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Geology and geomorphology as reasons for location of archaeological sites. Egypt

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Abstract

Geological investigation of archaeological sites conducted by the author from 1979 in a vast area from Upper Egypt up to the Delta are presented (Hierakonpolis, Armant, Qurna – Deir el-Bahari, el-Tarif, Fayum – Qasr el-Sagha, Tell el-Farkha) in the study. There are described general (united) geological profiles done on the basis of field observation of both archaeological and natural outcrops. (a lot of archaeological as well as natural outcrops)

Obtained data help to perform correlation of sediments between described sites and propose reconstruction of paleo-environment and climate conditions at the phase of Late Neolithic – Early Dynastic transition. The mentioned observation and reconstruction has led to conclusion, that at the phase of the transition climate was extremely dry. This dry climatic phase is the factor, that most probably constitute very difficult conditions for life and agriculture, which obligated the Egyptians to the reorganization of life, i.e. was the reason for creation of dynastic Egypt.

I Hierakonpolis

Geological and mineralogical investigation of the site were conducted together with expedition of Penstate University USA (Pawlikowski, Such 2008).

Examination of natural outcrops as well as many boreholes help to determine the general geology of the site. Data showed, that the site is located at an old and dry delta of a wadi fading into the Nile from the West Desert (Fig. 1). The boreholes document the presence of a complicated sediments sequence there(Fig. 2).

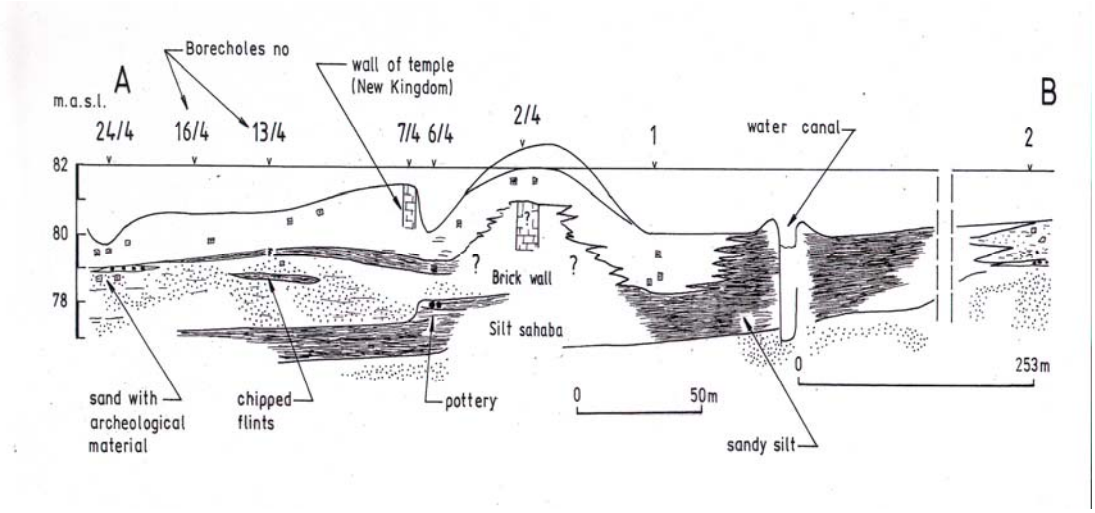

Fig. 1 Cross-section (A (E) – B (W)) of a sandy delta of a wadi coming from west to the Nile Valley in Hierakonpolis. 1, 2, 2/4, 6/4, 7/4, 13/4, 16/4, 24/4 – nos of boreholes. Natural structures damaged by human activity. General geological profile of sediments presents fig. 2

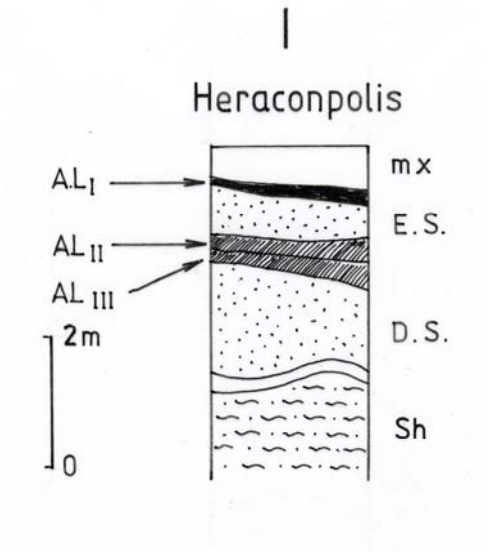

Fig. 2 General geological profile of sediments in Hierakonpolis.

Mx- mixed secondary sediments, A.L.$_J$ – New Kingdom, E.S. – eolian sands, A.L.$_{JJ}$ - upper-Old Kingdom, lower – Nagada II, III, D.S. – delta sands, Sh – Sahaba formation.

The observed phenomenon, especially location of Nagada II and III layers, as well as horizon of the Old Kingdom on the delta sands of big wadi, confirm very dry climatic conditions at the moment of transition Neolithic-Early Dynastic.

II Armant

Archaeological and geological investigation were carried out on the left bank of the Nile during works of Polish-German mission (Ginter et al. 1988, Pawlikowski 1993, 1994 a, b, c, d , 2002). The site is located at a typical part of the Nile valley, where one can determine six morphologically-sedimentological zones (Fig. 3).

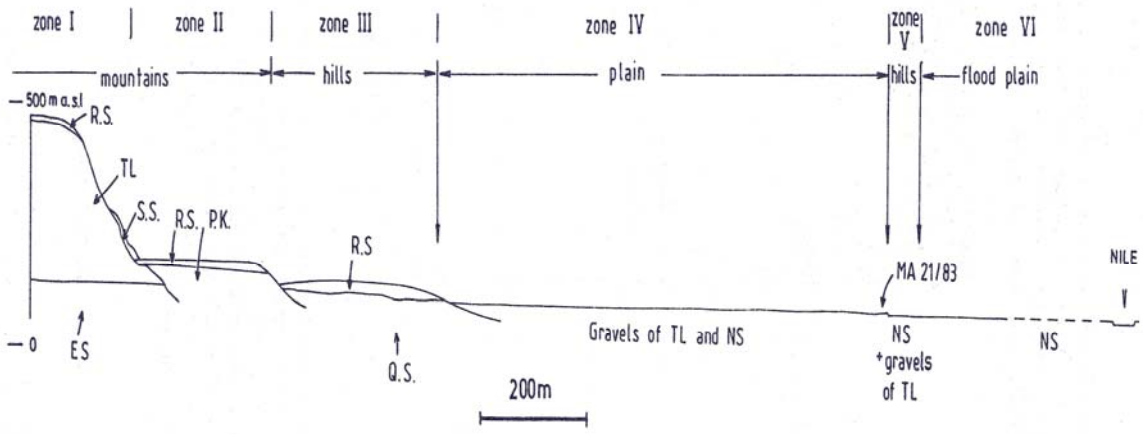

Fig. 3 General cross-section of the Nile Valley. Zone I – the plateau and steep slopes of the gebel – the environment and morphology typical for a high mountain.
R.S. – red soils, T.L.- Theban limestones, S.S. slope sediments, E.S. – Esna shales. Zone II – hills built of R.S. – red soils (at their secondary position) and P.K. – Paleogene conglomerates. Zone III – small hills built of Q.S. (Qena sands) and R.S. – red soils mixed with gravels. Zone IV – zone of mixed sedimentation represented by gravels of Theban limestones (T.L.) from the gebel and the Nile silts (N.S.). Zone V – zone of presence of prehistoric and Pre-Protodynastic sites. Zone VI – flood plain of silent conditions of the Nile sedimentation, N.S. – Nile silts. MA 21/83 no. of the investigated archaeological site

The united profile of investigated sediments on the left bank of the Nile showed the following sequence – Fig. 4

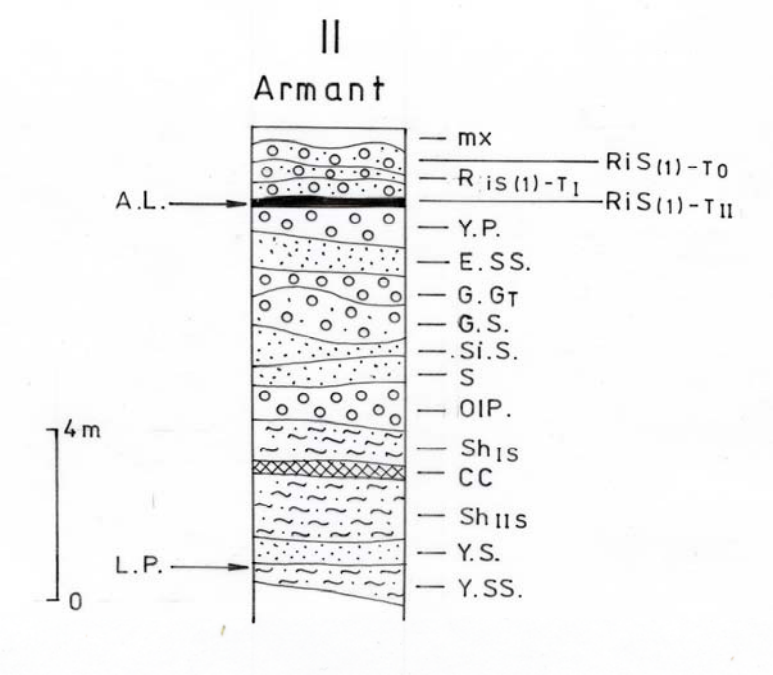

Fig. 4 General geological profile of sediments observed in zones II-V (see fig. 3). Mx – mixed secondary sediments, Ri,S. 1 –T_{o-II} – river sediments observed at terraces of dry wadis. A.L. – archaeological layer – Neolithic – Pre-Proto Dynastic. Y.P. - younger pediment, E.S.S. eolina sands and silts 6300 +,- 80 B.P. (Sediments of the high Nile – phase about 7000 B.P. is not present in Armant). G.G. – gravels with sand (Elkab agregation, phase 8000-7900 B.P.). G.S. – fluvial deposits – gravels from the gebel, SiS. – sands with admixture of the Nile silts. Younger phase – sands with admixture of humus (Arkin formation ? about 9500-8900 B.P.), S. – sands (river) and silts (eolian). O.P. gravels of older pediment 11 000-10 00 B.P., Sh_J – Sahaba formation – upper part, C.l. – calcite layer, Sh_{JJ} – Sahaba formation – lower part, Y.S. yellowish sands (altered Y.S.S.), Y.S.S. – yellowish sands and silts.

The performed investigation of many geological profiles in this region confirms very hot and dry climatic stage at the end of Neolithic and beginning of Dynastic in this part of the Nile Valley.

III Qurna - Deir el-Bahari

Investigation of the area was conducted in the 1980s and 90s by a combined Polish –German archaeological mission (Ginter et al. 1986, 1987 and Pawlikowski 2007b, 2009, Pawlikowski, Such 2007c).

Most of archaeological sites present in this area are damaged because of intensive archaeological works and the complete reconstruction of the primary sequence of layers is difficult. Synthetic profile of sediments representing the area has been constructed using observation and correlation of many profiles around Qurna.

The general profile composed as a result of many examined outcrops at local valleys and slopes is following (Fig. 5)

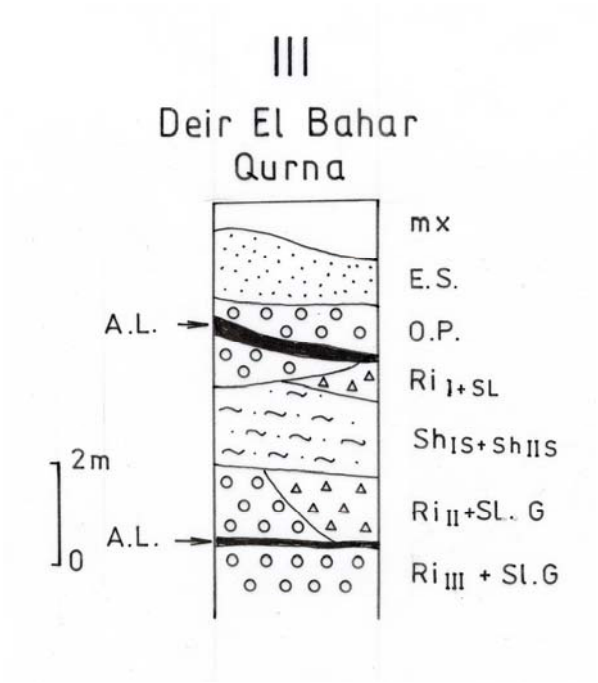

Fig. 5 General geological profile of sediments in the area Qurna – Deir el-Bahari Mx- mixed secondary sediments, E.S. – eolian sands. O.P. – relics of gravels of older pediment and river gravels, A.L. - archaeological layer , R_{i+Sl} – river sediments + slope sediments, $Sh_J + Sh_{JIS}$ – lower and upper Sahaba formation – silts of various color, R_{II} +Sl.G. – river gravels and slope sediments (Paleolithic sites) R_{II} +Sl.G – relics of red soils primarily developed (at humid climate) on weathered surface of Theban limestones + slope gravels. A.L. – Palaeolithic sites. R_{III} +Sl.G – relics of red soils and gravels (rounded gravels of Theban limestones).

The presence of relics of eolian sands over Old pediment confirm the phase of hot and dry climate between Neolitic and Dynastic.

IV El-Tarif

The described area of el-Tarif is located on the left bank of the Nile about 20 km North from Qurna. Investigation were conducted there in the 1980s and 90s by a combined Polish–German archaeological mission (Ginter et al. 1998). The general profile of sediments at this archaeological site is showed in Fig. 6.

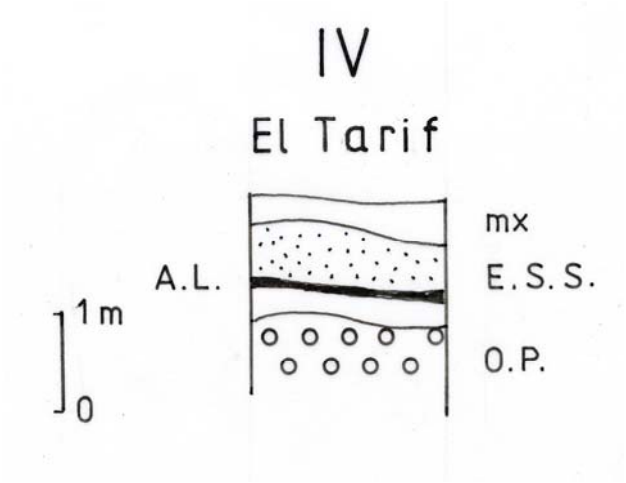

Fig. 6 United general geological profile of sediments in el-Tarif
Mx – mixed secondary sediments, E.S.S – eolian sands and silts,
A.L. – archaeological layer (Tarifien), O.P. – older pediment (Paleolithic implements at secondary position).

The presence of the Tariffen culture over gravels of older pediment at the phase of eolian sedimentation sands and silts confirm a very dry phase of climate. This phase was most probably the reason for location of the Tariffien occupation at the edge of the Nile flood plain.

V Fayum – Qasr el-Sagha

Examination of oscillation of the shore of the Moeris lake (the Fayum lake) were performed in the 1970s and 80s by a Polish-German mission in Qasr el-Sagha (Ginter el al 1983). The general profile of sediments in the area of Qasrel-
Sag

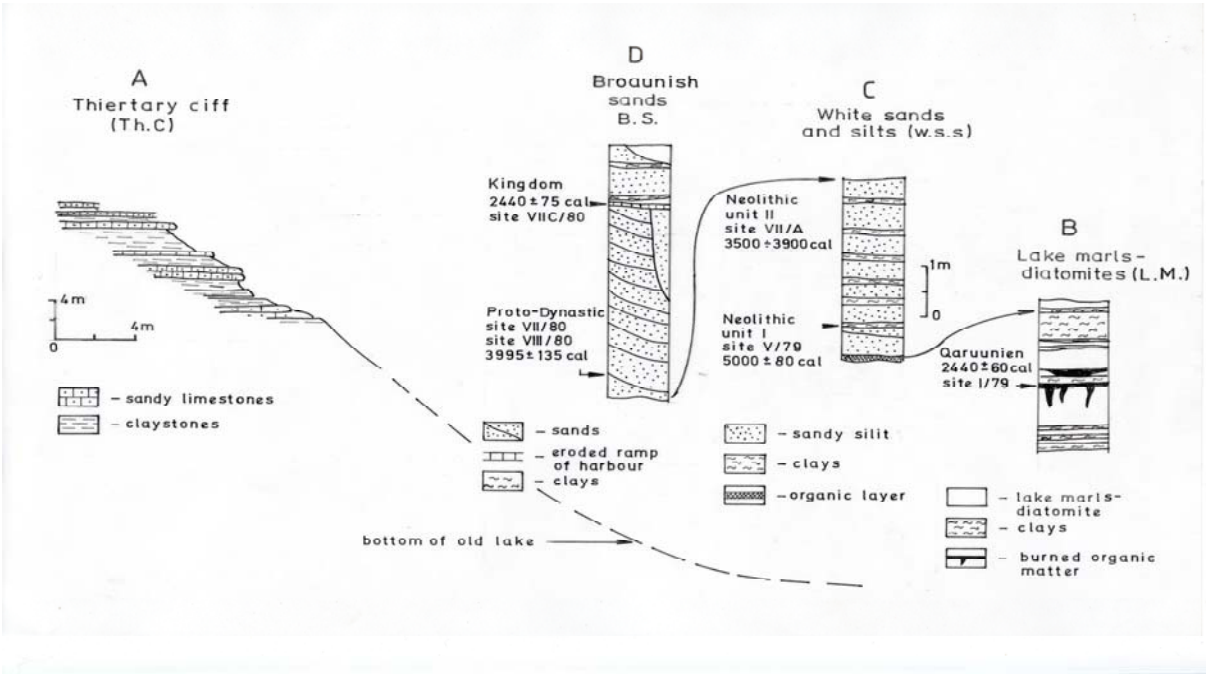

Fig. 7 General scheme of sediments of the Fayum lake near Qasr el-Sagha (left NW- right SE). Mx – mixed secondary sediments, B.S. – brownish sands with clayey intercalation and $A.L._{I}$ (Middle Kingdom), W.S.S. – white sands and silts intercalated with thin layers of greenish clays, $A.L._{II}$ - Upper Neolithic, Predynastic, $A.L._{III}$ – Neolithic, L.M.-D. – lake marls intercalated with clays and organic, burnt soils at the top, $A.L._{IV}$ – Qarunien.

Sagha is represented by various sediments in various parts of the basin (Fig. 7). The lake has no outflow and, due to it, is bigger or smaller according to the rains. Due to this phenomenon, the obtained data were used for reconstructing the general scheme of phases of human occupation of the lake shore – according to its oscillation due to climate variation – dry or humid (Fig. 8).

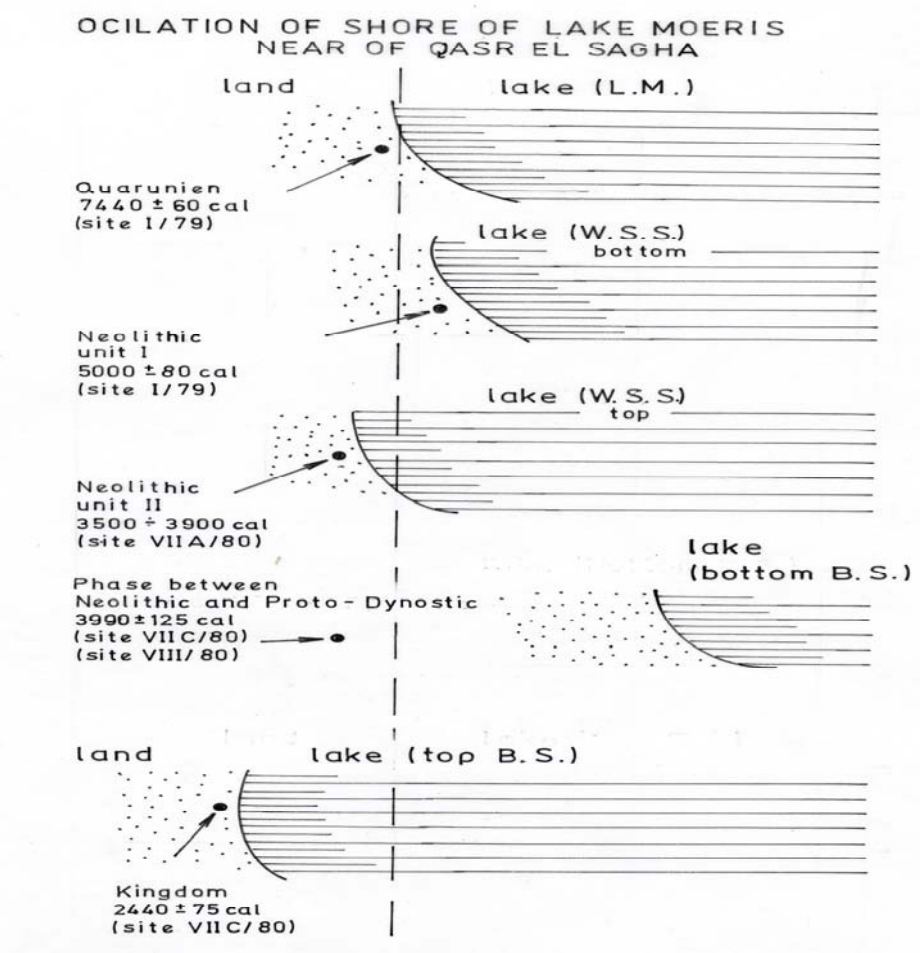

Fig. 8 Location of discovered archaeological sites due to oscillation of the lake size as a results of climate changes.

The general geological profile of sediments of the examined area has been constructed using observation of many natural as well as artificial outcrops (Fig. 9).

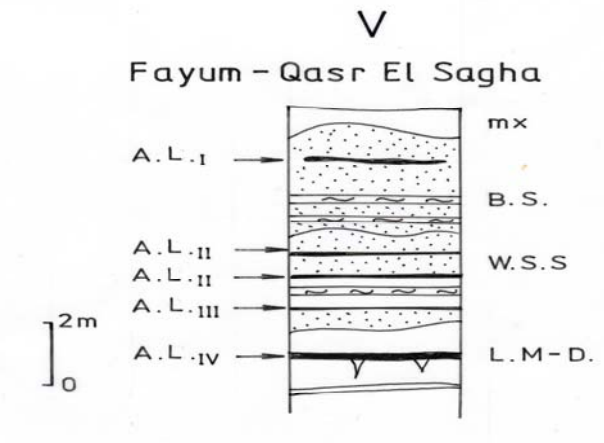

Fig. 9 United geological profile of Quaternary lake (Fayum) sediments in Qasr el-Sagha. Mx – mixed sediments, B.S. – brownish sands, W.S.S. – white sands and silts, L.M.-D. – lake marls and diatomites.

Oscillation of the lake size and general tendency to climate drying are well seen at geological profiles of the tested area. Location of archaeological sites confirms oscillations mentioned, which are dependent on changes of the lake shore. At the moment when climate was dry, one can localize many archaeological sites around the lake. This situation is observed at the end of Neolithic and transition do Dynastic Egypt.

VI Delta – Tell el-Farkha

Examination of the site is conducted by the Polish Archaeological Expedition to the Eastern Nile Delta from 1998 (Pawlikowski 2002a, b, 2005, 2007a, Pawlikowski, Wasilewski 2007, Chłodnicki, Ciałowicz et al. 2008).

Deposition of sediments at Tell el-Farkha is a result of interference of natural and anthropogenic activity. Because of natural morphology of the site (gezira) one can see there phases of the high Nile sedimentation (grey silts) deposited over sands of gezira and on the other hand, deposition of anthropogenic material over the Nile silts at moments, when the Nile level was low (Fig. 10).

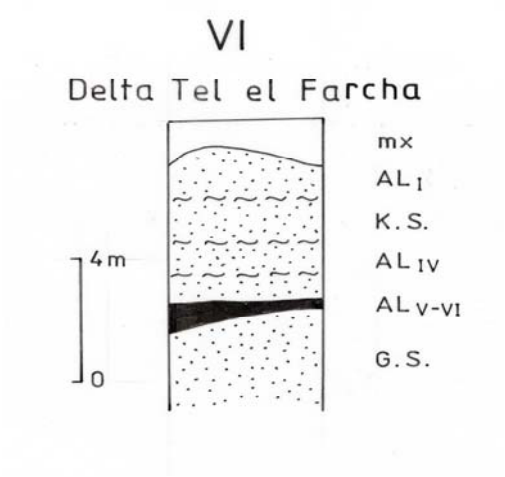

Fig. 10 United geological profile of sediments at Tell el-Farkha.
Complex of sediments developed over the top of gezira built of yellowish sands. Mx – mixed secondary sediments, A.L.$_{I}$ – A.L.$_{IV}$ sequence of archaeological horizon (Pre-, Protodynastic and Old Kingdom) intercalated with thin layers of the Nile silts, K.S. – Kingdom anthropogenic sediments, A.L.$_{V-VI}$ – Nagada II, III, G.S.– sands of gezira.

Because of the Delta geomorphology, sediments present there are very monotony. This is the result of very silent sedimentary conditions. Sites, such as Tell el-Farkha (slopes of occupied gezira) are the best places for geological observations and reconstruction of climatic phenomena (Fig. 11). Edges of gezira are places of sedimentation of anthropogenic material over natural Nile silts (when the Nile was low) and sedimentation of silts over anthropogenic layers (when the Nile was high). This is also the reason, why

geziras and surrounding areas are the best places for reconstruction of phases of occupation, stages of site destruction (human, eolian, etc.) as well as of stages, when the top of gezira was not occupied.

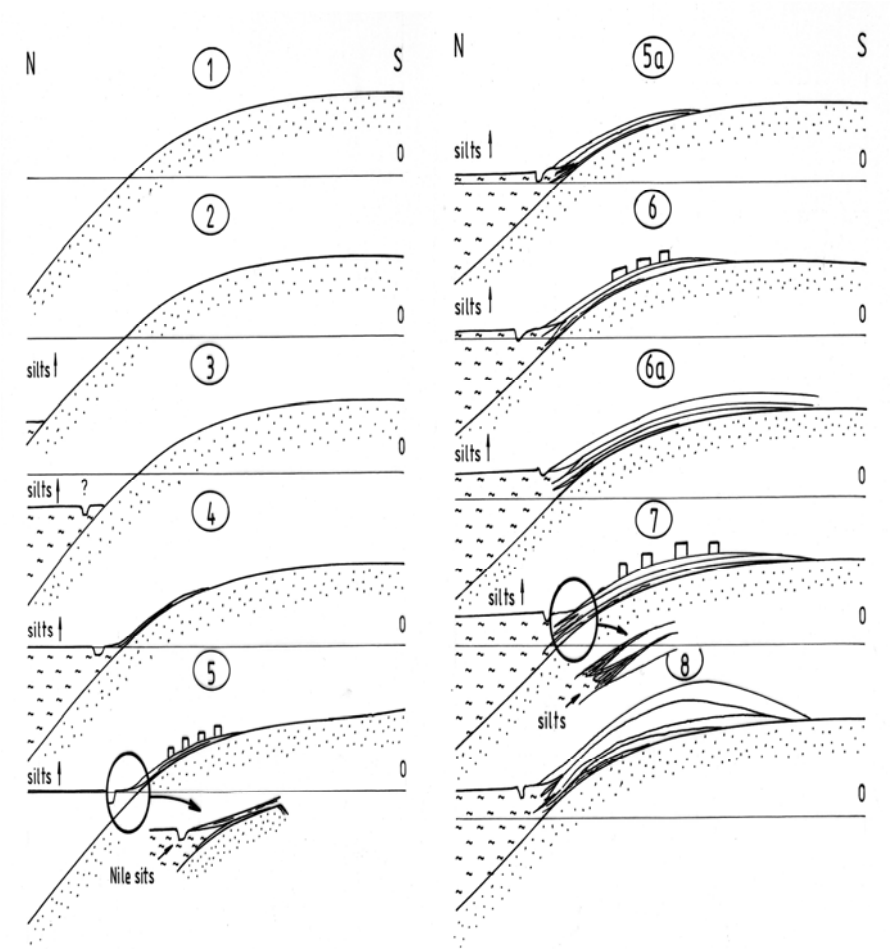

Fig. 11 Reconstruction of selected phases of occupation and phases of natural sedimentation and destruction (1-8). Slope of the gezira at Tell el-Farkha.
0 – present level of the Mediterranean Sea.

The obtained geological as well as archaeological data help to correlate geological profiles of the examined sites and are helpful for reconstruction of geological and climatic phenomena along the Nile Valley during last 10 000 years (Fig. 12).

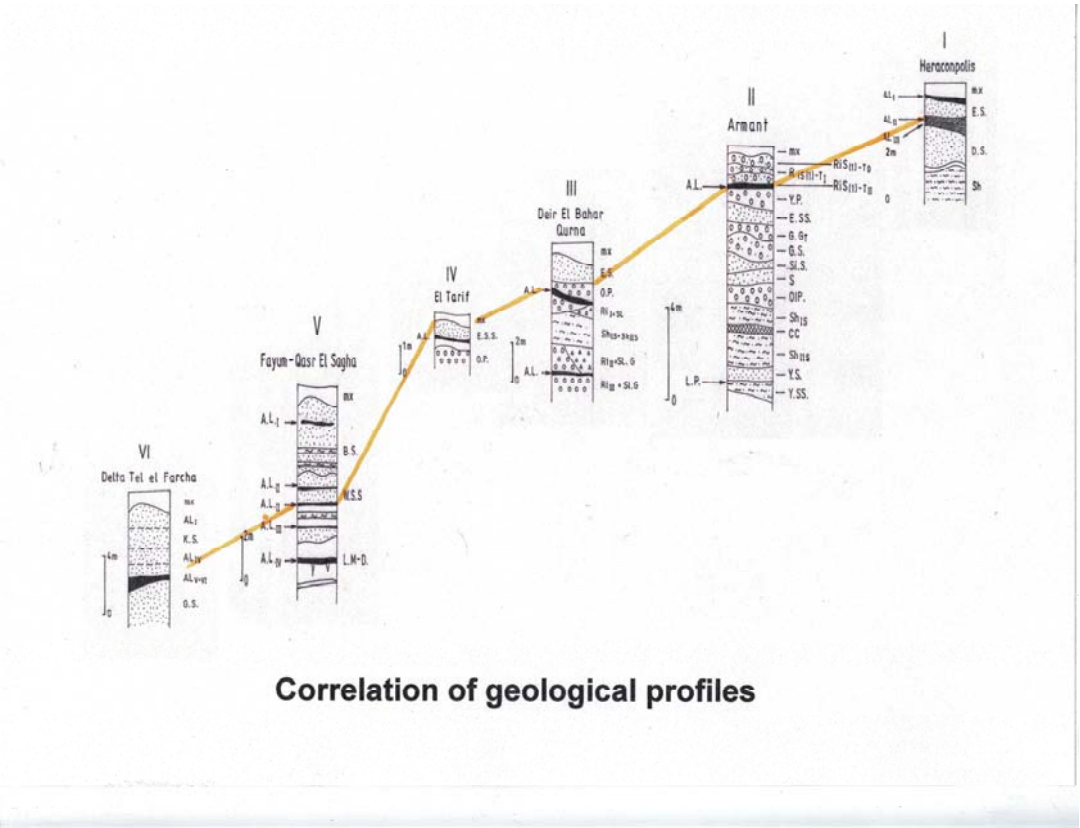

Fig. 12 Geological profiles of the tested areas correlated using geological, sedimentological, mineralogical as well as archaeological data.

Conclusions

The performed investigation, as well as correlation of geological profiles along the Nile valley, confirm very dry climatic phase between Neolithic and Early Dynastic in 300-400 years' period . This very dry climatic phase, reduction of the Nile floods was very dangerous for local life and most probably forced societies of the time to change their life organization, therefore being the main reason for transition between Neolithic and Dynastic.

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