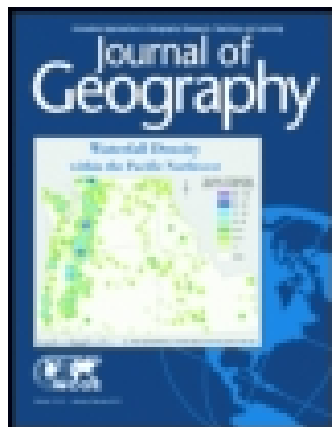


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The Physical Geography of Minnesota

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THE PHYSICAL GEOGRAPHY OF MINNESOTA

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GENERAL GEOGRAPHY

LOCATION and area. Minnesota is located approximately at the exact geographical center of North America. It is on the northern boundary of the United States, lying equally distant from Vancouver Island and from Nova Scotia, and half way between the Beaufort Sea and the Caribbean Sea. The part of Minnesota lying north of the 49th parallel in the north-west corner of the Lake of the Woods, which comprises an area of about 150 square miles, is the most northern portion of the United States, excepting Alaska.

The area of Minnesota is 84,682 square miles, including 80,858 square miles of land surface and 3,824 square miles of water surface. This does not include the area of 2,514 square miles of Lake Superior adjoining and within the political boundaries of Minnesota. Its greatest length from the northernmost point in the Lake of the Woods to the Iowa boundary is 408 miles, its greatest width, from St. Vincent to Pigeon Point, is 357 miles.

Geology. The rocks of a large area of Minnesota belong to the oldest formations, the pre-Cambrian, and form the southwest margin of the pre-Cambrian shield of North America. A smaller area, the southeastern part of the state, includes rocks of later formation, the Paleozoic and still younger rocks, the Mesozoic, occur over the western part of the state. These formations, over the greater part of the state, are covered by unconsolidated surface deposits made by the weathering of older rocks, by wind, stream, and wave deposition, and by the continental ice sheet.

The pre-Cambrian areas of Minnesota are made up of igneous and sedimentary rocks and their metamorphosed equivalents. The lavas of Pine and Chisago counties, of the north shore of Lake Superior, and of other areas of northeastern Minnesota; the large masses of intrusive granites, gabbros, etc., in the pre-Cambrian area, are igneous rocks, formed by the cooling of molten material. Some of the slates, the ferruginous cherts, the quartzites of central and northeastern Minnesota, the quartzite of New Ulm, of Watonwan, Cot-

tonwood, Pipestone, and Rock counties are metamorphic rocks, derived from muds, shales, and sandstones. The gneisses and schists of central and north-eastern Minnesota and of the Minnesota Valley are also metamorphic rocks. These were made by the alteration of both igneous and sedimentary rocks.

The Paleozoic and Mesozoic areas are made up of sedimentary rocks, limestones, shales, sandstones, and conglomerate.

In general the pre-Cambrian rocks have suffered great changes by folding, faulting, fissuring, and by recrystallization. In some of them the original mineral constituents have been altered and new ones have been developed. The Paleozoic and Mesozoic rocks have been altered very little since their deposition; locally they are folded or gently tilted.

Geological History. The geological events of Minnesota which have a close bearing on its physiography can be summarized as follows: (1) a pre-Cambrian period of deposition of sedimentary rocks and extensive igneous extrusion and intrusion; (2) a period when all the Minnesota area was mountainous, resulting from the folding of the pre-Cambrian rocks; (3) the reduction of the area to a peneplain; (4) the submergence of the greater portion of the area beneath the ocean and deposition of the Paleozoic sediments. These events were not without interruptions and there were oscillations of the sea level during the Paleozoic. (5) A period when the Minnesota area was dry land and denudation was active; during the period the greater portion was reduced to a peneplain; (6) submergence of part of the area beneath the ocean and the deposition of the Cretaceous sediments; (7) a period when Minnesota was dry land, and was being sculptured to something like its present form; (8) a glacial period during which the entire area, except the extreme southeast corner of the state, was buried beneath an ice sheet; (9) a brief post-glacial period.

TOPOGRAPHY

Minnesota is a great undulating plain. The larger part of it lies between 1000 and 1500 feet above sea level. The average altitude of the state is about 1200 feet. The greatest altitude, 2230 feet, is found in one of the peaks of the Misquah Hills in north central Cook County. The lowest elevation, 602 feet, is the level of Lake Superior. The level of the Mississippi River where it crosses the state line in the southeast corner is 620 feet, and that of the Red River of the North in the northwest corner is 753 feet. A narrow belt below the 100-foot contour occupies the Red River Valley, and follows down the valley of the Minnesota to its confluence with the Mississippi; here it expands to include a large area to the north and east. It follows the Mississippi River, becoming narrower as the southern boundary is reached. Another area below the 1000-foot contour is a narrow strip bordering Lake Superior. There are three areas above 1500 feet: (1) parts of St. Louis, Cook, and Lake counties, (2) parts of Becker, Hubbard, Clearwater, and Mahanomen counties, (3) the Coteau des Prairies, in the southwestern corner of the state.

HYDROGRAPHY

Drainage. Minnesota is the watershed of the portion of the continent lying east of the Rocky Mountains. Its waters drain into Hudson Bay on the north, into the Great Lakes on the east, and through the Mississippi River into the Gulf of Mexico on the south. The water surface, excluding the part of Lake Superior within the state, is greater than that of any state in the union, the average being 1 square mile of water to 20 square miles of land.

The Hudson Bay-Nelson River system drains the northwestern and northern part of the state and drains about 34 per cent of the area of the state. It is represented by the Red River of the North, the Rainy River, and their tributaries. The Red River of the North rises in the southwestern corner of Clearwater County, about 13 miles west of Lake Itasca, the source of the Mississippi River. The divide between it and the Mississippi River is here about 1750 feet above sea level. The divide between the Red River and the Minnesota River is 973 feet. The divide between the Rainy River and Pigeon River on the International Boundary is 1700 feet. The Great Lakes-St. Lawrence River system drains the northeastern part of Minnesota, about 9 per cent of its area. The principal stream of this area is the St. Louis and its tributaries, but there are also many short swift streams flowing directly into Lake Superior. The Mississippi River system is the largest and most important and drains the greater part of the state, or about 57 per cent of its area. Its chief tributaries are the Prairie, Crow Wing, Sauk, Rum, St. Croix, Minnesota, Cannon, Zumbro, and Root rivers. Cedar and Des Moines rivers in southern Minnesota flow through Iowa to the Mississippi. Rock River in the southwestern corner is a tributary of the Missouri River.

Lakes. Excepting the southeast, southwest, and northwest corners, lakes are abundantly distributed over the state. The largest is Red Lake, a shallow body of water with an area of about 440 square miles. Other large lakes are Mille Lacs, Winnibigoshish, Leech, Minnetonka, and Vermilion. In the Lake Park region, beginning near Taylor's Falls, passing southwest to the Twin Cities, and then northwest to Fergus Falls, then north and northeast across the central and northeastern portion of the state, are thousands of lakes of various shapes and sizes. About three-fourths of the lakes of Minnesota occur among the moraine ridges and on outwash areas. Others occur on till plains, in rock basins, in limestone sinks, on flood-plains, and in river channels.

Coast. The northeast projection of Minnesota fronts on the water of Lake Superior, the coast line in the state being about 150 miles. It is a bold, straight shore line rising abruptly from the water's edge several hundred feet. Very few large indentations occur along the entire coast. Small promontories and scattered islands break the monotony near the northern boundary. There are but few good natural harbors. At Two Harbors there is a twofold indentation of the coast by which a double harbor is formed.

The Duluth harbor, at the "Head of the Lakes," is located behind a sand spit, Minnesota Point. It is the best harbor along the Minnesota coast.

GEOGRAPHICAL PROVINCES OF MINNESOTA

The United States may be divided naturally into physiographic provinces on the basis of geographical features, geology, topography, climate, etc. Minnesota lies in two of the larger divisions, the Lake Superior Highlands and the Prairie Plains. These, however, may be sub-divided into smaller physiographic provinces.

The Northeastern Highland. This geographical province occupies the northeastern part of the state and is a broad undulating upland or plateau worn down to low relief. It occupies the site of ancient lofty mountains as is shown by the rocks exposed and the structure of these rocks. Monadnocks—erosional remnants of more resistant rocks—rise above the general level of the plateau. These form striking topographic features, among them the Giants Range, Jasper Peak, and the knobs in the Misquah Hills in Cook County. After this area was peneplained, at least a part of it was lowered beneath the sea and marine sediments of the Paleozoic were laid down on it. It was again uplifted and gently folded and attacked by the processes of denudation, a part of the ancient surface was exposed again; subsequently a part of the region was submerged again and buried beneath Cretaceous sediments. Later it was uplifted and exposed to the processes of weathering which exhumed parts of it. Finally the entire area was modified by glaciation.

Red River Lowlands. The basin of the Red River, occupied by the Glacial Lake Agassiz, in the northwestern part of the state, is a comparatively low area and is one of the most nearly level regions known. It is so flat that much of the rain falling upon it can not find its way into the streams, but sinks into the soil. The surface is covered deeply with fine silt, "lake washed till," and conglomerate; all of these are horizontally bedded. The most striking physiographical features are the former beaches or ridges of sand and gravel, marking the successive levels of Lake Agassiz.

The Lake Superior Lowland. The lowlands of Lake Superior are made up of a narrow strip along the shore of Lake Superior, which extends into eastern Carlton County along the St. Louis River. This area was occupied by the Glacial Lake Duluth. Here also are found beaches formed at successive levels of Lake Duluth. The area is bordered by high escarpments.

The Southern Lowlands. The central and southern portions of Minnesota occupy a low plateau. On the north it slopes gradually to the Minnesota-Mississippi valleys and from the southern boundary it slopes with an even grade northward to the Minnesota Valley. The area is composed of Cretaceous and Paleozoic sediments, with several exposed monadnocks of the pre-Cambrian in the Minnesota Valley and southwestward from New Ulm to Pipestone. The pre-Pleistocene topography is for the most part concealed

by a heavy mantle of glacial drift. In the southwestern portion of this area is a small plateau rising 500 feet above the adjacent upland, the transition from one level to the other, although gradual, is comparatively well defined. This higher plateau extending from Minnesota into the Dakotas, is known as the "Coteau des Prairies." Two other slightly elevated regions in this area mark the topography. One of these is in Mower County, where it forms a flat dome from which the surface slopes gradually in all directions. It rises about 1400 feet above sea level or 200 to 300 feet above the general level of the area. The other elevated region is the morainic area of central Minnesota. Between these three elevated areas there are three troughlike depressions whose axes slope away from the highest elevation in the southwest toward the lowest depressions in the northeast.

MINNESOTA

THE DRIFTLESS AREA OF MINNESOTA, A GEOGRAPHIC UNIT

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DESCRIPTION OF THE DRIFTLESS AREA

AN area of approximately 2500 square miles in the southeastern part of Minnesota has conditions of topography, drainage, and soil so different from the rest of the state that it forms a geographic unit. It is a part of the well known unglaciated or driftless area in southwestern Wisconsin, northwestern Illinois, and northeastern Iowa. In Minnesota, the driftless area borders the Mississippi River and is drained by the Root, Whitewater, and Zumbro rivers. It includes all of Houston and Winona counties, and adjacent sections in Fillmore, Olmsted, Wabasha and Goodhue counties.

The driftless area in Minnesota is a region of horizontally bedded shales, sandstones, and limestones dissected to topographic maturity. Here the bed rock, which in most of southern Minnesota is buried beneath a thick deposit of glacial drift, outcrops in the slopes of the valleys. Economically the most important rock is a thick bed of limestone which outcrops in the upper portion of the bluffs along the Mississippi. It is quarried in many places and is one of the materials most used in building basements, bridges, roads, and wing dams in the river.

Topographically this area is divided into an upland and a lowland province. The upland, which is about 1200 feet above sea level, has in its western portion a comparatively level undissected surface, while to the east it is so much dissected by the tributaries of the Mississippi that it exists only as flat topped spurs between the valleys. Such valleys are from 350 to 450 feet below the upland and form a lowland section. In their upper reaches they are narrow, steep sided, and V-shaped. Their lower, wider sections have