Climatic changes and their influences for the archaeological events during the holocene in central turkey and northern Syria

Kashima, Kaoru
Department of Earth and Planetary Sciences, Kyushu University

出版情報：地形. 32 (2), pp.108-114, 2011-04. Japanese Geomorphological Union
バージョン：

地形　第32巻第2号
108-114頁　(2011)

JGU Transactions, Japanese Geomorphological Union
32-2, p. 108-114 (2011)

Climatic Changes and their Influences for the Archaeological Events during the Holocene in Central Turkey and Northern Syria

Kaoru KASHIMA*

Abstract

The project is a multidisciplinary geologic research program collaborated with archaeological excavations made clear the history of the climatic changes in Central Turkey and Northern Syria. The warming and very dry climate could be observed in the data from all our drillings in the early Holocene. The humid climate recovered at first in the northern part of Syria at 8500 years BP. in the drillings from Lake Khatouniyeh. After 2000 years, the Holocene humidity started at the northern part of the central Turkey, at Lake Seyfe and Kültepe, Kayseri. However a dry climate continued in the southern part of the central Turkey such as Konya basin and the area of Lake Tuz. The above-noted recovery of humidity and its regional variability in the Holocene presumably was one of the major causes for the archaeological events, especially with regard to water availability.

Key words: *archeological events, climatic change, lake sediment, Holocene, Syria, Turkey*

Introduction

In 1991 a geo-archaeological research project in Turkey and Syria was started. The project is part of the excavation of Kaman-Kalehöyük by the Japanese Institute of Anatolian Archaeology, and the excavation of Tel Seker al-Aheimar by the University of Tokyo. The project is a multidisciplinary research program, focused on the environmental history of the Neolithic and later periods in this region. More in detail, our research is aimed at a high resolution environmental reconstruction for Central Turkey and northern Syria in order to make clear the climatic development during the Neolithic, and its impact on human societies. We undertook field surveys at inland lakes and marshes surrounding archaeological sites in the Konya basin in Central Turkey (Lake Tuz, Lake Seyfe, Kayseri and Kaman Kalehöyük), and Lake Khatouniyeh in northeastern Syria.

Received October 26, 2010; accepted December 17, 2010
* Department of Earth and Planetary Sciences, Kyushu University, Hakozaki, Fukuoka, 812-8581, Japan

Konya Basin and Lake Tuz

The Konya basin is located in the southern part of the Anatolia Plateau. A huge lake once covered almost all part of the basin in the Last glacial period, but this has completely disappeared now (Eroll, 1978; Roberts, 1983). In 1991, we made a drilling in the centre of the basin, ca. 20 km east of the city of Konya. Successions of diatoms and chemical components seem to indicate glacial and inter-glacial changes during the Late Quaternary, but we could not recognize clear Holocene lake deposits (Kitagawa and Yasuda, 1997). We could dated at the uppermost lake deposits by means of shells found in them. On the basis of the resulting twelve C^{14} dates we distinguished the last lake phase was dated at 10,950±460 years BP (non-calibrated), which can be correlated to the Younger Dryas period (Kashima, 2002, 2003).

Subsequently, in 1995-1997, we took drillings at Lake Tuz. This is a shallow salt lake, the second largest lake in Turkey, located northeast of the Konya basin. We took eight drillings in Aksaray, northeast coast of Lake Tuz, where Eroll (1978) traced lake level fluctuations during the Holocene. We identified three layers of lake deposits, dated ca. 11,000-20,000 years BP. These layers were deposited due to cyclic lake level changes at the final stage of the Pleistocene. We could, however, not trace lake level changes after 11,000 years BP (Kashima, 2002).

The results of our drillings in the Konya basin and in Lake Tuz indicate that the peaks of lake levels in both basins occurred during the Late Glacial Maximum (LGM, about 20,000 years BP,) to the Younger Dryas period. Lakes were much larger and about 30m higher than at present. After the Younger Dryas, water levels decreased, and the lakes became much smaller. Expansion of lake areas did not occur during the Holocene.

Lake Seyfe

Lake Seyfe is located about 200 km northeast of Konya. In 2001, a series of drillings were placed at a transect running from the shore to the center of the lake. It appeared that there were two lake deposits consisting of organic sandy clay with a large number of diatoms. The lower lake layer was dated at 17,000-18,000 years BP (non-calibrated), i.e. immediately after the Last Glacial Maximum when huge lakes were formed in the Konya basin (Ishimaru and Kashima, 2002) (Fig. 1 and Fig. 2).

The deposition of the upper lake layer started about 5000 years BP (non-calibrated), about 4000 BC (calibrated). It presumed that the wet environment recovered again in the middle Holocene after the very dry environment in the early Holocene. The diatoms from the upper lake layer of Lake Seife indicated fluctuations of the lake environment from salty (dry) to fresh water (humid). However, because the sedimentary rate was very slow, it was not possible to establish the age of each of these environmental fluctuations.

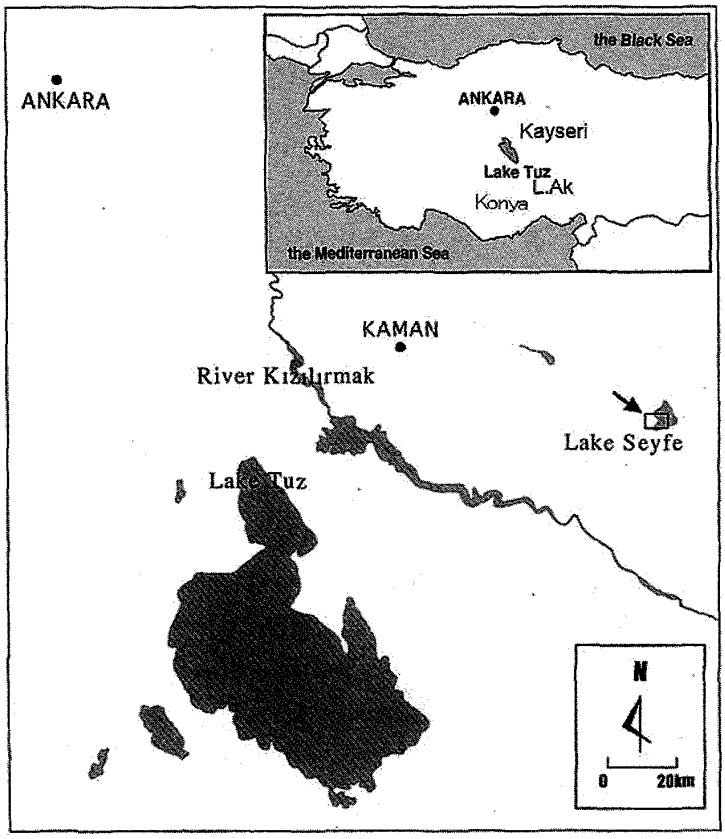
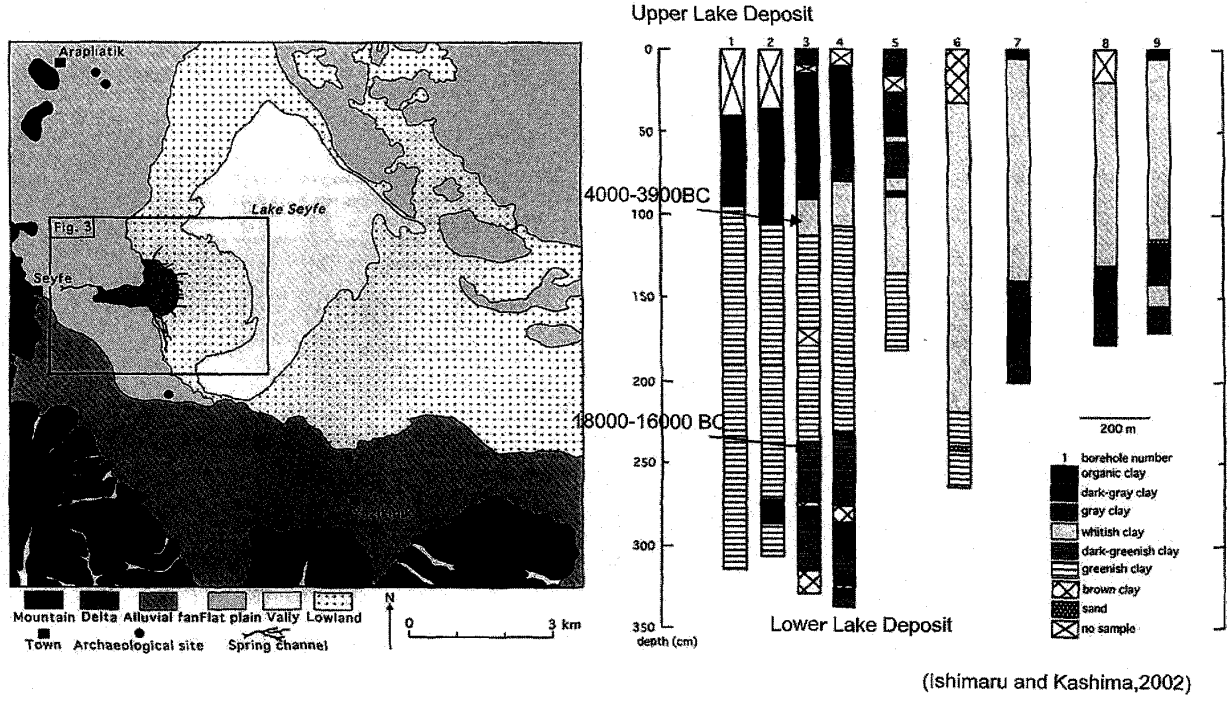


Fig. 1. Research Area in the central part of Turkey.



(Ishimaru and Kashima,2002)

Fig. 2. Drilling sites at Lake Seyfe, central Turkey.

Kültepe

Similar water level changes were observed at ponds and marshes near archaeological sites in central Anatolia. Kültepe is one of the most important archaeological sites of the Middle Bronze Age in this area. The site is located in a small basin 20 km northeast of Kayseri, about 200 km northeast of Konya. It mainly consists of an extended palace (*Kanis*) and a lower town for merchants (*Karum*). Kültepe prospered as a trade center between Anatolia and Mesopotamia in the Middle Bronze Age. It was destroyed in the early part of the Late Bronze Age, probably by rulers of the Old Hittite Kingdom.

In 2003, we made two drillings at the marshes surrounding Kültepe, which were former lakes. The samples reached the bottom of the marsh sediments. A lithologic (grain size) analysis and micro-paleontological analyses (diatom and pollen) made it clear that there were three cyclic changes of water levels at the marshes (Kashima et al., 2005) (Fig. 3).

The peaty clay of the base of the lowest marsh deposit was dated about 4500 BC (calibrated). After that period, the initial lake was buried by fluviatile sediments. The second lake was formed about 2000 BC (calibrated). This lake gradually dried up again.

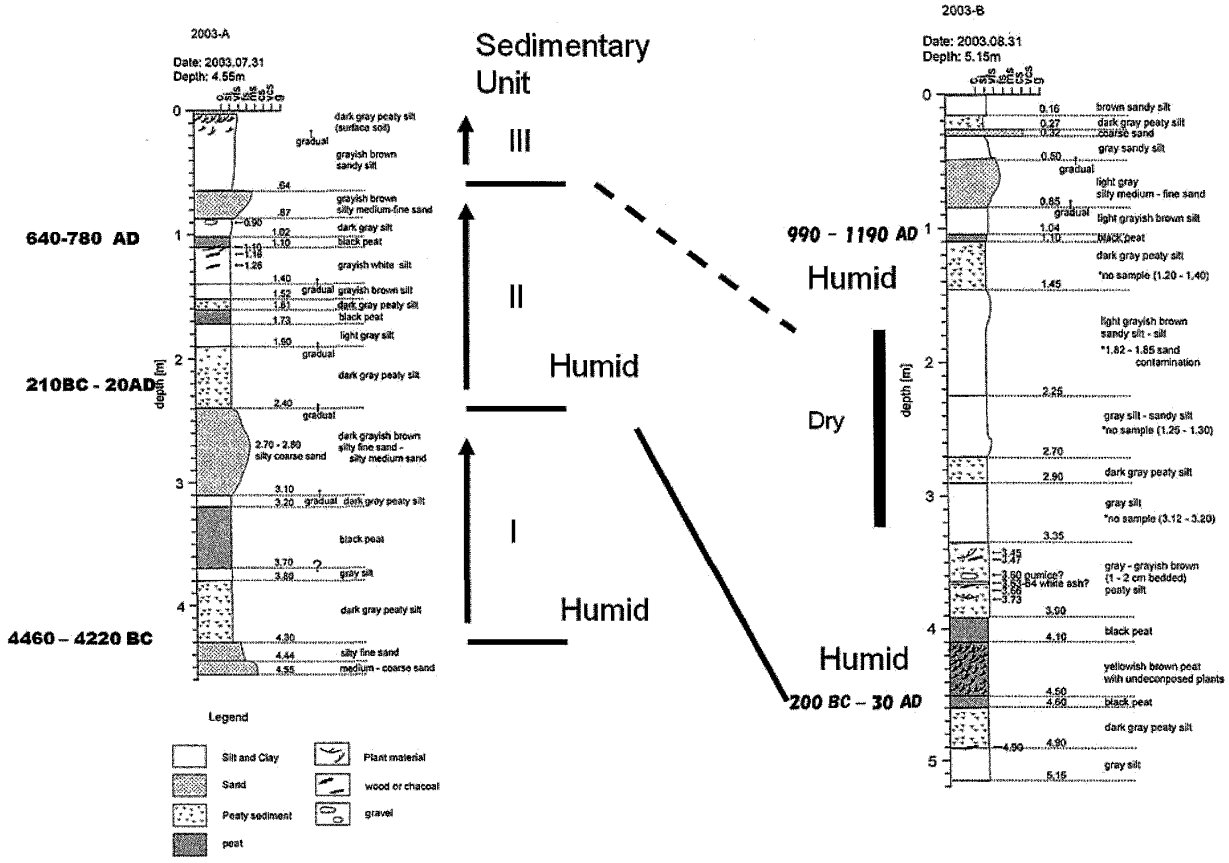


Fig. 3. Paleo-environmental changes at Kültepe Archaeological site, Kayseri, Turkey.

The most recent lake deposition was dated about 1000 AD (calibrated) (Kashima et al., 2005) (Fig. 3).

Lake Khatouniyeh in north east Syria

Lake Khatouniyeh is located about 50 km east of Hassake in the Khabur region in northeastern Syria. It is a small lake with slightly salt water. A large terrace surrounds the lake. The terrace is more than 10 m higher than the present lake level, and the terrace area is much wider than the present lake. The terrace was presumably formed during the Last Glacial, like Lake Tuz and Konya basin (Fig. 4 and Fig. 5).

We took two drillings at the North side of the lake, and reached the base of the deposits at 6.3 m below the present lake level. Two C^{14} dates were obtained from lake

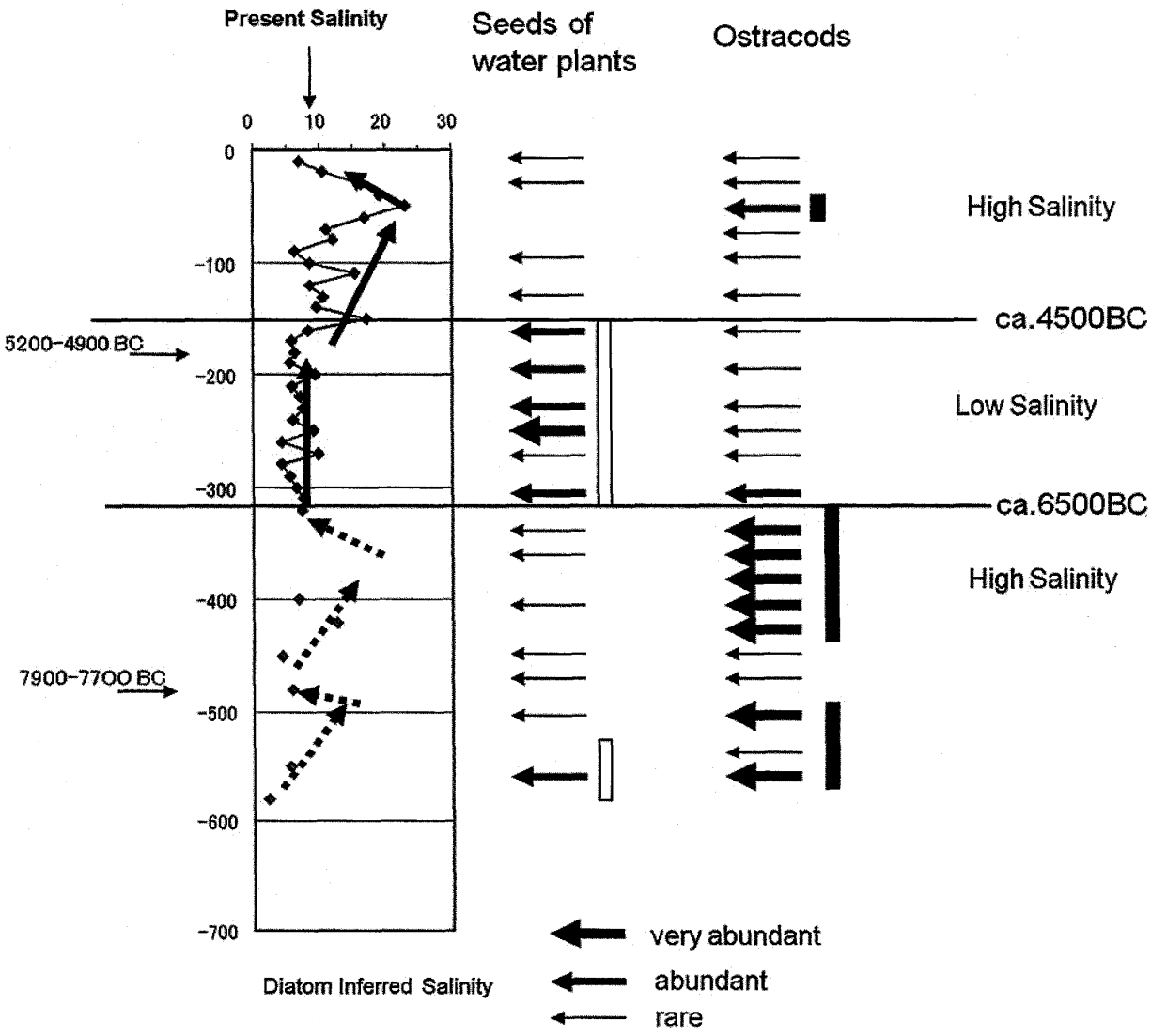


Fig. 4. Fossil assemblages and environmental changes at Lake Khatouniyeh, East Syria.

deposits,. The most recent lake deposition started about 8500 BC, i.e. at approximately the beginning of the so-called Climatic Optimum in the Near East. The sediment of the most recent lake contained a large number of diatoms, ostracods, and seeds of water plants.

The above-indicated changes clearly indicate changes in water salinity of the lake. In short: the present lake formed at a depth of −5.5 to −6.0 m, and the salinity of the lake soon increased, as indicated by a dominance of saline water ostracods above −5.5 m. The quite suddenly changed at −3.2 m. According to the diatom assemblages, the salinity of the lake was estimated about 5-10 ‰ in sediments of 1.8-3.2 m in depth, i.e. nearly the same as that of the present lake. Abundant seeds of water plants in these deposits supported the low salinity environment. Subsequently, salinity gradually increased to 25 ‰ in deposits at depths of −1.7 to −0.5m. Ostracods were abundant at −0.5 m. Above −0.5 m, the salinity decreased to the present-day level of about 6 ‰.

Two C^{14} dates were taken from the drilling core. Presuming a constant sediment deposition between the dates, the layer indicative of the above-noted sudden environmental change at −3.2 m depth is provisionally dated at ca. 6700 BC. The apparent sudden decrease of the lake level suggests that the lake level rose and that the climate became more humid. This trend continued until ca. 5000 BC, after then it became very dry again.

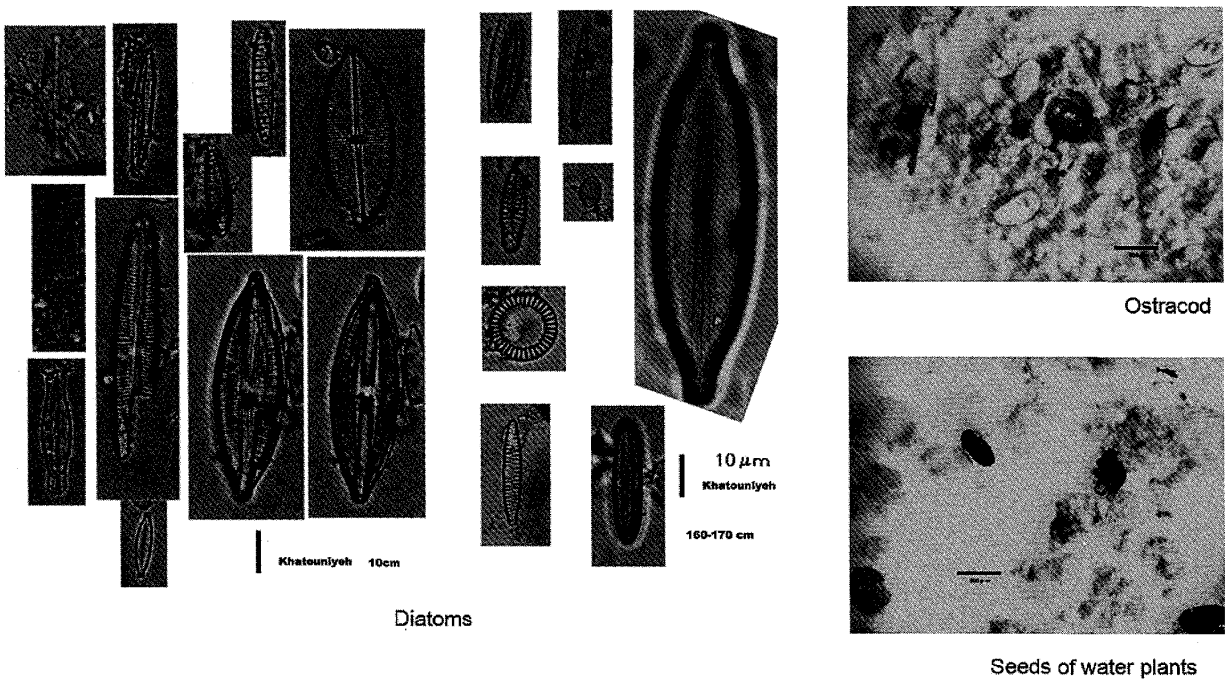


Fig. 5. Small fossils taken from lake deposits at Lake Khatouniyeh, East Syria.

Climatic events during the Holocene and their influences for the archaeological events

At ca. 11,000 BC the climate improved after the cold event of the Younger Dryas. The warming and very dry climate could be observed in the data from all our drillings. A more humid environment started at about 8500 years BP, as could clearly be observed in the drillings from Lake Khatouniyeh in northeastern Syria. Holocene sedimentation of the lake began about 8500 BC, and at about 6700 BC a peak in humidity was evident. In contrast to this, a dry environment continued during the early part of the Holocene in Central Turkey. In the northern part of the central Turkey humidity increased at about 6500 years BP in the drilling of Lake Seyfe and Kültepe, as marked expansions of small lakes and marshes. However a dry climate continued in the southern part of the central Turkey such as Konya basin and the area of Lake Tuz where the very wide lakes were distributed in the Last Glacial period.

The climatic changes probably had significant impacts archaeological communities, especially with regard to water availability. In central Anatolia, for instance, the distribution of Neolithic sites was limited to the southern marginal part of the plateau. However, since the Chalcolithic period (about 6500 years BP), the distribution of archaeological sites expanded to the northern part of the central plateau. The above-noted recovery of humidity presumably was one of the major causes for this expansion.

References

Erol, O. (1978) The Quaternary history of the lake basins of central and southern Anatolia: *In* Brice, W. C. ed. *The Environmental History of the Near and Middle East since the Last Ice Age*: Academic Press, London, 111–139.

Ishimaru, K. and Kashima, K. (2002) Reconstruction of water quality and climate changes at Lake Seyfe, central Anatolia, central Turkey: Anatolian Archaeological Studies, **11**, 145–152.

Kashima, K. (2002) Environmental and climatic changes during the last 20,000 years at Lake Tuz, central Turkey: CATENA, **48**, 3–20.

Kashima, K. (2003) The quantitative reconstruction of salinity changes using diatom assemblages in inland saline lakes in the central part of Turkey during the Late Quaternary: Quaternary International, **105**, 13–19.

Kashima, K, Hirose, K., Yamaguchi, M. and Fujiki, T. (2005) Palaeo-environmental change at Kültepe: the capital city of the Middle Bronze Age, central Anatolia, Turkey: Anatolian Archaeological Studies, **14**, 137–146.

Kitagawa, H. and Yasuda, Y. (1997) Sedimentary farcies of a 60.85m core from Konya basin, Turkey: Japan Review, **8**, 59–64.

Roberts, N. (1983) Age, palaeoenvironments, and climatic significance of late Pleistocene Konya Lake: Quaternary Research, **19**, 154–171.