Loess of Central Asia

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ABSTRACT: Loess deposits are widespread within the piedmont and intramontane depressions of Central Asia. They cover piedmont plains, river terraces, ridge slopes and watersheds. Loess is a significant component in the piedmonts of Tien Shan, eastern Fergana depression, the Afgan-Tajik depression, piedmonts of Kopetdag, Badchyz and Karabil Hills north of Parapamiz, in the Kashmir valley, on the Potwar Plateau and in the Peshawar Basin.

Introduction

Scientists of Central Asia have long been concerned with the problem of loess origin. Studies by F. Richthofen, I. V. Mushketov, V. A. Obruchev were especially important for the origin and development of ideas concerning the nature of loess formation. These scientists and their followers believed that typical loess was formed under arid and cool climatic conditions with the eolian processes controlling the accumulation of dust. These problems are treated in publications on the geology of loess in various Central Asian regions (Agrawal et al. 1979, 1988; Dodonov 1986a, b, 1987; Kadyrov 1979; Kes 1984; Kriger 1984; Pant et al. 1985; Rendell 1988).

The concept and evolution of the eolian genesis theory of Central Asian loess stands in contrast to other ideas on the generation of subaerial loess mantles. The most widespread hypotheses include: the soil or eluvial hypothesis, wadi (proluvial) or fluvial processes and the polygenetic hypothesis (Berg 1947; Pavlov 1903; Vasilkovsky 1952; Kostenko 1962; Mavlyanov 1958; Chernyakhovsky 1966).

The suggested scheme (Fig 1) illustrates the concept of the eolian hypothesis applied to Central Asian environment. It shows five conventional sections, related to areas of high-mountain glaciation, river runoff, plain-valley accumulation, sand and stone deserts and finally, piedmont regions with loess-soil covers.

In the areas of high-mountain glaciation, vast amounts of silt material resulting from frost and thermal weathering formed moraines and eluvial-deluvial covers. Silt washed out became a part of the system of fluvial runoff in mountain valleys. Fine grained and dust material was carried from the mountains and accumulated in piedmont plains and valleys, deserts and semi-deserts that extended over vast areas with arid climate. In the deflation zone continuous evacuation of dust mineral material has occurred which was transported by wind over large distances and accumulated in piedmont watersheds and slopes. Abundant grass cover and low precipitation provided favourable conditions for dust accumulation.

Distribution of Loess

The loess-covered piedmonts and hills frequently bear local names; they are called adyry in Tajikistan, chuly in Uzbekistan and bajiry in S Turkmenia. In Kashmir, the loess-covered plateau is generally designated as Karewa or Udra. These are probably the most typical elements of the piedmont zone topography where loesses form almost continuous mantles several tens of metres thick, while in certain regions such as S Tajikistan or in the vicinity of Tashkent, the loess strata exceed amounts up to 100 and even 200m. Thickness of loess cover on the Potwar plateau, in Peshawar basin and in Kashmir varies some up to 20–25m.

In the piedmonts of Tien Shan and Pamir-Alay, the loess distribution is in altitude occurring below 2500m above sea level (Fig 2). Fragmental thin loess covers are sometimes found at higher altitudes – up to 3000m. In Kashmir valley no loess has been found above 2000m (Agrawal et al. 1979; Pant, Dilli 1986). The topography of loess distribution is controlled by absolute heights of
Mineralogical analysis of loesses in Kashmir valley has confirmed that their source was the dust material transported by wind from the alluvial-lacustrine plain in the Kashmir valley (Pant, Dilli 1986). Higher content of fine dust fraction reported from Kashmir loess (6–20 μm – 30–40%) and significant amount of clay material (clay fraction – 20–35%) indicates that the loess material was at least partially transported from remote territories located possibly beyond the bounds of Pir Panjal (Bronger et al. 1987). Higher sand fraction indicates the proximity of the deflation zone. For instance, in the vicinity of the deflation zone along the margins of the Kyzyl-Kum desert, the loess covers show higher sand content (up to 30%) compared to the piedmont zone of N Tien Shan where it decreases to 4% (data by E. V. Kadyrov).

**Age of loess**

The oldest Central Asian loesses are dated by palaeontological and paleomagnetic data as some 2–2.4 m yr. This has been acknowledged for loess-paleosol sequences of Chashmanigar, Khonako, Karamaidan, Obigarm located in S Tajikistan (Fig 4). The Konako and Karamaidan sequences along with other loess-paleosol sections of South Tajikistan and the Tashkent region (including the Orkutsai section) have been visited by participants of international geological excursions organized during the Symposium on Neogene-Quaternary boundary (Dushanbe, 1977), the 11th INQUA Congress (Moscow, 1982) and the 27th International Geological Congress (Moscow, 1984).

Ancient loess and loess-like deposits intercalated with red-brown fossil soils at the base of the Obigarm section.

Fig 2
Loess section Khonako-2 located in piedmont of Pamir.
Loess of 150 m thickness covers the watershed of Kuğitek range at an altitude ca. 2000 m