



## BURIED SOILS AND THEIR SIGNIFICANCE

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Buried soils are of no importance from the standpoint of their agricultural value, but much information can be secured from them in relation to geological activities which have occurred since their deposition. Buried soils may be formed in at least three different ways, which are as follows: (1) Deposition of alluvial material over the soil by running water; (2) Deposition of sand or loess over the soil by the action of wind; and (3) Deposition of ground moraine over the soil by the action of glaciers, particularly in regions where severe glacial erosion did not occur.

The gradual accumulation of alluvium, loess, or fine sand would not form a buried soil. There must be an interval during which no sediments are deposited in order that the growth and decay of vegetation can increase the organic matter content of the surface layer of soil so that there will be a marked difference between the color of the surface layer of the buried soil as compared with the color of the sediments deposited on top of it. Also the structure of the soil profile which develops as a result of the weathering processes is very different from the parent material from which the soil was derived. In mature soils a zone of concentration of clay will be found which aids in the identification of buried soils when they are being compared with other types of sediment or parent soil material. The accumulation of any kind of a deposit on top of a buried soil will not affect the structure which developed before the soil was buried. The most common change which frequently occurs in buried soils is a change in the color of the zone of organic matter accumulation. Gray colors frequently replace the dark brown colors originally present in the surface soil, especially when the buried soil contains a considerable amount of moisture. This is due to the fact that the iron remains in a ferrous condition and the white minerals in the soil become more prominent as the organic matter gradually decomposes.

In Oklahoma no soils have been formed as a result of glacial action; consequently the most common types of buried soils which might occur in Oklahoma would be soils which have been covered by alluvium and soils which have been covered by soil material carried by the wind.

### BURIED SOILS AND THE ACTIVITY OF STREAMS

In the normal development of a valley the stream usually deepens its channel during the early stages of its development. As the head of the stream gradually works its way farther and farther into the plain, the

lower portion of the valley gradually fills with alluvium due to the decrease in the carrying power of flood waters when the velocity of the stream is reduced. This process of aggradation in most cases has taken place so gradually that in many places buried soils can not be found. In order to have a buried soil it is necessary that a considerable period of time elapse between the deposition of the first sediments and the accumulation of more recent alluvium. During the process of soil formation not only does organic matter accumulate in the surface layers of soil and develop dark colored horizons, but also there is a movement of the finer soil particles from the surface layers of soil into the subsurface zone. When considerable amounts of clay are present in the alluvium from which the soil is derived, mature soils develop a very compact layer or B Horizon at a depth of 12 to 18 inches below the surface of the soil. In case of sandy soils this compact layer is frequently not so pronounced and may be found several feet below the top of the ground.

A long period of time is required in order to develop this zone of concentration of clay; consequently where buried soils are found which have this compact layer present, it is very evident that a long interval existed between the deposition of the sediment from which the buried soil was derived and the deposition of the alluvium which has covered the buried soil.

A very good example of a buried soil which was formed from the weathering of sandy shale can be seen on the west bank of the Salt Fork River, at Pond Creek, Oklahoma. At this particular place a buried residual soil appears at the base of the soil cross section and alluvium has been deposited on top of it. This alluvium was undisturbed for a long period of time because a very pronounced zone of concentration of clay has developed at a depth of about 18 inches below the surface of this soil. During a more recent period this old alluvial soil which developed on top of an old residual soil has been covered with several feet of sediment which has not been changed appreciably by the process of weathering and presents all of the characteristics of an immature soil. These different formations would indicate that the Salt Fork River has passed through two separate periods of aggradation at this particular place which were separated by a long period of time during which practically no deposition of sediment occurred. Since that time erosion has replaced the process of aggradation and sediments which accumulated at this point a long time ago are being transported at the present time down the valley to some other portion of the flood plain.

#### **BURIED SOILS IN RELATION TO THE MOVEMENT OF SAND DUNES**

A study of buried soils in relation to the sandy areas of Oklahoma should give some very interesting information in regard to the method by which these particular areas were formed. Anyone who has studied these soils will observe that in many places relatively level areas occur which have many characteristics in common with alluvial deposits. A dune topography usually surrounds these level areas and sand dunes are numerous in some localities. If the wind has been the most active agency in the formation of these soils, there should be many places, at least at the contacts between these sandy areas and the adjacent uplands, where buried soils can be found. However, if the major portion of any of these areas has been formed by the action of running water working back and forth across the valley, buried soils formed from the weathering of sandstone or shale would not be found except under alluvium similar to that previously described.

A careful examination of the contact between the sandy land along the north side of the Salt Fork River and along the north side of the Cimarron River between Perkins and Ringwood, Oklahoma, seems to indicate that the movement of sand by the wind has been local in nature. A study of the rocks, which underlie this area indicates that the major portion are sandstone. The weathering of sandstone by the action of rainfall or running water will produce a sandy soil. If the sandstone does not contain very much cementing material, it may be difficult to determine whether or not it was deposited as a sedimentary rock or whether it has been formed by the action of running water or deposited by wind. Stratification in these sandstones can be found, especially in the deeper layers; however this is not necessarily an indication of deposition by water because excellent stratification frequently occurs in soil material which has been deposited by the wind. Consequently stratification cannot always be used as a means of determining the origin of deposits.

In two places deep exposures were studied in the valleys of streams which crossed the sandy belt between Crescent and Ringwood, Oklahoma. In these deeper valleys no evidence of buried soils could be found which would indicate that in most cases the valley of the Cimarron River has been eroded and then gradually filled again with alluvium as the stream worked its way westward toward and into the High Plains Region. A careful study of soils along the north edge of the sandy area north of the Cimarron River does not substantiate the theory that the sand has been moved any great distance by the wind. An examination of soil profiles does not reveal that any buried soils exist between the sand dunes or beneath any of the areas of level sandy land. There is a very gradual change from the loose sandy soils to the finer textured soils of the uplands which occur usually one or two miles beyond the edge of the black jack timber which is usually considered the boundary line between the so-called sand hills and the western prairie soils.

Because of the fact that there are no buried soils in the transitional zone between the sandy land and the prairie, it would seem that wind has played a very minor part in the development of this particular soil formation. The part which wind has played in the formation of these sandy soils is still in progress. Sand dunes are being formed along the north bank of the streams and these deposits of sand are gradually forcing the streams farther and farther south. The sand is carried from the stream channels by the wind and is being piled upon or near the north bank of the streams in the form of a levee. Frequently there are large areas of the flood plain which occur north of these sand levees and if the erosion of the stream channel continues, these areas will eventually appear as high terraces between the sand dunes similar to the areas found farther north and at slightly higher elevations. In Canadian County the surface soil on the north side of the North Canadian River has been mapped as Derby sandy loam, which is a soil type which has been developed on areas where the soil material has been deposited in part by the action of the wind. On the south side of the same stream the same soil type has been mapped. In this area the soils have been derived from the weathering of a sandstone and the wind has developed a faint dune topography in certain places. There is no doubt concerning the influence which the wind has had on the development of the dune topography on many of these sandy areas in Oklahoma. However a study of the buried soils indicates that the wind has not been an important factor in transporting soil material very far from the point where it was originally deposited or formed for the decomposition of pre-existing rocks.

Another example of the action of wind in the process of soil formation occurs north of Enid in Garfield County, Oklahoma, where a deep sandstone formation occurs. On the surface of this sandstone formation many small sand dunes appear. Apparently these sand dunes have been formed by the action of the wind on the soil produced from the weathering of the parent rock which is a very soft sandstone. To the west of this area the sandstone disappears beneath a layer of shale which has weathered into a mature soil and has a very compact B Horizon. Although a detailed study of the edges of this area has not been made, several different soil profiles have been examined and no buried soils were found.

A critical study of other localities in Oklahoma might help to solve the problem of the origin of the sandy lands. One other study conducted in Beckham County, south of Sayre, Oklahoma, would seem to indicate that the sandy material of that area was also deposited by running water and that wind action has been relatively unimportant except as it has affected the topography of the area.

#### SUMMARY

A study of agencies which are important in the formation of buried soils was made.

Deposition of sediments by action of wind and running water are the most important methods by which buried soils can be formed in Oklahoma.

A buried soil which developed from the weathering of alluvium was found resting on a buried soil formed from the weathering of a sandy shale near Pond Creek, Oklahoma. Buried soils are frequently found in river terraces.

No evidence of buried soils was discovered at the edge of the sandy areas on the north side of Cimarron and Salt Fork Rivers. Wind apparently has not been an important factor in moving the sand very far from the streams, but it has been responsible for the development of the dune topography which occurs on these areas.

A theory was proposed in regard to the method by which the sandy lands along the north side of many Oklahoma streams have been formed.