

SAND AND GRAVEL DEPOSITS IN SOUTH DAKOTA

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The sand and gravel deposits of South Dakota may be divided into two distinct types, those of glacial origin and the terrace gravels of local origin. East of the Missouri River in South Dakota all of the sand and gravel deposits are of glacial origin while the deposits west of the River occur as terrace remnants and buttes in the modern drainages, the materials being derived from the harder parts of the surrounding formations.

There are four essential types of glacial deposits of sand and gravel known as outwash plains, valley trains, kames and eskers.

Outwash plains form one of the best sources of gravel, both as to quantity and quality. When terminal moraines are forming and the melting ice furnishes abundant water, a sheet of sand and gravel is spread in front of the moraine known as an outwash plain. The outwash plain is composed entirely of materials carried by the ice. The material is ordinarily uniform in size throughout the deposit, though there is a tendency for it to become coarser near the moraine and finer farther away.

Valley trains have an origin quite similar to that of outwash plains. Instead of being deposited in a sheet in front of the ice the materials are carried down a valley by the waters from the melting ice and deposited in the valley. In general, the materials are fairly well sorted, the coarser materials tending to be deposited near the ice front, while the finer are deposited farther down stream.

Kames are beehive shaped hills, varying in size. They are formed by a stream flowing along the top of a glacier and emptying itself into a great hole or moulin in the ice, filling this hole with the debris the stream is carrying. Or the stream may plunge over a cliff at the edge of the ice, piling the stones and boulders it carries at the bottom of the cliff.

Tunnels are often hollowed out in the bottom of stagnant ice by streams formed from its melting and these tunnels become filled with the debris the streams are carrying. When the ice melts away, a long narrow ridge is left which is known as an esker.

The gravels west of the Missouri River are the result of stream deposition in the recent past, geologically, and lie in the valleys of the present streams. The deposits are remnants of valley fills which have resisted erosion and now lie on buttes and terraces which arise above the valley bottom.

The largest and most extensive gravel deposits occur in the northern part of the Prairie Hills upland in Day, Grant, and Codington counties. The deposits are in the form of large outwash plains, channel fills and valley trains in the drainage of the Big Sioux Valley. Some of these outwash plains and channels in Day County contain as much as 325,000,000 cubic yards of well sorted sands and gravels with a thickness of 18 and 20 feet. In the southern portion of the Big Sioux Valley drainage the deposits are largely valley trains of sands and fine gravels such as in Minnehaha County. A conservative estimate of the total volume of gravels in Minnehaha County is approximately 380,000,000 cubic yards.

An abundance of gravels occur in the broad and flat James River Valley. From Huron north to the state line the most important deposits occur as channel deposits, the flow of water from the ice not being great enough to form large outwash plains. In the southern drainage of the James River, as in Yankton County, the deposits occur in or near the valleys of the larger streams as terraces on the valley walls. These terraces in Yankton County contain anywhere from a few thousand cubic yards of gravel to as much as 500,000 cubic yards.

The area west of the Missouri River may be separated into four drainage divisions based upon the materials in the gravel and the drainage systems.

The first division is the northwest area which includes all of the gravel deposits north of the Belle Fourche River and the Cheyenne River below the junction with the Belle Fourche, and west of the Missouri River.

The materials of the gravels in this division are all derived by concentrating the harder materials in the rocks outcropping in the vicinity. Most of the deposits contain a large proportion of sand, sandstone pebbles, limestone and limonite, although areas are present where limonite pebbles are the main constituent and also where limestone is the main constituent.

The second division includes the Black Hills and its immediate drainage. The gravels in this area are concentrates of mostly igneous rocks having their origin in the Black Hills.

The White River division lies in the south central part of the state, being east and south of the White River and west of the Missouri River. The materials for the gravels are of local origin, there being two sources. The bedrock gravels are bars composed of quartz, metamorphic rocks, feldspar, granite and limestone, that were deposited in ancient stream channels. The limestone gravels are deposits of lime pebbles concentrated from the surrounding bed rock formations in the valleys of the present streams.

The central South Dakota division is bounded on the west and north by the Cheyenne River, on the south by the White River and on the east by the Missouri River. The gravels of this area are mostly limestone gravels deriving their materials from the concretions of the Pierre shale which is exposed to the surface. Some of the deposits along the Cheyenne River are composed of materials derived from the Black Hills.

The terrace gravel deposits west of the Missouri River average between 2,000 and 25,000 cubic yards in each terrace; however, some have as large a volume as 250,000 cubic yards of material. Thus accumulated in one drainage system the volume of gravels may be quite high.

The gravel deposits of glacial origin found in outwash plains and channels and valley trains have the largest volume of materials. The sands and gravels in these deposits are clean, well sorted and composed mostly of quartz grains. However, kames and eskers, of glacial origin, are usually quite dirty and have an abundance of oversize through the deposit in addition to having a small volume of materials.

Terrace gravels, west of the Missouri River are on the whole not quite as large and clean deposits as those of glacial origin. The gravel and sand is not as well sorted and not nearly as clean, containing much fines in the form of silt. The average material is limestone and limonite which is less resistant to wear than quartz grains making them poorer in value than the glacial gravels.

Sand and gravel deposits are of commercial value to South Dakota being used mostly for building materials, road surfacing, paving and construction work. During the year 1938, South Dakota produced 4,677,593 short tons of sand and gravel either sold or used at a value of \$627,344.

Approximately 22 per cent of the total area of South Dakota has been investigated for sand and gravel deposits. A very conservative estimate of the volume of materials in the area investigated is 1,394,000,000 cubic yards. Thus at an average production of 5 million cubic yards per year the State of South Dakota has enough known supplies to last for 275 years. Assuming that the deposits are as large in the uninvestigated areas, the total deposits in the State would be large enough to last us for over 1,100 years at the present rate of production.