



Late Neogene Paleoenvironments in the Chinese Loess Plateau - Evidence from a Long Terrestrial Sequence, Lantian, China

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A conformable, fossiliferous sedimentary sequence along the Bahe River in the Lantian area, Shaanxi Province, China was studied is an important stratigraphical key site in northern China. The region is located within the Weihe graben basin in the southernmost Loess Plateau. The basin infill comprises over 2000 m terrestrial, clastic deposits, ranging from the Eocene to the Holocene. The work reported here is a contribution to a Finnish - Chinese multidisciplinary research project that carried out paleontological and geological investigations on the late Neogene part of the sedimentary infill in the Lantian area over the years 1997 - 2001.

The basal Bahe Fm is ca. 280 m thick in the study area spanning from about 11 Ma to 6.8 Ma. The facies associations are interpreted to have been deposited in a relatively low-energy, multichannelled fluvial system with broad floodplains (Kaakinen & Lunkka, 2003). The Bahe Fm is overlain by a ca. 50 metres thick sequence of mainly aeolian Red Clay, named as the Lantian Fm in the study area. It is composed of strongly rubified silty clay to clayey silt beds that frequently contain carbonate-rich horizons, typical features of the Red Clay deposits underlying the Pleistocene loess-paleosol sequences in northern China. The succession indicates relatively stable conditions throughout the deposition of the lower part of the sequence. A major sedimentological change occurred at the formation boundary at ca. 6.8 Ma. The boundary is not always sharp as stated by earlier studies, but often transitional with fluvial imprint in the lower part of the red clay.

A total of 49 localities were found at different levels in a sequence, including remains

of large and small mammals. Taphonomic and sedimentological studies show that the richest fossil vertebrate accumulations occur in proximal floodplain sediments like sheet or crevasse splay sands and silts (Andersson & Kaakinen, 2004).

The stable carbon and oxygen isotopic compositions were measured from the soil carbonates. In the fluvial part of the sequence, the records show only slight variation in $\delta^{13}\text{C}$ and $\delta^{18}\text{O}$ values implying relatively stable and water-stressed conditions. A shift in both carbon and oxygen stable isotope curves occur at the formation boundary, indicative of a shift to more humid conditions in Lantian Fm. There is no evidence suggesting a significant C_4 component in the vegetation at any time.

The environmental interpretation made from the sedimentological and isotopical records is consistent with that derived from the vertebrate fossil faunas. The analyses on fossil mammals show an extraordinary lack of change until 6.8 Ma, and that the transition in sedimentary regime from fluvial to mainly aeolian at 6.8 Ma was preceded by a major turnover event in the mammal fauna indicating a more closed and humid environment for the Lantian Fm than for the environments preceding the turnover (Zhang et al., 2002). This transition from dry and open landscape towards more humid and forested one is opposite to the global trend. The environmental change has been related to the intensification of the rain-bearing East Asian summer monsoon at about 7-8 million years ago resulting in the transition to more humid and closed habitats.

References

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