

CLIMATIC CHANGES & HISTORICAL REALITY OF DESERTIFICATION IN IRAQ & SURROUNDING AREAS DURING LATE QUATERNARY

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Received: 17/11/2007

Accepted: 22/12/2007

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Abstract:

The Iraqi territory & neighboring countries passed during geological history in many climatic variation, during which a successive periods of drought & wet conditions were seen periodically, where its impact was reflected on geological record as seen in palynological zones (pollen-diagram). It was found that the phenomenon of desertification was very old. The study deduced that there were many periods of drought (desertification) emerged during late quaternary period (36000Y.BP- present time), that leads to predominance of pollens & spores of non-boreal vegetation that lived in this type of climate (i.e. *Chenopodiaceae*).

At the beginning of history climatic condition play the basic role that affected the desertification phases in Mesopotamian-plain and after the old human settle the plain & make his civilization in the region he start to play an important role in increasing desertification and become the main factor affected this phenomenon in addition to the climate factors, which played a secondary role too.

التغيرات المناخية والواقع التاريخي لمفهوم التصحر في العراق والمناطق المجاورة خلال العصر الرباعي المتأخر

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تأريخ القبول:

تأريخ الاستلام: ٢٠٠٧/١١/١٧
٢٠٠٧/١٢/٢٢

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المستخلص

مرت الأراضي العراقية والبلدان المجاورة بالعديد من التغيرات المناخية التي اثرت عليها خلال التاريخ الجيولوجي تعاقبت فيها المواسم الجافة والمطيرة دورياً والتي انعكست اثارها على السجل الجيولوجي، اذ حيث تبين بان ظاهرة التصحر قديمة جداً. أكدت الدراسة على ان ظهور العديد من فترات الجفاف خلال العصر الرباعي المتأخر والتي أدت الى سيادة مظاهر التصحر في المنطقة وذلك من خلال انتشار وتوزيع النواتج التكاثرية للنباتات (حبوب الطلع واللقاح). كانت العوامل المناخية هي الأساس في ظهور التصحر ولكن بعد استيطان الإنسان لمناطق وادي الرافدين اخذ يلعب دور مهما في زيادة مظاهر التصحر وأصبح هو الأساس في هذه العملية فضلاً عن المناخ الذي لعب دوراً ثانوياً أيضاً.

Introduction

Desertification is the most important problem that threatened the people in the world in last and present century, which called sometimes drought and famine, in

addition to other titles such as ("desert creep and desert progressive).

Desertification is a newly term which mentioned made to the movement of desert toward the land in Algeria, Tunisia and Libya in later half of the twentieth century.

Its uses expanded after the drought that affected the African shore region during (1968, 1973), so has likened and compared with the desert and semi – desert environments and become intended to turning of the productive land to barren one unfit for human or animal life because of the low productivity to the level of productivity of land in the regions dominated by desert and semi – desert condition's regard less of the prevailing circumstances.

The phenomenon cleared in all the border areas adjacent to the desert, so it seems that the desert creep and progressed forward in horizontal direction, the desert creep arise gradually on stages either vertically or horizontality.

The process (Desertification) passed in a vertical direction in 4- stages:

- 1- deterioration of vegetation cover and erosion.
- 2- drought stage (local climatic change).
- 3- Erosion stage.
- 4- desertification stage (Sahara), in which

the last phase of it is the emergence of bedrocks.

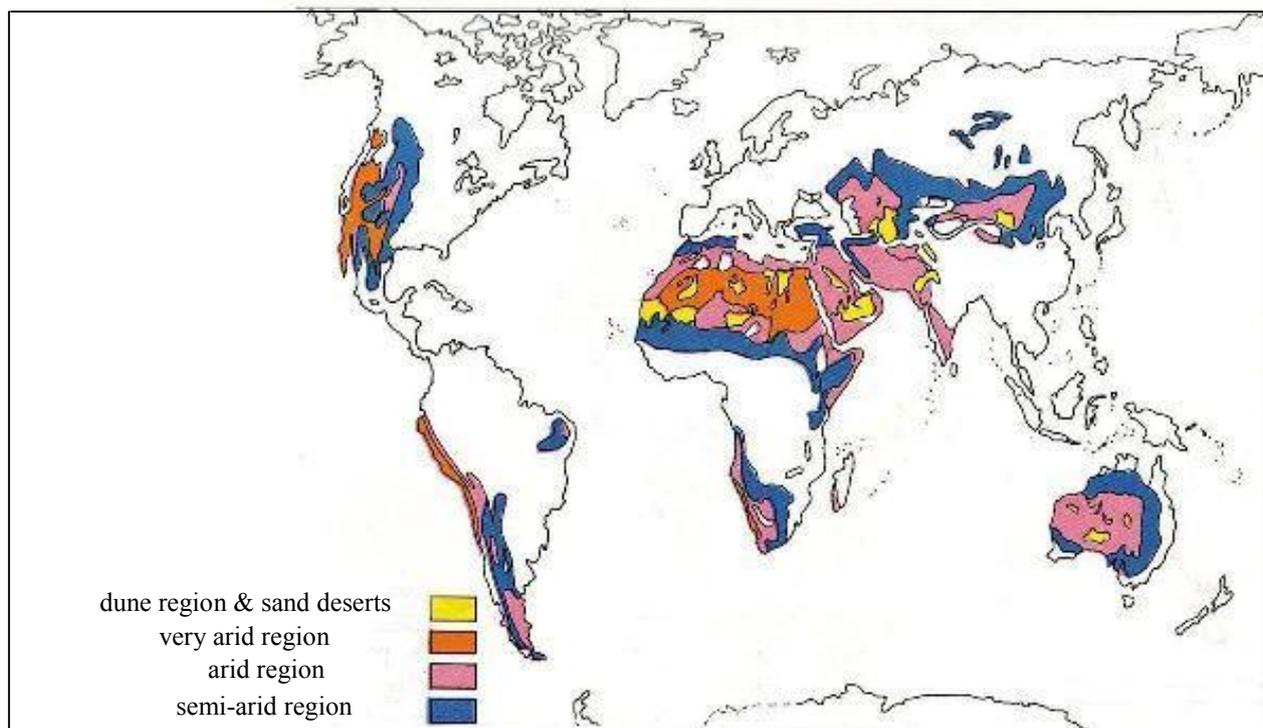
The final outcome of these process on arid lands is the formation of loss sand layers and migrated sand dunes.

Either in the horizontal direction, the desertified areas enters gradually within desert zone, leading to expansion of desert.

The desertification coupled with the expression of drought, so that used a term (drought and desertification), when the main cause of desertification is the climatic factors, especially drought factor.

Dynamic imbalance between the basic component of the natural environment, which includes the climatic factors, rocks and pedological nature, vegetation and livestock leads to deterioration of the natural characteristic of soils and the circumstances surrounding it, and there for leads to low productions capacity of these lands, whether this imbalance caused by the harsh (hart) natural conditions such as drought, or as a result of direct and indirect impact of unsuitable human activities or both (UNEP, 1997).

Fig-1: Arid and desert regions in world (Atlas



Desertification across Geologic Time & it's impact on human history

Desertification phenomenon preceded the emergence of human on the earth planet. Many studies and researches in various fields (geological, geographic, Archeological and biological ...etc) mentioned that there were big climatic changed with successive dry and wet periods across the geological time, the presence of wind sediments and sand dunes, it's direction and constituents signed that these deserts are formed under the dry climatic conditions, the big Sahara which occupy a largest part of the Arab region is one of the oldest desert in the world, formed during Miocene period (Table – 1).

There are many examples and data deduced that there were many significant climatic changes in Pleistocene. The study of pollen and spores is one of the important tools used in determining the climatic variations especially in quaternary period.

The vegetation assemblages near the border of it's environmental requirements more sensitive to these abrupt climatic changes, where in the dry environments small increasing in the amount of water (precipitation) can change the nature of the earth by increasing the density of plants, so the desert lands provide a good record to

the sudden changes in vegetations and pollen and climate. During drought periods and due to lack of plant covers we notice decreasing of pollen sum, while in humid period the vegetation increased which leads to produce sufficient quantities of pollen grains (Dupont, 1992).

Through a study conducted by Al-Dulaimy (1999) on the sediments of Euphrates flood plain, he detected many climatic cycles effected the area, the oldest one emerged in his study during the period (21000-18000 Y.B.P) where the climatic conditions were highly humidity and warm with possibility of summer precipitation as mentioned by the wide distribution of *Graminae* pollen grains (PZI), (Fig . 2), Also Al – Tawash (1996) noted increased the water level of Razzazah lake during the same period.

McClure (1976) notice that the desert of Empty – quarter (Saudia) passed during the period (36000 – 17000 Y.B.P) in a humid condition where the water level of lakes there are increased, agreed on what Wasulikova, 1967, in: (El – Moslimany, 1989) pointed that lake Zerbari in Iran was high leveled during (22000-14000Y.B.P).

Yan and Petite-Maire (1994) confirmed that the Arabian plateau affected by a humid climatic during (30000-21000Y.B.P)(Fig.-2).

Table-1: correlation of vegetation belts positions in 1958, with that before 1000 Y

Location (according to latitude 5° N)					
Mean present precipitation (mm)	1958		Before 10.000 year		Vegetation Belts
	%	Location	%	Location	
0 - 75	٢٢,٠	١٨-١٦	-	-	desert
75 - 300	٥٤,٠	١٦-١٣,٣٠	٣٣,٣	١٨-١٦	Semi-desert
300 - 1000	٢٤,٠	١٣,٣٠-١٢	٦٢,٥	١٦-١٢ ٤٥	Savanna with little precipitation
1000 - 1300	-	-	٢,٨	١٢ ٤٥-١٢	Savanna with high precipitation
1000 - 1300	-	-	١,٤	١٢ ٤٥-١٢	Flood-regions

Awawdah (1998) confirmed this conclusion and show that the Jordanian (10Y.B.P)

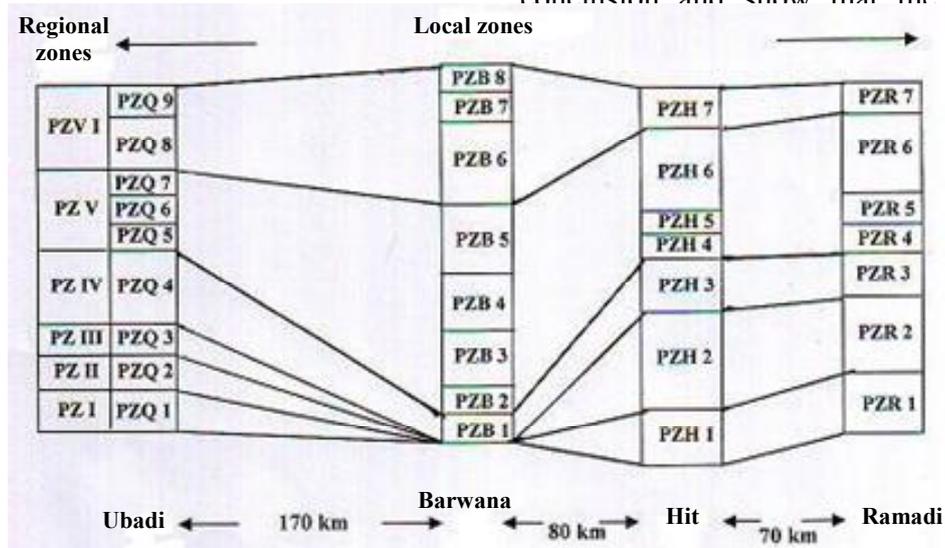


Fig-2: pollen-diagram of Euphrates Flood plain (Late Quaternary) (Al-Dulaimy, 1999).

The studies have shown that the climate during (18000-14000Y.B.P) was very severe drought, through the domination of *Chenopodiaceae* pollen and decreasing of grass pollen (*Graminae*) in Euphrates Flood – plain (PZI, Fig.2) (Al-Dulaimy, 1999), in addition to that Al-Tawash (1996) indicated that the Razzazah lake was drought completely during 15000 Y.B.P, where the desertification phenomenon dominated the Iraqi lands, Al-Jubowri(1997) supported this conclusion during her study to the southern part of Mesopotamia, where she mentioned that the area was affected by cold and dry climatic during that time.

We believe that this period may represent and match the last glacial maximum (LGM) in Africa which Street-Perrott and Roberts (1982) mentioned, where the climate was very cold and dry with strong winds. This period represent the highest drought period during Late – Pleistocene.

On the other hand Abed (1995) pointed that the lake Lissan in Jordan passed by a server drought during (20000-16000Y.B.P).

was dominated by a steppe vegetation that resist the dry and very cold climatic.

The wet and warm conditions returned to cover widely Iraq and neighboring countries during (14000-11000Y.B.P). through the dominance of *Graminae* and decreasing of *Chenopodiaceae* in Euphrates flood-plain (PZIII). (Al-Dulaimy, 1999,2003).

Humidity increased in the empty- quarter desert during (12000-1000Y.B.P). (Anton, 1989).

On the other hand many of the studies indicated that the warmth period that followed (LGM) was irregular and vibrated in the Arabian regions, and the more visible are two stages of Arabian Gulf transgressions that covered the area due to rise of sea level during (14000 and 11000 Y.B.P). (Yan and Petite, 1994).

There were many climatic variation which may be small scale on Arab region, where the Iraqi territory and the surrounding areas subjected to the very wet conditions with warmth, which represented by dominance of *Gramminae* on the vegetations of the area with obvious decline in *Chenopodiaceae* and high

diversity of plants in the area, with emergence of *plamae* pollens grains in climate studies, some of which suggested that the most Arabian and African deserts were subjected to Moon soon precipitation during (14000-11000Y.B.P). where transgression of Arabian – Gulf started (Roberts, 1980).

Cremaschi and Dilerine (1999) study the climatic changes and cultural dynamics in the Libyan Sahara, and shows that the sediments of caves in A Acacus mountains from 14000 up to 9700 years B.P are indicative of a substantial increasing precipitation during upper pleistocene and at the very beginning of the Holocene.

The historical studies on the first humanity groups that were stabilized during that periods (which called palaeolithic) in the high lands plains away from the Tigris and Euphrates rivers, where it's needed from foods were benefits from forests and natural vegetations that covers the plains, in addition to providing diverse animals that were depends on them by hunting.

The archaeological evidences found in Scheinder caves (N – Iraq) as well as those found on quartzite rocks along wadi - Hauran in western Iraqi desert support the previous conclusion. Humans began to tame and exploit wild species only about 11000 years ago after several million years of collecting plant food and hunting gawe(Hole, 20070).

Also Hole (2007) mentioned agriculture began in the near east some 11000 years ago toward the end of younger Dryas when aridity had diminished wild food resources of younger Dryas when aridity had in the narrow strip of land that runs from Gulf of Aqaba to SE- Turkey including Fertile Crescent after several million years of collecting plant and hunting game. During the pre-agricultural period human had little impact on the earth other than cutting trees and Shrubs for fuel. (Hole, 2007).

reasonable rates, this consistent with most

The Mesopotamian region was affected by a great event, which impacted on the human settlement and existing civilizations considerably, we believed that this event is (NOAH DELUGE) where the studies of Al- Dulaimy (1999,2004) on Euphrates flood plain, Al-Tawash (1990) on Razzazah lake in central Iraq, Al-Jubowri (1997) on Mesopotamian plain – south Iraq and Bony (2002) on Najaf -Sea, shows the existence of such a great event, through the presence of marine organisms (Dinoflagellate, Achritarch, Foraminiferal lining in the sediments of that period (pls. 1,2), where the impact of Arabian Gulf transgrasion extends and reached the upper Mesopotamian region during the period(10500Y.B.P).Beke (1834) in: Evans and Larson (1978) pointed that the coast of Arabian Gulf located in the area between Baghdad-Samara during (7000-6000 Y.B.P) (Fig.-3).

Also Baker in Al- Sakny (1993) in his book Gilgamesh epic pointed the deluge event in ancient Iraq, and mentioned that it was happened in the Late so-called (Chalcolithic), before the start of summerian civilization in the ended the fourth millennium BC. The causes of the deluge due to rise of Arabian Gulf level, in addition to increase of river floods and high precipitation.

These conditions represent humid climate with continuation of summer precipitation, where the sediments of this period pointed to summer precipitation, with high amount of grass plants (*Gramminae*) and high diversity of plants with clear representation of *pinus*.

These events coincide with transition period from pliestocene – Holocene (11000-9000Y-B-P). (AL- Dulaimy,1999), (Al-Ameri et. al., 2000).

Brooks(2006) pointed that regions such as the Sahara were characterized by numerous water bodies and supported abundant humid -climate flora and fauna

and significant human populations, and rain fall and surface water were more

abundant throughout much of the northern

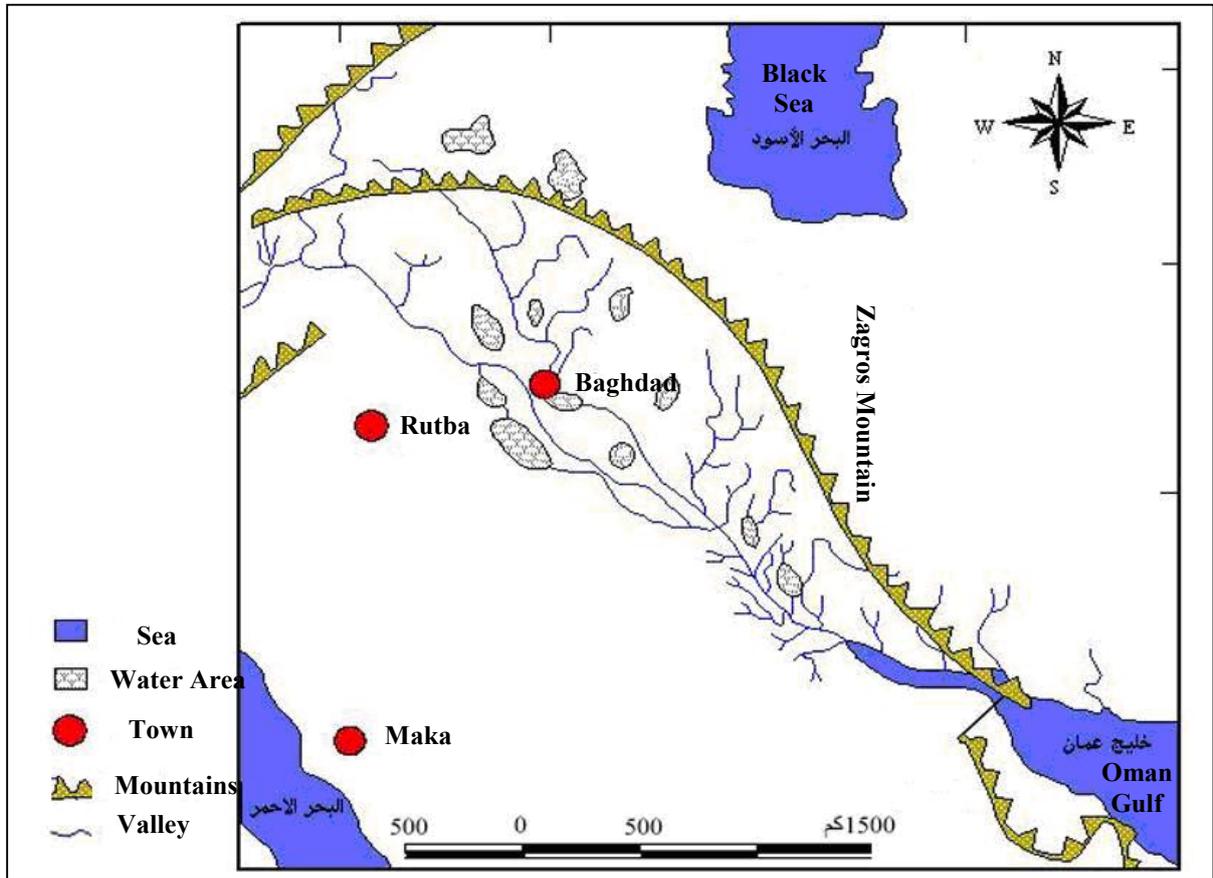


Fig-3: Map show shore line of Arabian Gulf before 10500 Y.BP (Al-Ameri, etal.,2000)

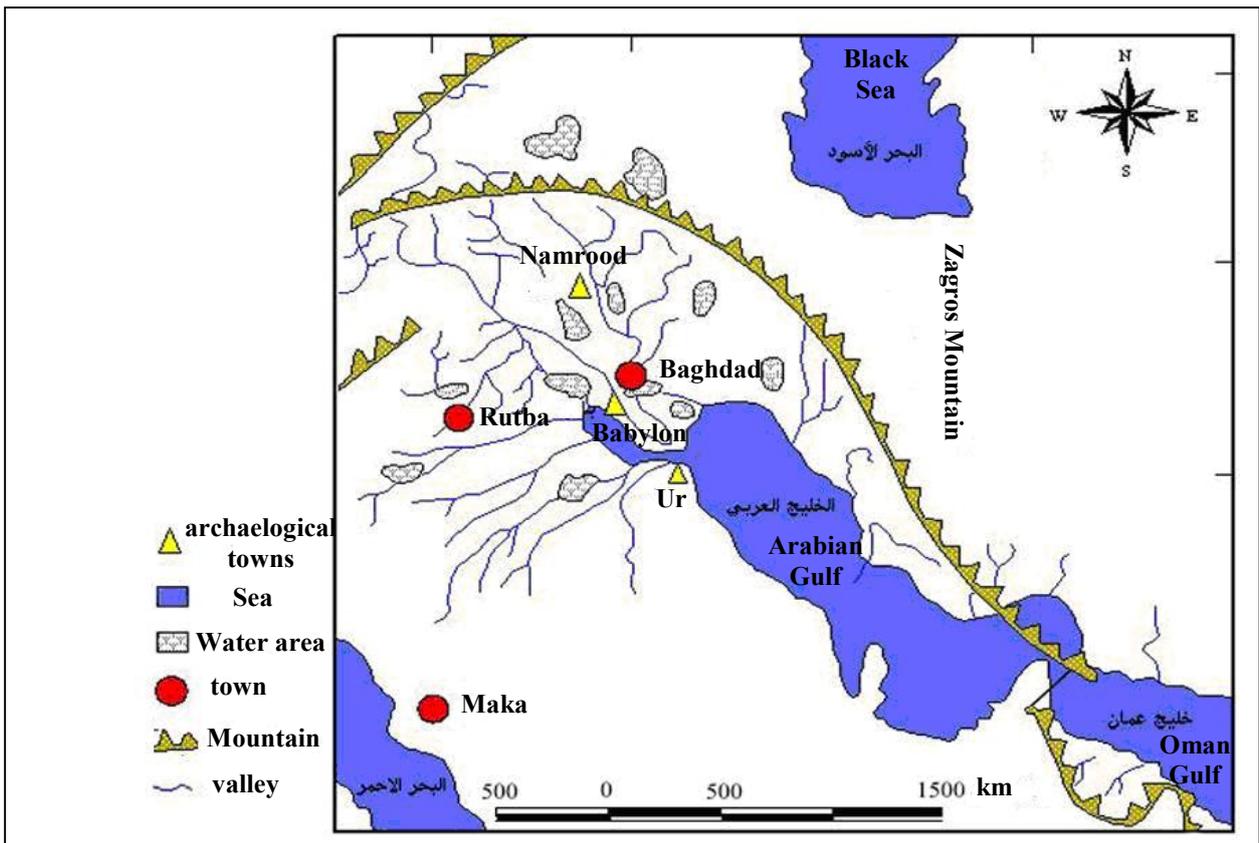


Fig-4: Map show shore line of Arabian Gulf around (10500-4000 Y.BP) (Al-Ameri etal.,2000)

hemisphere extra-tropical zone during (10000-6000 Y.BP).

The important observation in the study of Al -Dulaimy (1999), presence of pollens of filed crops (Cereals) for the first time in the sediment of the region, in high percentages, which means that the first human groups (Mesolithic) moved during the period (11000-9000Y-B-P) from the grazing and hunting and trying to stabilized and settlement in Mesopotamian plain and cultivated the area to get foods. A widely held view is that the process of increasing social complexity associated with the development of agricultures, large settled communities and the earliest status, was made possible by the relatively benign climate of the Holocene (Fagan, 2004, in: Brooks, 2006).

The archaeological study done by Al-Bassam (1988) to the chert pieces covered the western Iraqi Desert in the area between Akashat – Rutba which back to the palaeolithic period, shows that the climatic conditions prevailing for the period(10000- 5000Y.B.P) were suitable for living by man and animals, where the area exposed to the high precipitation. The moisture and warmth conditions continued affecting Arabian- Region during the period(9000- 6000Y.B.P) with continuation of summer precipitation.

It was noted in the study of Al-Dulaimy (2007) presence of pollens of forest, especially in the uplands areas surroundings Mesopotamian plain, during the period (10000-6000 Y.BP) with the exception the period (8000-7000 Y.B.P), which was recorded in the Tigris Flood – plain, which pointed to cold & dry conditions with scarcity of precipitation, as indicated by dominance of *Chenopodiaceae* and pollens of plants that lived in such climate, in addition to the distribution of *Artemisia* pollen which

inducted very high cold condition, noting that this stage was not recorded in Euphrates and Razzazah sediments. Cremaschi & Di Lernia (1999). Pointed that around (8100- 7200 Y.B.P) an erosional phase and arid climate occurred in Libya caver as indicated by sedimentary gap & presence of aeolian sand. This humid period extends to cover area of Empty-Quarter desert, where the water level of the lakes present there are raised (McClure, 1976).

On the other hand Robert (1980) pointed that most of Fertile-Crescent countries and Arabian deserts where effected by monsoon rains during the period (9000-6000Y.B.P).

The climatic volatility in Mesopotamian-plain and surrounding regions continued since the period (6000Y.B.P), this cleared by the clear oscillation in the vegetation assemblages that dominated the sediments of the region, and prevailing of the dry climatic conditions similar to that circumstances present today, which indicated by the dominance of *Chenopodiaceae* and *palmae* pollen, *plantago* and *Centaurea*, which pointed to the clear influence of human activities on the environment, here the role of human as a basic factor contributing to the increasing of desertification was emerged, through his unusual exercise on the ecosystem, especially in the pastoral areas surrounding rivers. (pl.-3).

Historical studies shows that the human groups of Neolithic man lived in Mesopotamian plain were moving and settled near river banks with increasing of drought and beginning of desertification in the region. Environmental catastrophics, particularly severe, rapil or abrupt changes in climate, are often associated in the academic literature with collapse of

civilizations. The fall of the Akkadian Empire and of the Egyptian old Kingdom (4.2 kyr. BP) have both been attributed to

He started the performance of irrigated agriculture and its remediation of land, as indicated by the presence of rock dams buried in the sediment of Euphrates floodplain in Haditha area, elevated many meters higher than the present level of the river, which means that human during that period began to develop irrigation systems by transporting the water from Euphrates river to the high land surrounding it and began aware of the flood dangerous and start to introduce the necessary precautions to reduce that (Al-Dulaimy, 1999).

This period was recoded also in the empty quarter, where McClure(1976) pointed that the drought conditions started in the region from (6000Y.B.P). as well as in the central and southern Iraq (Al-Tawash, 1996, Al-Jubowri, 1997). This declination in the climate and continuation of drought and desertification still continued affecting the region to the present time. Even the presence of some short – climatic oscillation refer to wet conditions, but may be they are local not on a regional scale. Cremasch & Dilerkra (1999) show that in Late seven millennium BP, humification and solute movements were progressively reduced. Erosional surfaces, deposition of aeolian sand inside caves and shelters (Libya), and the collapse of shelter roofs indicate the onset of severe dry conditions after 5000 Y.BP. Also he mentioned that pollen grains also indicate a dry steppe environment.

climatic change resulting in a period of pronounced regional desiccation (Brooks, 2006).

Appears from the foregoing that human was able to get used to the prevailing environmental conditions, and the drought remained the main factor in the emergence of phenomenon of desertification, but this status changed gradually with development of human and increased his different efficiencies and imposes himself in a picture not suitable to the prevailing ecosystems found in his region, where his activities become the main factor affecting this phenomenon and the role of climate took second place. The phenomenon of desertification is one of the most important reasons that led to the establishment of human civilizations around the rivers and water sources in the Nile valley and Mesopotamian plain (Al-sakny, 1993). The present distribution of vegetations in the Arab region is similar to the distribution of environments that was existed for thousands of years with the apparent difference in the area, with clear deterioration in vast areas by drought and desertification.

The historical studies indicated that Mesopotamian plain was famous by dense forests that extends beyond distances on both sides of Tigris and Euphrates rivers and their tributaries while natural forests located on the mountain ranges in the north where successive civilization including "Sumerian" depends on that wealth, and they bring precious timber and timber construction from the eastern mountains of Iran.

(X750)

Plate-1

- 1- *Homotryblium plectilum*
- 2- *Protoperidinium* sp.
- 3- *Retitri Colpites* sp.
- 4- Genus A sp.1
- 5- *Tubuli floridites viteauensis*
- 6- *Leptodinium* sp.
- 7- *Comparodinium*
- 8- *Leptodinium* sp
- 9- *Cichorium intybus*
- 10- *Genus A* sp.2
- 11- *Genus A* sp.2
- 12- *Genus A* sp.3
- 13- *Genus A* sp.3
- 14- *Forammferai*
- 15- *Fibrocysta* sp

(X750)

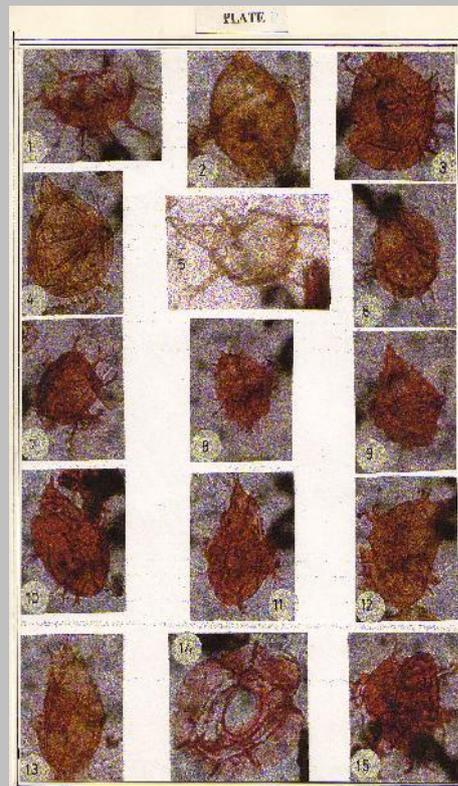


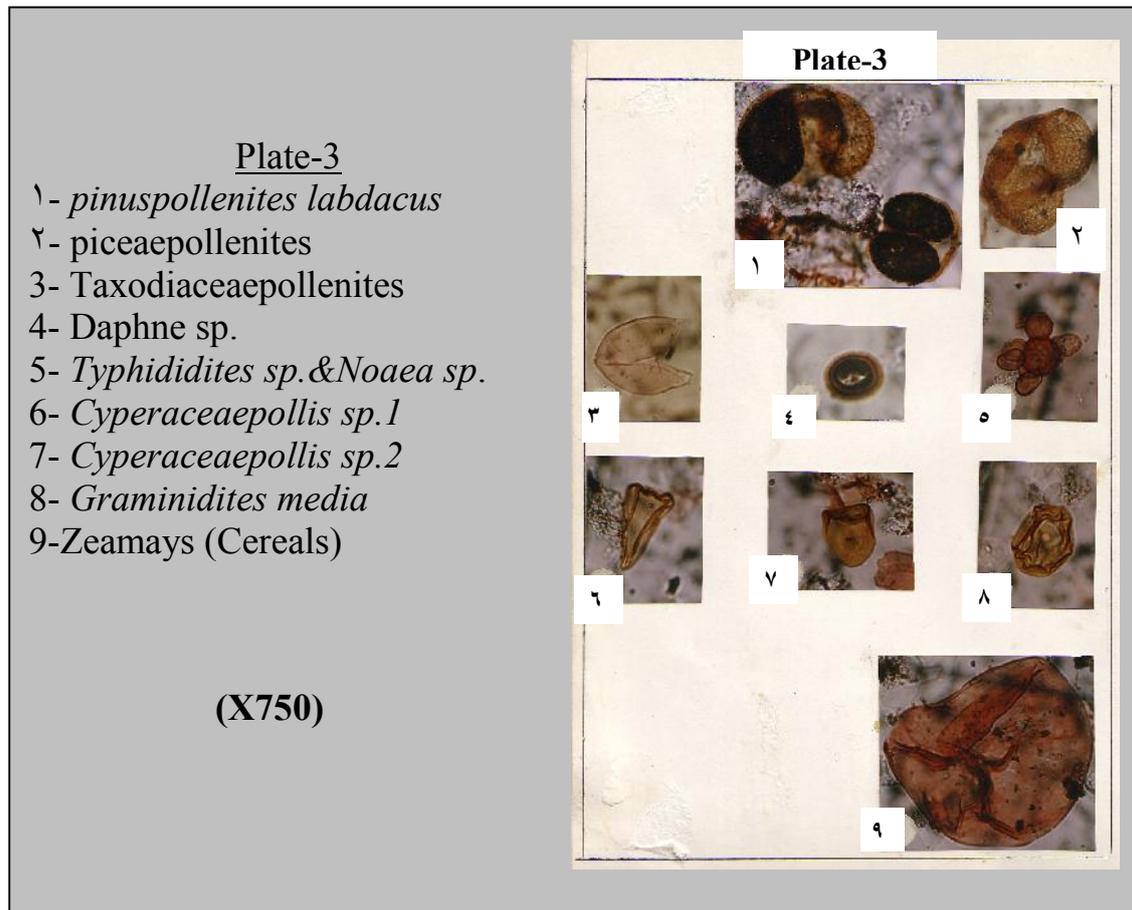
Plate-2

- 1- *Palmaepollenites* sp.1
- 2- *P.sp.2*
- 3- *P.sp.3*
- 4- *p.sp.4*
- 5- *Psilamoncolpites nanus*
- 6- *Psilamoncolpites nanus*
- 7- *Palmaepollenites* sp.3
- 8- *p.sp.3*
- 9- *p.sp.2*
- 10- *laevigatosporites* sp.
- 11- *Polypodiceaesporites haardtii*
- 12- *Thelypteris* sp.
- 13- *Cihorium* sp. (*Compositae*)
- 14- *Cichorium intybus* (Comp.),
- 15- *Taxodiaceapollenites hiatus* & *graminia*



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- نافذه جديدة على تاريخ الفراتيين في ضوء الدلائل الجيولوجية والمكتشفات الأثرية. دار الشؤون الثقافية العامة-وزارة الثقافة والإعلام ()
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