



Continental climate dynamics prior to uplift of the Northern Tien Shan – the Oligocene-Miocene succession of the Ili Basin, southeastern Kazakhstan

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Continental settings of Central Asia witnessed increased desertification and the establishment of a monsoonal climate during the Cenozoic as a result of India's collision with Asia. These continental-scale climate shifts are connected to oscillations in the extent of the Paratethys and the uplift of mountain ranges of the Tibetan-Himalaya complex. However, their interplay with the global climate evolution and their timing is yet poorly constrained. A 400-m-thick Oligocene-Miocene succession exposed in the Aktau Hills (Ili Basin, northern Tien Shan, Kazakhstan), has great potential as a terrestrial palaeoenvironmental archive because of its large thickness and excellent exposure. Prior to the main uplift of the northern Tien Shan, the Ili Basin mainly accommodated distal, low-energy sediments on a regionally extensive peneplain. Sediments of the Aktau Hills were deposited close to the basin centre and consist of reddish-coloured floodplain and fluvial deposits that grade into grey lacustrine and mudflat deposits with locally intercalated coal seams. About 80 m of floodplain deposits in the lower part of the succession (Bastau Fm) appear as cyclically bedded alternation of sheet floods, detrital mudflats and arid paleosols. Spectral analysis of sediment colour shows a cycle-frequency ratio typical of Milankovitch frequencies with a strong dominance of the obliquity signal. Bulk-sediment geochemistry is used to determine changes in provenance (Ti/Al), weathering intensity (Chemical Index of Alteration – CIA) and basin drainage (Sr). A prominent feature of the yet available data set is a distinct increase in Sr content associated with the first occurrence of gypsisols and playa lake sediments. Elevated Sr as well as sulphate concentrations are interpreted to originate from stagnant ground waters associated to a base-level rise. The floodplain deposits of the Bastau Fm are underlain by fluvial sediments of an incised meandering-river channel fill (Aidarli Fm). In the upper part they are replaced by ephemeral playa lake sediments (Koktal Fm) and develop into a freshwater lake facies, comprising charophytes, ostracods, benthic foraminifera and gastropods (Kokterek Fm). Altogether, the succession represents a period of fluvial incision followed by a major base-level rise. The age of the Oligocene-Miocene succession is constrained by vertebrate remains in the Aidarli Fm. The lower Aidarli Fm is possibly of late Oligocene age based on the occurrence of *Schizotherium*, and the upper part is of early Miocene age (MN 4-5) based on co-occurrences of different even- and odd-toed ungulates. The transition from fluvial incision and well-drained red-beds to lacustrine sedimentation in the northern Tien Shan region was possibly linked to the initial Tchokrakian transgression in the Eastern Paratethys. Soil carbonates show an increase in $\delta^{13}C$ of 2 ‰ that may correspond with the onset of the Mid-Miocene climatic optimum (15.5-16.5 Ma).