HOLOCENE ARIDIFICATION IN CENTRAL IRAQ

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ABSTRACT

Shari Playa is a closed basin located in central Iraq and characterized by the development of clastic and saline sediment facies during the last (6000 – 6500) years. The present climate in the area is semiarid with a mean annual precipitation of about 150 mm and a mean annual temperature of 22°C. The palynomorph constituents of the Shari Playa sediments revealed climatic changes towards dry periods. These palynomorphs include: *Tricolpate, Lycopodium, Artemisia, Armeria martima, Palmaepollenites, Chenopodiacea, Graminae, Caryophyllaceae, Lavigatosporites, Quercus, Alnus-Pollenites, Retitriporites, Polygonium, Convolvollus* and *Centaurea.*

Six palaeoecological zones are suggested by the pollen diagram of these sediments. Two wet episodes (Zones 2 and 5) are indicated at (5200 – 5800) years and (2500 – 4200) years B.P. The rest zones represent dry and transitional episodes. The predominance of Chenopods in the uppermost zone indicates the climatic deterioration and aridification in the area leading to the present climate.

تصحر وسط العراق في فترة الهولوسين

رافع زائر جاسم و يحيى توفيق الراوي و حبيب رشيد حبيب

المستخلص

مملحة الشارع حوض مغلق في وسط العراق يتصف بوجود سحنات الرسوبيات المنقولة والترسبات الملحية خلال فترة (6000 – 6500) سنة المنصرمة. المناخ الحالي في المنطقة شبه جاف ويكون معدل سقوط الأمطار فيه حوالي 150 ملم سنوياً ومعدل درجات الحرارة السنوي حوالي 22 °م. يظهر محتوى ترسبات المملحة من حبوب الطلع والسبورات تغيراً في المناخ تسوده فترات من الجفاف. وقد تواجدت حبوب الطلع والسبورات بنسب مختلفة تبعاً لطبيعة المناخ وتمثلت ب:

Tricolpate, Lycopodium, Chenepodiacea, Palmaepollenites, Armeria martima, Artemisia, Quercus, Lavigatosporites, Caryophyllaceae, Graminae, Centaurea, Convolvollus, Polygonium, Retitriporites and Alnus-Pollenites.

تم اقتراح ستة أنطقة حياتية قديمة اعتماداً على مخطط محتوى حبوب الطلع والسبورات في هذه الرسوبيات وقد أمكن تمييز فترتين مطيرتين (النطاقين 2 و5) تمثلتا بالفترتين (5200 - 5800) سنة و (2500 - 4200) سنة من الآن. أما باقي الأنطقة فقد مثلت فترات جافة وانتقالية. إن وجود نسبة عالية من Chenopods في النطاق العلوي يشير إلى التردي في المناخ والتصحر في المنطقة مفضياً إلى المناخ الحالي.

INTRODUCTION

Shari Playa is a longitudinal depression located about 35 Km northeast of Samarra City, Central Iraq (Fig.1). The area is hot and dry in summer and somewhat cold and wet in winter. The mean maximum temperature in July is about 45 ^{o}C, with lowest relative humidity of 25%, and the mean minimum temperature for January is about 4 ^{o}C with 70% relative humidity. The wet season starts in November and lasts until April with maximum mean rainfall of 50 mm in March. The mean annual amount of rainfall for the period between 1941 –1980 is 150 mm, while the mean annual amount of evaporation for the same period is 3000 mm (I.M.O., 1989).

The present work has been conducted during 1995 – 1996 by drilling 15 boreholes inside the playa and reached a depth of 46 m, 6.5 m of this depth was rich in pollens and spores, while in the rest they were oxidized and not preserved.

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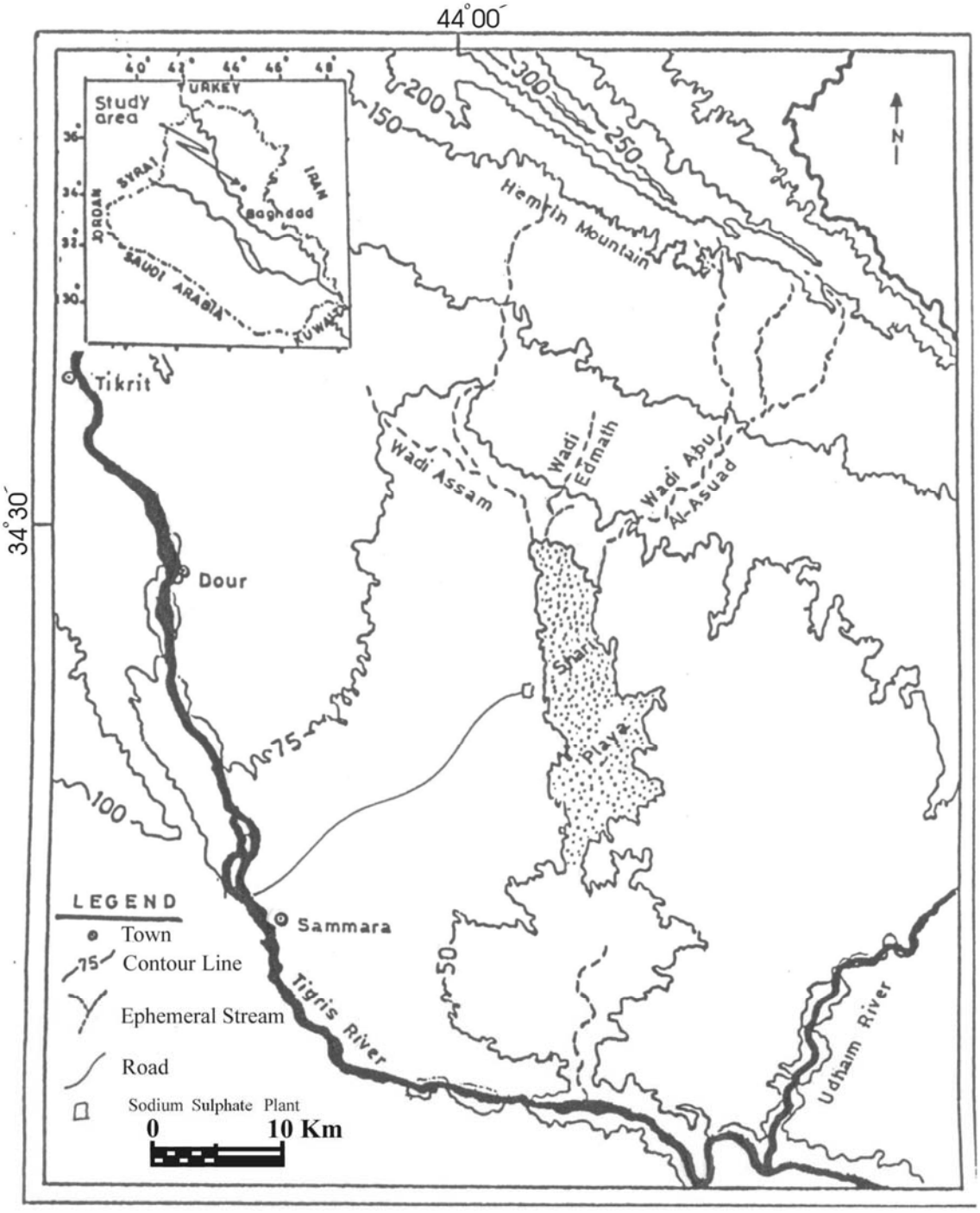

Fig. 1: Location map of Sharia Playa

SAMPLING AND METHOD OF WORK

The palynological study of the sediments of Shari Playa is an attempt to shade light on the climatic changes that took place from the beginning of its formation to the present, by studying the botanic history. The dominance of certain pollen or spores will ultimately reflect the suitable climatic conditions at the time of deposition for its growth. The climatic conditions achieved by comparing the conditions of growth and dominance of the nowadays living plants with previous conditions of growth.

The palynological indications are used in this study to outline the climatic changes that accompanied the formation of Shari Playa. The present climatic conditions are semiarid, characterized by low precipitation (<150 mm / year), mean annual temperature of 22°C and mean annual evaporation of 3000 mm / year.

To carry out the palynological studies, 10 samples were chosen from the core of borehole Sh /15, which is located about 1 Km inside the playa, in its mid-western part of Shari Playa. These samples extend to a depth of 14.10 m, 7.85 m of which represent the playa sediments (Holocene) and the rest represent the Pleistocene sediments present before the playa formation and represented by reddish clay.

The sediments of Shari Playa are composed of black mud slurry under lain by mud with embedded glauberite crystals, mud with embedded gypsum crystals and silty clay. The Pleistocene sediments are composed of alternations of clay, silt and sand. The samples were prepared according to Bars and Williams method (1974). The prepared slides were studied under the microscope for identification, counting and photography of the pollens and spores.

PALYNOMORPH CONSTITUENTS

The palynological examination revealed the presence of many palynomorphs (Table1). The identification of pollens and spores was based upon the external features like the number of colpi, spines and the shape of the surface and colpi. The types of palynomorphs are listed, with their percentages of distribution, in the sediment's column (Table 1), presented in the pollen diagram (Fig.2) and shown in Figs. (3 and 4). The identified palynomorphs include *Tricolpate, Lycopodium, Artemisia, Armeria martima, Palmaepollenites, Chenopodiacea, Graminae, Caryophyllaceae, Lavigatosporites, Quercus, Alnus -pollenites, Retitriporites, Polygonium, Convolvollus* and *Centaurea. Lysimachia and Dinoflagelat*e cyst were found in the Pleistocene layers only in small amounts.

CLIMATIC HISTORY

Environmental and climatic changes may affect the dominance or even the growth and presence of floral species. Therefore, the variations in the dominant species may indicate the climatic changes imposed on the area. Knowledge of the variations in the dominant species has been achieved by studying the pollen accumulations in the sediments that reflects the floral species grown up in the area or in the nearby (Harrison and Digerfeld, 1993). The relationship between the climate and the floral species were utilized to understand the climatic history of the Shari Playa basin.

The present playnological study of the samples that represent the sediments of Shari Playa is interpreted on the basis of descriptions of the pollen and spores, their floras and the climates at which they grow as outlined in the studies of Barnett (1989), Traverse (1988), El-Moslimany (1987) and Horn (1994). The pollen and spore percentages in the sediments of Shari Playa are shown on the pollens diagram (Fig.2). From this diagram, it could be noticed that *Armeria martima, Chenopodiaceae, Convolvollus, Quercus and Graminae* could be used as a climatic indicator.

Table 1: Palynological analysis and percentage distribution in the sediments of Shari Playa

Depth (m)	***Tricolpate***	***Lycopodium***	***Artemisia***	***Armeria*** martima	***Palmaepollenites***	***Chenopodiacea***	***Graminae***	***Caryophyllaceae***	***Lavigatosporites***	***Quercus***	***Alnus-Pollenites***	***Retitriporites***	***Polygonium***	***Convolvollus***	***Centaurea***
	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %	No. %
1.70	8 4.08	3 1.53	14 7.14	16 8.2	6 3.06	97 49.5	41 20.9	9 4.59	2 1.02	-	-	-	-	-	-
2.75	-	-	1 4.17	-	-	12 50	6 25	2 8.32	-	1 4.17	1 4.17	1 4.17	-	-	-
4.25	-	-	2 2.15	50 53.76	-	25 26.88	10 10.75	-	-	-	-	1 1.08	2 2.15	3 3.23	-
5.40	3 12.9	-	1 4.35	5 21.7	-	5 21.7	2 8.6	-	-	2 8.6	-	-	1 4.35	4 17.3	-
6.25	3 6.53	3 6.53	3 6.5	15 32.6	-	15 32.6	2 4.34	-	-	-	-	-	2 4.34	3 6.52	-
6.60	-	1 2.22	1 2.22	25 55.5	-	11 24.45	2 4.44	-	-	4 8.89	-	-	-	-	1 2.22
6.90	-	-	-	-	-	2 25	1 12.5	5 62.5	-	-	-	-	-	-	-

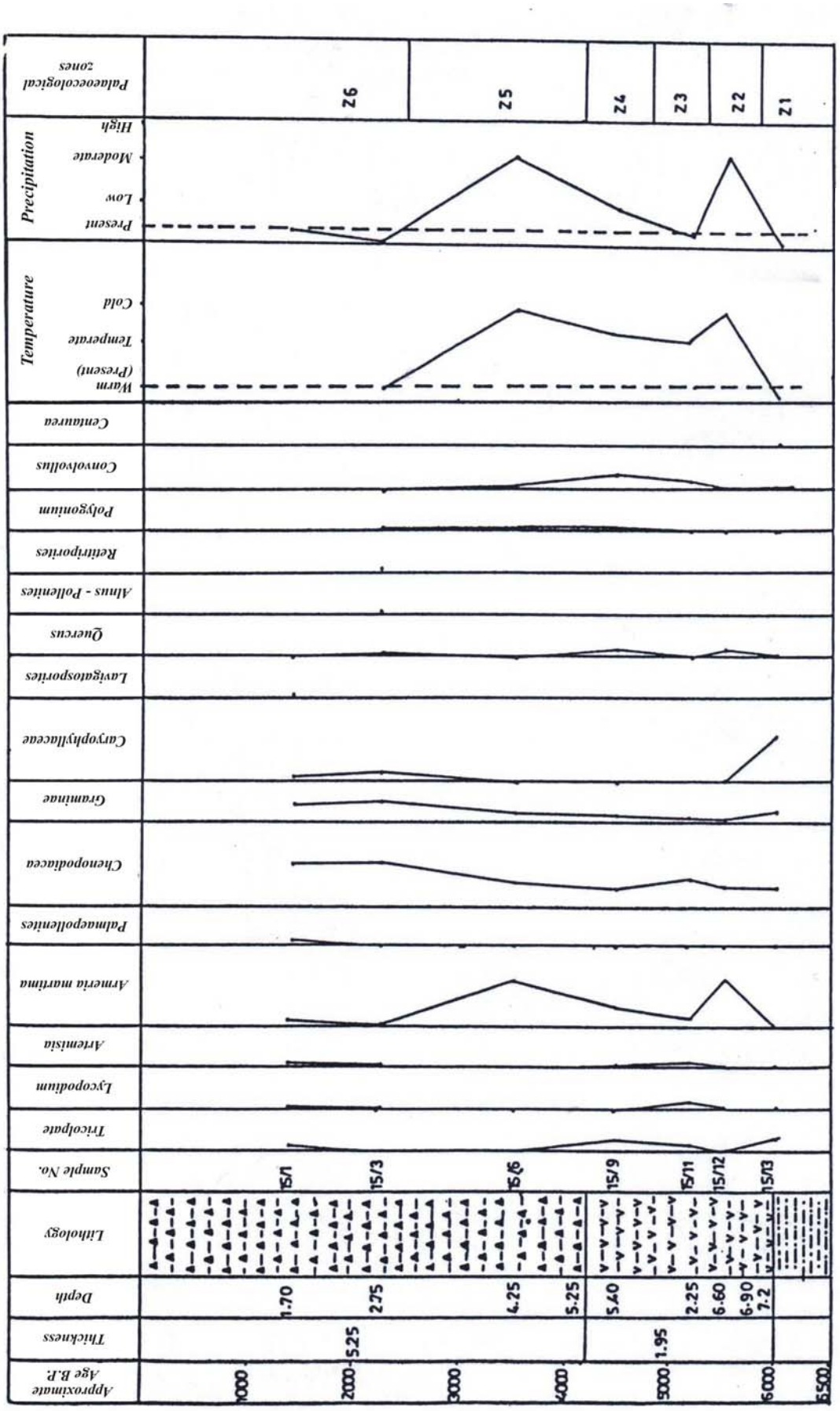

Fig. 2: Pollen diagram for the sediments of Shari Plaua and the suggest pelaeoecological zones

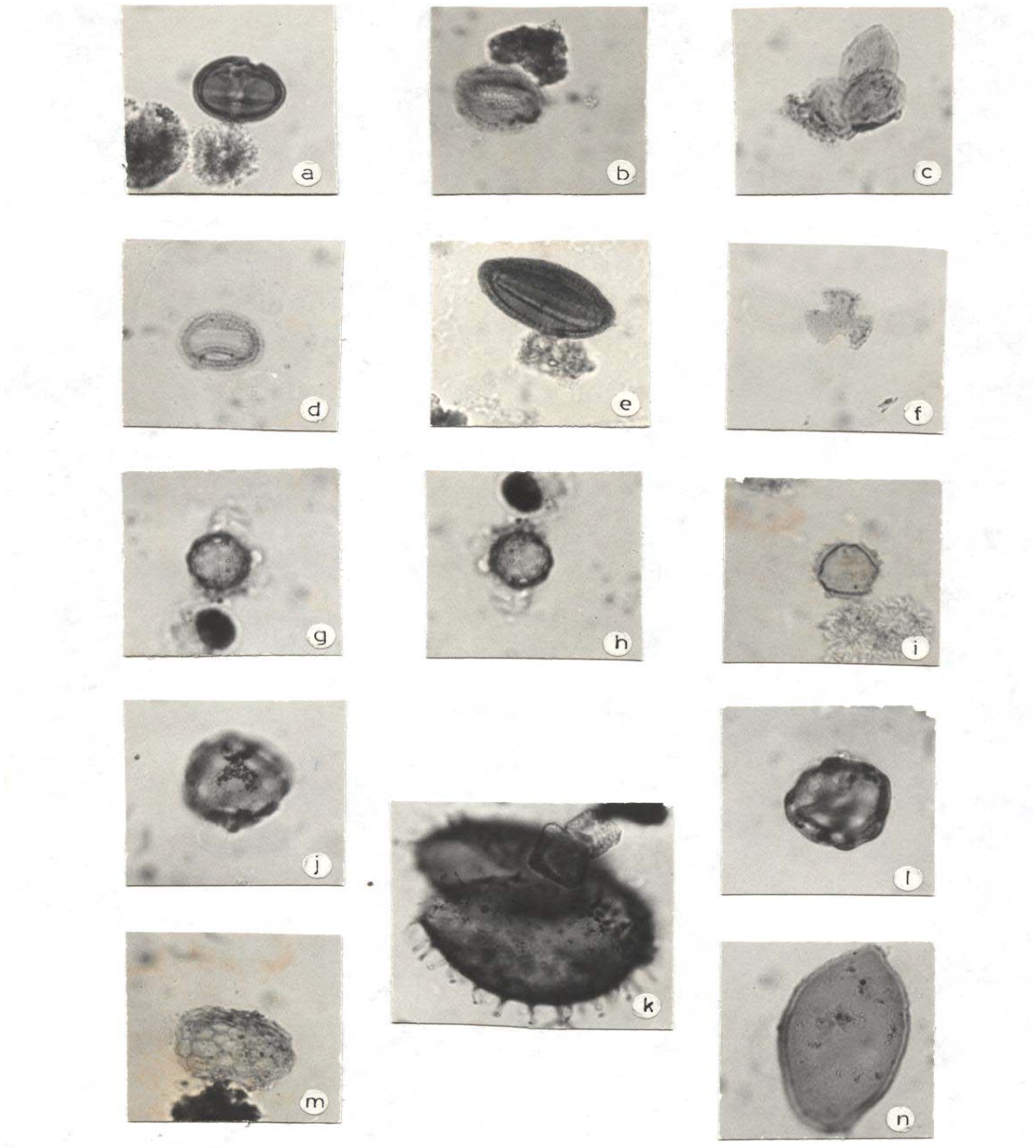

Fig. 3: Photomicrographs of palynomorph species from the sediments of Shari Playa

a, b and c	*Tricoplate* pollen	(400 X)	j and l	*Lysimachia* sp.	(400 X)
d and e	*Quercus*	(400 X)	k	*Dinoflagelate*	(400 X)
f	*Artemisia* sp.	(250 X)	m	*Lycopodium* sp.	(400 X)
g and h	*Caryophyllaceae* sp.	(400 X)	n	*Centaurea* sp.	(400 X)
i	*Retitriporites* sp.	(400 X)			

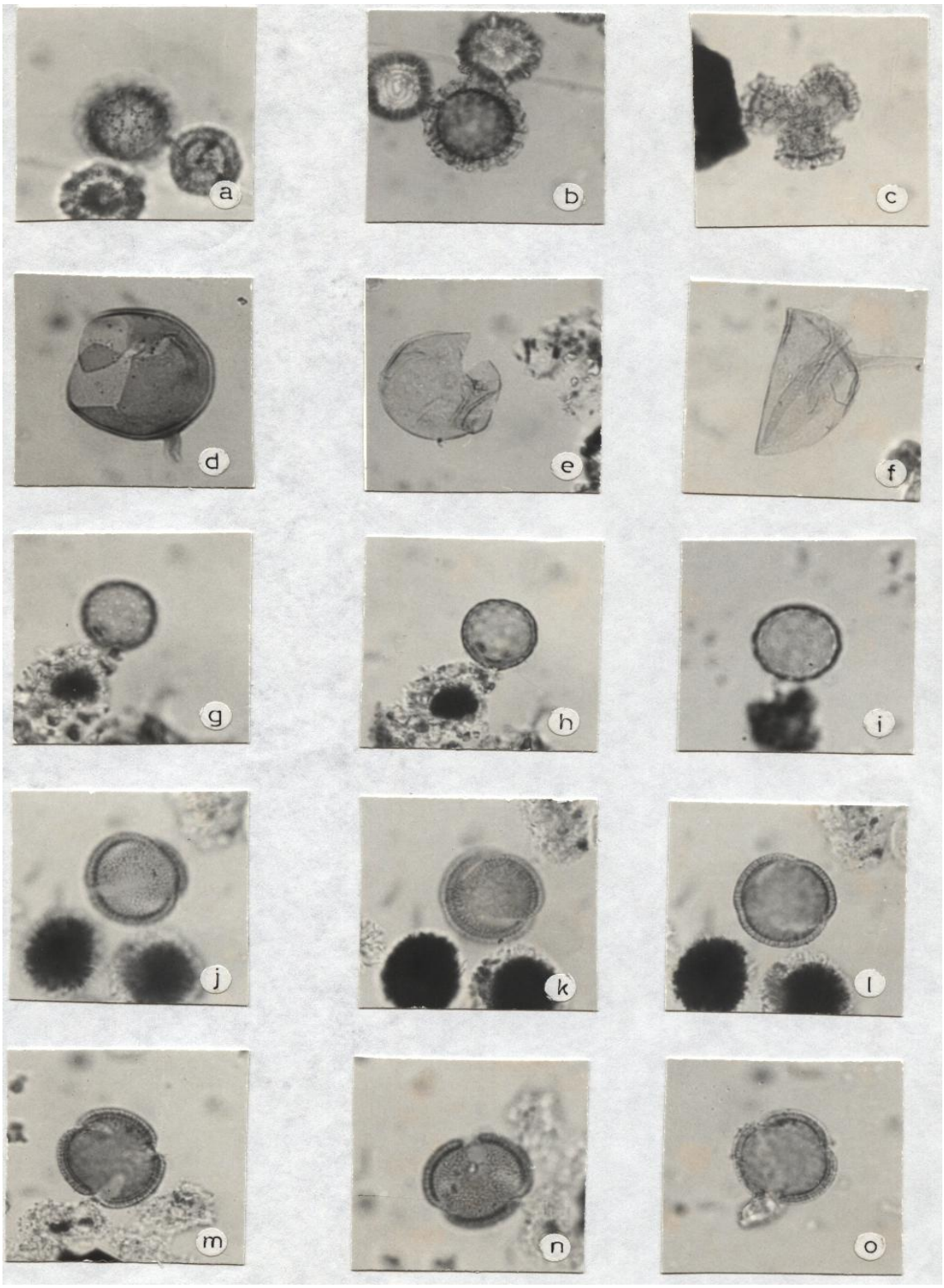

Fig. 4: Photomicrographs of palynomorph species from the sediments of Shari Playa

a, b and c *Armeria martima* (400 X)
d, e and f *Graminae* (400 X)
g, h and i *Chenopodaceae* (400 X)
j, k and l *Polygonium* bistorta type (400 X)
m, n and o *Convlousia Convolvollus* (400 X)

Six palaeoecological zones are suggested depending on the pollen diagram for the sediments of Shari Playa. They represent the wet, transitional and dry episodes (Fig.2). These zones show that there were two humid episodes. The first zone (Z2) corresponds to the sediments at a depth of 6.60 m, which represent the period (5200 – 5800) years B.P. assuming a sedimentation rate of 120 cm /1000 years. The second zone (Z5) corresponds to the sediments at a depth of 4.25 m, representing (2500 – 4200) years B.P., for the same sedimentation rate (Fig.2). These results are similar to that found by Yan and Petit-Maire (1994) and Gasse and Campo (1994) on the Afro-Asian arid-semiarid transitional zone, where two humid episodes were recognized at 3800 and 6200 years B.P., respectively. The first episode was recorded by McClure (1976 and 1984) in Saudi Arabia; El-Moslimany (1987) in Western Iran; Spaulding (1991) in North America and North Africa; Harrison and Digerfeld (1993) in Europe, and Al-Tawash (1996) in Iraq. The zone (Z2) is probably equivalent in age to the upper part of zone (Z7) of Al-Tawash (1996); it reflects the wide distribution of shrubs and swamp flora with scarcity of chenopods and absence of palm trees. Whereas the upper part of zone (Z6) is probably equivalent to zone (Z8) of Al-Tawash (1996), but unlike it in its high palynomorph constituents. This zone, which shows the dominance of chenopods pollen indicating the climatic deterioration and aridification.

CONCLUSIONS

- The palynomorph constituents and distribution in the sediments of Shari Playa revealed that the climate in the area was characterized by wet period between about (5800 –5200) years B.P., followed by dry period from (5200 –4800) B.P.
- Another wet period with relatively moderate to low rainfall rate was followed and extended over a period of 600 years.
- The period between 4200 and 2500, B.P. is interpreted to be of moderate rainfall rate.
- It has been found that the botanic species that need high to moderate rainfall rate are scarce or absent in the period between 2500 years B.P. until now.
- Since the area of the Shari Playa, which is located in Central Iraq, is categorized as semiarid in the present day, it is concluded from the present study that this area underwent aridification since 2500 years B.P.

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