LOESS AND ITS ECONOMIC IMPORTANCE.

M. K. ELIAS.

ABSTRACT. The purpose of the symposium on loess is to present the status of our knowledge on it, particularly in regard to Nebraska.

Fertility of loess, because of which it is frequently miscalled soil, is its most valuable property for mankind. The principal wheat producing regions of the world roughly coincide with the areas of distribution of this "golden earth" of agriculture. Where it mantles the ground the loess and the soils developed from it are the principal or, frequently, the only readily available material for roads, dams, and other engineering constructions.

In spite of many published studies on loess much remains to be learned about its origin, distribution, and best utilization.

THIS symposium on loess has for its purpose the taking stock of the present knowledge of loess, its origin, and distribution, its relation to the soils, and its use in engineering construction.

In the genesis of loess some soil processes must have played a part, because in the course of its accumulation the surfaces of the successive layers were exposed to atmospheric agents, until covered and buried under succeeding layers deposited upon them. On the other hand, on the subsequently exposed surfaces of loess the modern soils have been developed.

In Nebraska loess and loess-like deposits are by far the most widespread among the outcropping formations and the richest soils of the state are those developed from loess. In many parts of the state loess is the only readily available natural material for construction of roads and earth dams.

Ever since the thick deposits of loess originated they have been subject to erosion and redeposition by water and wind. Great quantities of washed-out loess were carried by running waters, and the suspended particles were dropped in backwaters along the valleys, where they, together with other sediments, built the fertile bottom lands.

Along the higher slopes of the valleys quantities of loess were sometimes gradually and sometimes suddenly slumping from higher to lower elevations, and thick loess muds were also creeping down. On their way down they were occasionally mixed with variable rock fragments. The valley-slope loess, thus redeposited, frequently shows rough stratification due to the interbedded layers in which it is mixed with rubble and other débris.

Some geologists and civil engineers refer to loess as soil. Strictly speaking this is erroneous because the true loess is but mother-rock on which soil is developed. However, typical loess is comparable to the good, productive soils in its earthy constitution, friability, porosity, and fertility. Loess is made of pulverized rocks, a ready made natural fine-grained mixture which has friability and porosity comparable to that in soils, and contains most of the soluble mineral compounds essential for growth of grains and other staple crops.

If all the black humus top zones of our tillable loess-soils were stripped from them, for instance by an extremely extensive blowout due to drought, and the primeval yellow loess under them exposed throughout our land—it could be put to tillage at once, and would probably produce a normal crop and, in some cases, where the top soil is impoverished, even better than normal crop, providing there would be sufficient amount of moisture in the ground. This statement should not be understood as minimizing the importance of erosion control of soils and of agronomic practices aimed at maintenances and improvement of its fertility,—the importance of these cannot be over-emphasized.

Typical loess contains an average of about 20 per cent of feldspar in a more or less advanced stage of decomposition. From this mineral the elements calcium, sodium and potassium are liberated in the form of soluble salts. Iron, manganese, phosphorous and other elements needed for plant growth are also liberated in form of soluble salts as a result of the decomposition of hornblende, apatite, and other minerals present. Because the smaller the grain the larger its surface in relation to bulk, the fine-grained minerals in loess yield their elements to water solution, and through it to plant roots, in proportionally greater amount than when the same minerals occur in coarser grains, as in sands or gravels. In surficial portions of loess the soluble minerals are being gradually removed, in part being taken by roots of plants, and in part being carried away by circulating water. The remaining salts are rendered less accessible for further solution because the alumosilicates, which are not soluble, tend to cover the surfaces of loess grains and also clog the passage ways between them. Thus loess deteriorates and gradually loses its original fertility and friability which is so valuable for crop production. On the other hand, as engineers find, the loess which has lost part of its

original porosity and reached greater compactness becomes better material for roads and other engineering structures.

There seems to be no doubt that it is loess with its fine-grained, friable structure, and with its fertility, that is the main factor in making our land most suitable for many crops. Hence it is the source of our agricultural richness. They often call petroleum "black gold" for the wealth which it brings to the nation. The humble "yellow dirt," as loess is called by farmers, which by its productivity is fundamental to our existence could be called with still greater propriety the *golden earth* of agriculture.

World distribution of loess and loess-like deposits, in large part closely associated with glacial drift deposits, coincide with the large wheat-producing areas of the world. The wheat and corn belts of the United States are coextensive with the areas underlain by loess and the "highly calcareous glacial accumulations." Wheat is grown on the soils developed from loess in Kansas, the leading wheat producing state, and in the other loess states, such as Nebraska, Illinois and Missouri; the corn of the leading corn producing state of Iowa grows on soils developed from loess. Marbut's (1930) "highly calcareous drift" zone covers the rest of the leading wheat and corn producing states: Montana, North and South Dakota, Minnesota, Indiana and Ohio. The isolated highly productive wheat region of Washington, Oregon and Idaho is coextensive with the loess deposits of the Columbia Plateau, and the extreme southwestern extension of the "hard winter wheat region" of the Mid-West in Oklahoma, Texas and New Mexico is located on patches of loess in the High Plains region (not shown on Marbut's generalized map).

A similar correlation of principal wheat producing areas and loess distribution holds true the world over. In Russia the wheat of the Ukraine and lower Volga River region is on the chernozem-capped loess (see Obruchev's account of loess distribution in this symposium). The bread-basket of the ancient world, the wheat-producing central-Asiatic possessions of Russia, has much loess-derived soil. Here the virgin loess of the foothills of the huge mountain-chains is, in some places, purposely washed by man down into the valleys to produce an artificial veneer of "soil" for better crop production. The wheat of Argentina comes from the great region of loess distribution in South America (Hobbs, 1943, fig. 16, on p. 298), and the

wheat of North Africa is grown on loess-covered regions. Only China's great masses of loess deposits are not used for wheat production, but rice and other staple oriental grains are raised there.

In contrast with soil developed from the inexhaustible amount of golden earth of the northern Mid-West, the soils, which have but little loess material and were formed under the forest belt east of the Great Plains, are frequently thin and irreplaceable. While these soils produced wonderful crops for the pioneer farmer, who cleared the forest and tilled the land thus made available, they did not continue to produce in abundance and were nearly exhausted within a few generations, becoming poor land unable to support the living progeny of the once prosperous pioneers.

Some economists in the east, who were alarmed by the dust storms of the middle west, suggested abandonment of tillage in western prairies and the turning of most land to moderate grazing. While reasonable precautions to safeguard against erosion and blowouts are essential for conservation and proper utilization of the land, general condemnation of dry farming in these areas is unreasonable. Instead, as the experience of our tenacious and progressive farmers show, dry farming combined with irrigation from rivers and creeks, and from shallow and deeper wells, assures continuous production of valuable crops in the drier parts of the Mid-West. Large scale wheat raising produces and will produce most of our bread. Compared with other parts of our country it is the northern part of the Mid-West, where the inexhaustible golden earth is located and where it is possible to maintain production of wheat, corn, potatoes and other fundamental foods for many generations to come, safeguarding a normal supply of these essentials of life for our own nation, as well as an emergency surplus for the rest of the world.

References.

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Nebraska Geological Survey,
University of Nebraska,
Lincoln, Nebr.