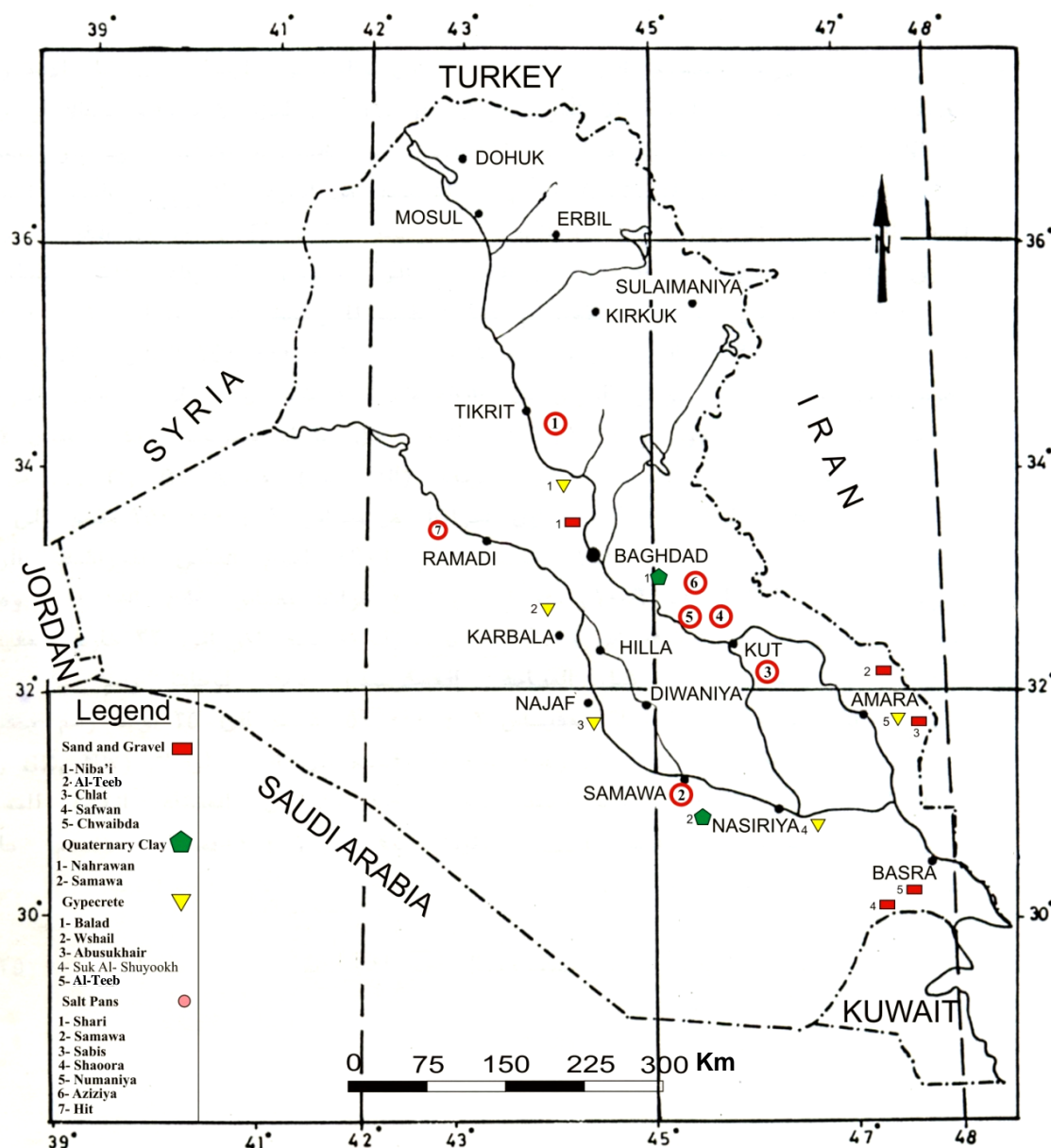


Fig.4: Location map of the deposits related to the Mesopotamia Plain

—**Nuba'i Gravel and Sand Deposits:** The best example of such deposits is located 60 Km northwest of Baghdad. The deposits are of Pleistocene age. The prospected reserve is about one billion cubic meter, the thickness of the industrial bed ranges from (14 – 46) m, with overburden between (0.1 – 3) m, the grain size ratio is 82% for gravel, 17.5% for sand and 0.5% for clay. The gravels are composed of 50% chert and flint, 12% carbonate, 10% igneous rocks, 7% metamorphic rocks, and 9% sandstone. The sand is mostly quartz and chert. The clays,  $SO_3$  and TSS contents are highly variable; the deposits require washing and sieving to become within the specified forms (Bulgargeomina, 1982).

—**Fatha Alluvial Fan** is the largest deposit, it covers an area of about (8 – 10) thousands  $Km^2$  in the region between Falluja, Samarra and Tikrit towns. It is the main deposit of gravels in Iraq and form the northern extension of the Nuba'i Deposits. However, it is worth mentioning that the deposits were considered as terraces of the Tigris River by Dimitrov (1984).

–**Al-Teeb Gravel and Sand Deposits:** They are alluvial fan deposits of Pleistocene age, their average thickness is about 2.9 m, the gravel content is about 69% and the sand is 30%. The calculated reserve of these deposits is about 7 millions m<sup>3</sup>. The gravel mineralogy is composed of 73% carbonate rocks, 20% chert, 6% quartz and 1% rock fragments (Al-Ka'aby and Bayati, 1975).

–**Chlat Gravel and Sand Deposits:** They are also alluvial fan deposits of Pleistocene age, located within Missan Governorate, in the eastern part of the Mesopotamia Plain. The sand represents about 20% of the deposits, the gravels are mainly of carbonate and silicate, with different sizes, the sulphate and salts are very low. The reserve of the deposits is about 63 cubic million meters (Younan and Saib, 1976).

–**Safwan Sand and Gravel Deposits:** They represent Al-Batin Alluvial Fan deposit of Pleistocene age, located 8 Km west of Safwan town. The calculated reserve is about 14 million m<sup>3</sup> (Al-Ubaidi, 1974). The thickness of the bed ranges between (0.7 – 4.6) m; composed of 68% sand and 32% gravel. The mineralogical composition of the deposit is mainly quartz, chert and igneous rocks. The SO<sub>3</sub> and TSS are 0.15% and 0.3%, respectively in the gravel fraction and 0.4% and 0.7%, respectively in the sand fraction, whereas the clay content is 0.35%.

–**Chwaibda Sand Deposits:** These are of Pleistocene age; representing Al-Batin Alluvial Fan deposits, located 10 Km northwest of Zubair town. The calculated reserve is 100 million m<sup>3</sup>. The investigated thickness is 3 m, with no overburden sediments. Quartz is the main composition (Al-Ubaidi, 1975). The average percentages of chemical compositions is shown in Table (1).

Table 1: Chemical compositions of Chwaibda sand deposits (wt.%)  
(Al-Ubaidi, 1975)

SiO <sub>2</sub>	SO <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	Fe <sub>2</sub> O <sub>3</sub>
94.0	0.25	2.5	0.6	0.17	0.35

–**Aeolian Sand:** The Aeolian sand has low economic importance, its use is very limited in a local area near to the Samawa town, and it is used as a raw material to correct the lime saturation factor in cement. There are three belts of sand dunes within the Mesopotamia Plain, the most extensively distributed belt is from Baiji town to Al-Teeb, east of Amara, and the sand is derived from alluvial fan sediments and adjacent pre-Quaternary sediments, which are exposed in Himreen Mountain. The central belt lies between Tigris and Euphrates Rivers and is generally rich in gypsum and clay, which are derived from sabkha and depression sediments. The southwestern belt is located at the margin of the Mesopotamia Plain (along the Euphrates Fault Zone), the sand of this belt consists of quartz and limestone fragments, derived from outcrops of Eocene and Miocene formations (Aqrawi, 2006 in Jassim and Goff, 2006). Two main sand dunes fields are developed in the plain, they are mentioned hereinafter.

**Sand Dunes of Baiji – Tikrit – Shari** are formed under the influence of northwestern winds. The Makhoul and Himreen Mountains are the most important sources of sands forming dune fields. The general distribution of these dunes is relatively stable. There is little variation within the mineral composition between sand dunes of Baiji, Tikrit and Balad Areas, the details are listed in Table (2).

Table 2: Composition of Baiji, Tikrit and Balad sand dunes (Abbas *et al.*, 1984)

Locality and main size	Wt % of size fraction	Quartz (%)	Chert (%)	Limestone (%)	Heavy minerals (%)	Feldspar (%)	Rock fragments (%)
Baiji + 0.125 mm	68	51.2	22.1	20.4	2.2	1.6	3.9
Tikrit + 0.125 mm	62	70	11	14	1.5	–	–
Balad + 0.25 mm	74.6	28.7	52.6	7.15	0.4	1.5	9.3

**Sand dunes of the Najaf – Samawa – Nasiriyah Zone** are mainly composed of quartz and minor amounts of pyroxene amphibole and Celestite. The calculated reserve of the sand dunes near to Samawa town shows 2400 million m<sup>3</sup>. The average chemical composition of the Najaf sand dunes is listed in Table (3).

Table 3: Chemical analysis of the Najaf sand dunes (wt.%) (Al-Ani, 1979).

SiO <sub>2</sub>	CaO	MgO	Al <sub>2</sub> O <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>	Na <sub>2</sub> O	L.O.I	SO <sub>3</sub>	Clay
69.9	11.48	0.51	1.35	0.32	0.3	6.9	7.8	3.95

#### ▪ Quaternary Clay Deposits

Quaternary clay deposits occupy vast parts of the Mesopotamia Plain, deposited in fluvial and fluvio – lacustrine environments. Some of the studied areas of this part have big industrial reserves. According to the technological properties of the Quaternary clays the prospected deposits could be divided into two major groups: The first group can be used in brick industry, whereas the second group can be used in cement industry.

The Quaternary clays are mixture of several minerals, they include (30 – 40)% silt size carbonate minerals, (20 – 25)% silt and sand size quartz, and (30 – 35)% clays, including kaolinite, illite, chlorite and palygorskite, (3 – 6)% iron oxides and hydroxides and (2 – 5)% gypsum and other salts; mostly halite (Al-Bassam, 1984), most of the Quartz is of Aeolian origin. Examples of large deposits of both groups are mentioned hereinafter:

–**Nahrwan Deposits:** They are used for brick industry, located 65 Km east of Baghdad, their thicknesses vary from (5.4 – 10.8) m (Jabbori, 1980). The average chemical composition of this site is shown in the Table (4).

Table 4: Range of chemical composition of the Nahrwan clays (wt.%)  
(after Jabbori, 1980)

SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	Cl	Na <sub>2</sub> O	L. O. I.	TSS	SO <sub>3</sub>
38.51 – 38.86	4.3 – 4.4	8.98 – 9.12	18.8 – 19.1	3.93 – 4.15	0.03 – 0.35	0.03 – 0.3	19.9 – 19.1	2.42 – 2.69	0.89 – 1.1

–**Samawa Deposits:** They are typical representatives for the Iraqi clay deposits for cement industry; they are of fluvio – lacustrine origin, composed of silt, silty clay and sand (Al-Koomi, 1981). The average thickness of the clay is about 1m; the average chemical composition is shown in Table (5).



Table 5: The range of the chemical composition (wt.%)  
of the Samawa clays (after Al-Koomi, 1981)

SiO <sub>2</sub>	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	CaO	MgO	K <sub>2</sub> O	Na <sub>2</sub> O	Cl	SO <sub>3</sub>	L. O. I.
38.24 – 43.77	2.63 – 4.4	6.12 – 8.47	17.53 – 20.9	4.5 – 4.6	0.79 – 1.28	0.55 – 0.99	0.06 – 0.23	0.15 – 0.79	15.17 – 20

#### ▪ Gypcrete

It is a type of secondary gypsum, formed in semi-arid climate from highly sulphate concentrated solution by means of ground water, which rises to the surface by capillary action and evaporates leaving the dissolved sulphate as porous impure gypsum (Fig.5). Gypcrete is randomly distributed in the Mesopotamia Plain. The gypcrete is of low quality because it is highly contaminated with clay and sand admixture. Such type of deposits is used as a binding material between bricks, produced by primitive plants. The chemical analyses results from different localities are listed in the Table (6).



Fig.5: Typical fibrous texture of gypcrete

Table 6: Chemical analysis of gypcrete samples from different localities

Locality	SO <sub>3</sub>	CaO	MgO	Fe <sub>2</sub> O <sub>3</sub>	Al <sub>2</sub> O <sub>3</sub>	Cl	L.O.I	H <sub>2</sub> O	R <sub>2</sub> O <sub>3</sub> +IR
*Balad, in Salah El-Deen	32.6	27.2	1.5	1.6	3.43	–	8.94	–	18.23
**Wshail, in Kerbala	34.87	27.42	0.53	–	–	–	–	16.89	18.32
*Abusukhair, in Najaf	23.27	17.78	0.25	0.18	1.32	0.1	12.06	10.26	43.94
*Suk Al-Shuyookh, In Thi Qar	21.71	19.46	0.95	0.44	2.51	0.06	14.55	9.04	40.21
*Al-Teeb, in Meesan	19.81	31.26	0.33	0.18	0.64	0.10	22.39	7.86	24.3

\* Al-Oqaily (1979)

\*\* Mustafa *et al.* (1978)

**▪ Salt Pans**

There are many salt pans in the Mesopotamia Plain, two of them are well studied; the Samawa and Shari Salt Pans, others are small and are not studied properly to estimate their actual salt reserves; all of them are rejuvenated annually covering part of the local demands. The following salt pans are described hereinafter.

– **Shari Salt Pan:** Is located about 35 Km NE of Samarra, covering an area of about 80 Km<sup>2</sup>. The salt pan represents shallow depression at the end of the drainage valley flowing from Himreen Mountain. The rain and springs water are the main source that feed this depression with dissolved salts. During summer season, evaporation of water leaves salt lamina about (7 – 10) cm in thickness, it is composed of about 22% Na<sub>2</sub>SO<sub>4</sub> and 53% glauberite and 26% Halite. The sodium sulphate reserve was estimated to be about 22 million tons and glauberite is about 34 million tons (Jassim, 1997). The sequence of the sediments and mineral distribution within the pan are illustrated in Fig. (5).

– **Samawa Salt Pan:** It is located 35 Km SW of Samawa town, represented by an elongated depression probably related to the Euphrates Fault system, with few meters lower than the surrounding area (Fig.6). Several springs of salt water feed the depression. The first upper meter is composed of alternation of salts and clay, followed by 5 m thick rock salt. The composition of this salt is shown in Table (7). The calculated reserve is about 42 million tons (Al-Badri *et al.*, 1984).

– **Minor Salt Pans:** There are many other minor salt pans within the Mesopotamia Plain (Fig.7). The main chemical analysis of the salts is listed in Table (8). There reserves are between (500 – 1000) tons.

Table 7: Chemical composition of the Samawa salt deposit (wt.%)  
(Al-Badri *et al.*, 1984)

NaCl	I.R	Ca	Mg	SO <sub>3</sub>	CO <sub>3</sub>	Fe <sub>2</sub> O <sub>3</sub>
98.4	0.27	0.1	0.02	0.23	0.15	< 50

Table 8: Chemical analysis of salts from some salt pans (wt.%)  
(Mikhu *et al.*, 2000)

Salt pans	NaCl	CaO	MgO	SO <sub>4</sub>	K <sub>2</sub> O
Sabis	76.16	0.64	5.6	7.2	0.1
Shaoora	94.07	0.21	1.99	4.5	—
Nu'amaniyah	94.89	0.64	0.03	1.14	0.02
Azziziyah	93.46	0.5	1.6	2.4	0.05

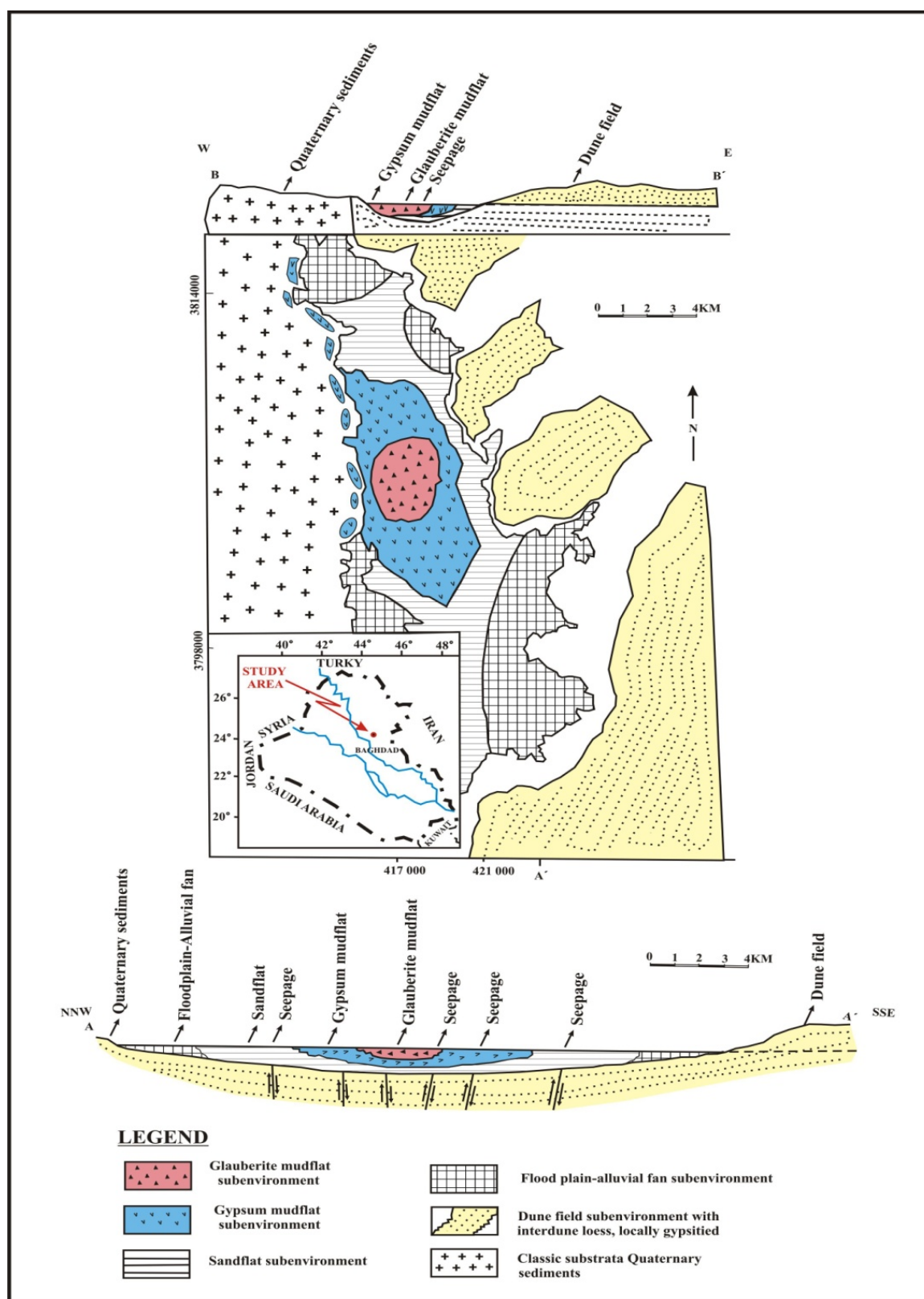


Fig.5: Location map with sections across the Shari Salt Pan (Jassim, 1997)

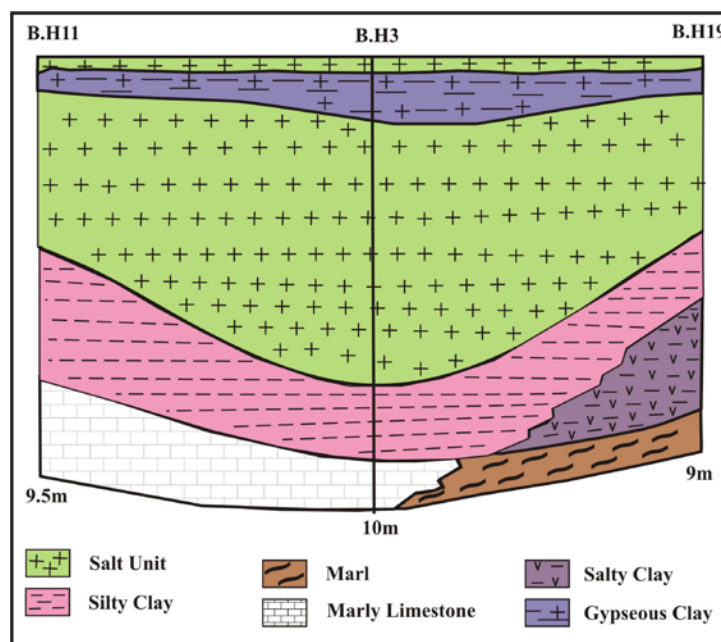


Fig.6: Cross section through the Samawa Salt Pan (Al-Badri *et al.*, 1984)



Fig.7: General view of a salt pan; near to Hit  
(off the Mesopotamia Plain)

#### ▪ Peat

During the hydrogeological surveys in the valley of the Euphrates River, Elerdashvili, (1973) in Dimitrov (1984) mentioned the presence of one peat layer near Bat'ha, in Basrah Governorate, with a thickness up to 4 m. This layer has developed on both sides of the river and was found only (7 – 9) m below the surface. The peat is of Quaternary age and has been formed by accumulation of plant remains in a continental marsh – lake basin. It can be used as a fertilizer in agriculture. Similar basins of marsh – lake peat formation exist in many other places in the lower reaches of Tigris and Euphrates Rivers, but till now they have not been subjected to a systematic geological study. Aqrawi (2006) in Jassim and Goff (2006) mentioned that peat accumulations within the Mesopotamia Plain are recovered at different levels within the Quaternary sediments, they formed due to the climatic changes that occurred prior to the middle Holocene transgression.

## CONCLUSIONS

- It is clear that the Mesopotamia Plain is almost entirely covered by Quaternary sediments, which are represented by flood plain sediments, river terraces, alluvial fans, Aeolian sands and continental evaporites.
- The most common types of deposits are gravels and sands, clays, gypcrete salt and peat. All these deposits exist at or near to the surface. The most important deposits of gravel are in the Nuba'i area, which have a strategic reserve and can cover the need of the central part of Iraq. In Nuba'i Deposits, 50% of the gravels are composed of chert and flint and 17% of igneous and metamorphic rocks (mainly granite, diorite and granodiorite) and the rest are carbonate and sandstone. In Al-Teeb Deposits, the carbonate rocks form 73%, with chert, quartz and rock fragments. The Chlat Deposit is composed mainly of carbonates and silicates.
- Aeolian sands are distributed within three belts. The northern and eastern belts (Baiji – Al-Teeb), southwestern belt along Euphrates Fault Zone, and the central belt (between Tigris and Euphrates Rivers). The first two belts consist of silicate and limestone grains, while the last one consists of gypsum and clay.
- The clay deposits are widely spread in the Mesopotamia Plain, they have formed under fluvial and fluvio lacustrine environments. The main uses of the Quaternary clays are in brick manufacturing and cement industry as raw material, both raw materials are nearly similar in their chemical composition. However, the clays for use in brick industry, have to underwent several tests before and after firing, and to carry out grain size analysis to decide their suitability for this purpose.
- Among the evaporite deposits, the gypcrete has a peculiar type of formation, which is formed in areas where the capillary action for solutions is rich in calcium sulphate, when evaporated during warm periods, fibrous texture of secondary gypsum is formed. Although such type of deposits are usually contaminated by clay and sand, but they are preferable in building, because they are natural mortar; as a binder between bricks.
- Different types of salt pans occur in the Mesopotamia Plain. The Shari Salt Pan contains sodium sulphate glauberite and halite. The Samawa Salt Pan contains halite; as a main mineral in its deposit and represents the main source of salt production for food and domestic uses in Iraq. Other salt pans are less important, due to their small sizes, limited annual production, and because their salts are contaminated with magnesium and sulphate minerals.
- Peat accumulations within the Mesopotamia Plain are mentioned in different levels and localities, this indicate there were climatic changes. The following-up of such deposits by systematic exploration may reveal a big reserves that are suitable as soil conditioner.

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