

process the surface rises slowly during the centuries to form great thicknesses of the soil we call loess. Look back again over the region. While the sand, from which was separated the dust we have just seen deposited to form loess, lags still scores of miles behind in its advance, we see the grassy plains bordered by a sea of high sand-dunes. They, too, have been arrested in their overwhelming progress by the slight growth of grasses and plants that are compatible with a soil of sand, under the slight precipitation near the border zone. Both the loess and the dunes grow continually in height.

We have seen a cycle of geological activity quite different from that which takes place on the periphery of a continent where the silts are distributed by ocean currents over great submarine areas. Here, on the contrary, the waste from the degrading mountains, which was spread by rivers over the plains, is returned by the winds to pile up on the piedmont zone, and this is obviously true not only of the solids, but of the soluble alkaline and earthy salts as well.

All this conforms strictly to Richthofen's theory that loess was a product of deflation of desert-surfaces, wind-borne till it found protection on the grass-covered zone. Here, however, we see that water intervened as an earlier transporting agent, and that on the plains evaporation restored to the fine silts the salts that had been leached out.

Let us return to our panorama. It is still that of many thousand years ago, and the grassy steppes across all Central Asia teem with herds of wild ruminants and horses and other animals that during early glacial and interglacial time were common to the Eurasian continent. I will ask the reader to look, at the same time, toward the edge of the plains. At short intervals we see streams emerging from the mountains through canyons on to the plain, where they spread out evenly over large fan-shaped deltas that slope radially outward from the apex at the canyon mouth. These are the delta-oases, of which I shall have more to say. Casting our eyes along the southern border of the plains, from the Caspian Sea eastward we see grassy loess-plains fringing the southern mountains, and filling out the great embayments between the spurs of the Tian Shan ranges in the east. But everywhere both these plains and the deltas are hemmed in by the sea of dunes.

During our foreshortened time-scale, our present glance sees also the effects of later climatic oscillations. It is perhaps a period of diminishing regional precipitation. The zone of vegetation narrows, the scant protecting plant life disappears from the dunes, and they advance over the edge of the loess-belt, and encroach also on the shrinking delta-plains. With a period of renewal of precipitation, vegetation resumes its former area, and the loess deposits expand over the dunes.

The processes which we have reviewed have been operating with fluctuating intensity since Tertiary time. The maximum of intensity existed probably as a consequence of the glacial period. Glacial epochs were accompanied by swollen rivers with broad flood-plains, expansions of the seas with extensive marshes, and by great extent of loess-steppes. During interglacial epochs the conditions were reversed, and subsequent to the last glacial epoch there began the general trend