

Eolian deposits in the Chinese Loess Plateau: Implications for Asian interior aridity and East Asian monsoon evolution

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Eolian deposits in the Chinese Loess Plateau (CLP) provide an apparently continuous record of the continental climate changes, with a temporal range exceeding millions of years, and a resolution on the order of millennia. In the last two decades, much research has been carried out to reconstruct the history and variability of Asian interior aridity and East Asian monsoon climate, and their potential linkages to global climate change. Notable progresses on understanding Asian interior aridity and East Asian monsoon evolution during the Neogene epoch are reviewed as follows:

Red Clay deposits covering the interval 22-6.2 Myr ago from the western CLP together with the loess-paleosol and Red Clay sequences spanning the last 7 Myr from the central CLP provide an excellent continental archive for documenting the history of Asian interior aridity. Palaeomagnetic result of Qinan section in the western CLP indicates that large source areas of eolian dust and energetic winter monsoon winds to transport the material have existed in the interior of Asia by the early Miocene epoch (Guo et al., 2002). During 3.6-2.6 Myr ago, synchronous increase of eolian fluxes from both continental and pelagic eolian sediments indicates a sharply drying of the dust source region (An et al., 2001). Over the past 2600 kyr, distinct aridity-humidity fluctuations occurred over glacial-interglacial time scales superimposed on a gradual long-term drying trend (Sun and An, 2005).

Variations in grain size and magnetic susceptibility (two widely employed monsoon indicators) reveal that the alternation of East Asian winter and summer monsoon may have commenced at least 7-8 Myr ago, and can be further divided into three stages: the initial stage around 7.2-3.4 Myr ago, the strengthening stage at about 3.4-2.6 Myr ago, and the prevailing stage since 2.6 Myr ago (An, 2000). Superimposed on the alternation of winter and summer monsoon variations in glacial-interglacial cycles during the last 2.6 Myr, are some abrupt shifts of monsoonal fluctuations occurred at around 1.7, 1.2, 0.9 and 0.6 Myr ago, respectively (Sun et al., 2006). Furthermore, millennial-scale variability of East Asian winter monsoon is also recognized in the last glacial loess and has been linked to millennial variability in the North Atlantic via the westerlies (Chen et al., 1997; Ding et al., 1998).