Nature, age and paleoclimatic implications of loess-soil sequences in Northern Iran

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In Northern Iran, loess deposits up to 80 m thick are found along a pronounced climatic gradient from the semi-deserts of the Turkmen steppe (annual precipitation r < 250 mm) towards the subhumid foothill zone of the Alborz mountains (r = ~700 mm) and the Sefid-Rud valley (~1000 mm). The loess deposits in different regions have been studied in key sections using a sedimentological-palaeopedological approach including granulometric, micromorphological, geochemical, and mineralogical investigations as well as numerical age estimates based on the luminescence method (Kehl et al. 2006, Frechen et al., 2009, Khormali et al., in preparation, Kehl et al., in preparation). The main objectives were to elucidate the nature, age and paleoclimatic implications of the northern Iranian loesses.

The grain size distribution as well as the mineralogical and geochemical composition of northern Iranian loesses closely resemble those of typical European or Central Asian loesses. Loess in the Turkmen steppe is comparatively coarse-grained and contains elevated gypsum percentages, up to 12 % high. The loess deposits in northern Iran are divided by several kinds of paleosols and pedocomplexes consisting of weakly developed steppe soils, represented by CBk, Ah or Bwk horizons to strongly developed forest soils (Bht, Bt horizons). The paleosols reflect comparatively humid climatic conditions and stable vegetation covers during the corresponding soil forming periods and their intercalation with unweathered loesses show fluctuations in moisture dependent weathering intensities. The differential degree of pedogenesis during the last interglacial reflects a similar climosequence of soils like the modern soils (Khormali et al, in preparation).

Our preliminary chronostratigraphic estimates of loesses and (paleo)soils will be discussed for two pedostratigraphies proposed for the Sefid-Rud valley and the foothills of the Alborz Mountains. For the last 60.000 years (60 ka), the age estimates are confirmed by physical dating. Based on these data and on correlation of climatic phases with the pollen profiles of Lake Zeribar and Lake Urmia (Van Zeist and Bottema 1977, Djamali et al. 2008) the paleosols can be correlated with interstadial and interglacial periods of the Middle to Upper Quaternary, respectively (Kehl 2009, in press).

The Northern Iranian loesses are excellent archives of Quaternary climate change and landscape evolution. High-resolving studies of granulometry, geochemistry, rock magnetics, stable isotopes and luminescence age estimates may identify more fluctuations in edaphic moisture of the past.

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