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extreme, while the mangrove has, at present at least, no other commercial use, and being distributed over nearly the entire tropical and subtropical parts of the globe, such an industry would be likely to become quite remunerative.

THE GLACIAL PERIOD AND MODERN GEOGRAPHY

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NOT many thousand years ago, portions of the North Temperate zone were reduced to an Arctic climate, and invaded by a great continental glacier from the North. It was not the first event of the kind. Probably it will not be the last. As geologists reckon time, the Glacial Period was not of long duration, for the pendulum of the clock which tells geologic time beats milleniums. Yet the advance of the glacier into temperate North America wrought changes which have been determining factors in the industrial development of half the continent.

When the Glacial Period came to an end, and the ice retreated, it left the region over which it had passed only slightly changed in topography. Some valleys were deepened by the scouring action of the advancing ice. Others were partially filled with glacial deposits. Ranges of low moraine hills, patches of drumlins, scattered eskers, and kames, were distributed over the area which the ice covered. These deposits have modified the relief only in the smaller details. The addition or the removal of a few feet of soil from a given area, the diversion of a stream a little from its former course, the damming of a river by a moraine deposit are minor topographic changes, but the effects of even such small changes have proved to be of fundamental importance in the geography of the regions where those changes occurred. The development of manufacturing in New England, the construction of the Erie Canal in New York, the munificence of agriculture in the Middle West, and the growth of our enormous iron and steel industry around the Great Lakes, all have connection with the Glacial Period.

When the "Great Ice Plow" pushed across New England, it scraped the soil from her granite hills, leaving many of them bare, and others with the merest veneering of soil. Much of the ancient soil was carried out into the ocean, and some of it now forms the surface of Cape Cod, Nantucket, Marthas Vineyard, and Long Island. But seemingly not content with thus far interfering with the farming of future New Englanders, the glacier wrenched from their moorings countless rock fragments and boulders, bore them along in its grasp, and at its melting, distributed them with great liberality over the surface of the land. Not all the uplands were robbed of their soil, nor all the lowlands burdened with a legacy of boulders; yet it was the case in many parts and the conditions were sufficiently widespread to impress upon the shrewd New England Yankee, that he could turn his capital, his intelligence, and his genius into more profitable enterprises than general farming.

In all the extensive region lying to the south and west of the present Great Lakes, a very different work was performed by the glacier. As the ice plowed its way into Ohio, Indiana, Illinois, Iowa, Minnesota, and Dakota, it brought with it a vast load of finely ground soil. Some of it was the soil which had covered the surface of Canada; the rest was made by the grinding, and scraping action of the ice itself, upon the underlying rock. But in this case the glacier had not plowed its way over hills of granite, and gneiss, as it had done in New England, and hence did not carry a burden of igneous boulders, too hard to be ground into soil. The ice had passed for the most part over a region of softer sedimentary rocks, grinding their loosened fragments into that rich, warm soil which makes the Upper Mississippi basin a veritable garden spot, the world's greatest wheat and corn field.

The work of the glacier in New York State was, on the one hand, less spiteful than in New England, and on the other, less beneficent than in the states farther west. From the Canadian highland and the Adirondacks, the ice brought "hard heads," as the farmers call the boulders, and scattered them unevenly over the state. To dispose of these cost the pioneer farmers and their sons an infinite amount of labor, but this drawback did not prevent New York's becoming a leading agricultural state. On the contrary, the variety and fertility of the glacial soil of New York is its greatest source of natural wealth.

Before leaving the consideration of the effect of the Glacial Period upon modern agricultural industries, one other important result should be noted. When the ice was slowly melting backward at the close of the Ice Age, many temporary lakes were formed in stream valleys. Over these lake-bottoms deposits of fine silt were spread. With the disappearance of the lakes, the silt deposits became rich soil. The best example of this kind is found in the peerless wheat lands of the valley of the Red River of the North; they are the deposits of Glacial Lake Agassiz, which covered an area considerably greater than the combined areas of the present Great Lakes. Lesser instances may be found in all the valleys of north-flowing streams in the glaciated area.

Not alone has the history and distribution of agricultural industries been influenced by glacial work, but in manufacturing also that influence is noteworthy. New England did not yield to the boulder invasion without recompense. Every one of her streams was obstructed by glacial deposits, and from those obstructions were born the great number of waterfalls and rapids which have helped to give New England pre-eminence in manufacturing. Around these glacier-born waterfalls have grown up the great mills of Lowell, Lawrence, and Manchester; of Lewiston, Nashua, Fall River, Holyoke, Pawtucket, Woonsocket, and a hundred other cities and towns. As early as 1810 the people of New England began to forsake agriculture and to develop manufacturing. It was largely the work which the glacier had done that impelled them in this movement. Even as recently as 1870 the United States census tells us that seventy-two per cent of the manufacturing of New England was done by water power. In contrast, note states like Pennsylvania and Missouri, which were but little influenced by glacial action, doing in 1870 respectively thirty-nine per cent and twelve per cent of their manufacturing with water power.

In nearly every state in the glaciated region, the impetus given to early manufacturing is due to the waterfalls which the glacier called into being. Notable examples are seen in the great silk mills of Paterson, at the falls of the Passaic; in the mammoth knitting mills of Cohoes, New York, at the falls of the Mohawk; in the paper mills at the falls of the Upper Hudson and Black Rivers in New York; in the flour mills of Rochester, at the falls of the Genesee; in the furniture factories of Grand Rapids, at the falls of the Grand;

and in the colossal flouring mills on the falls of the Mississippi at Minneapolis.

But the glacier, as if desiring to perpetuate its memory by a monument suggestive of its own tremendous power, has given us the cataract of Niagara, from whose brink a million tons of water plunge each minute, generating a power sufficient, if utilized, to run all the machinery in the great state of New York. It seems likely that the city of Niagara Falls is destined to become one of the important manufacturing centres of the United States.

The great industry of transportation, so important in modern times, has in several specific instances, been remarkably facilitated by the work of the glacier. When the Glacial Period was drawing to a close, and while the St. Lawrence Valley was still buried in glacial ice, the Great Lakes found an outlet to the ocean through the valleys of the Mohawk and the Hudson Rivers, the former of which flows through the gap made in the ancient mountain range of east central New York. The glacial work in the Mohawk Valley helped to make the Erie Canal possible. By glacial deposits, the Ontario Plain of New York was graded with a deep, loose soil which still further facilitated the digging of this canal, which has been of such deep importance economically to New York City and State.

The finest system of internal waterways in the world is the series of Great Lakes of North America. Their influence on the history and industrial development of the United States has been incalculable. And the cities which have grown up along the shores of Lake Erie and Lake Michigan are close rivals of the eastern sea-coast cities in the volume of their commerce. The vessels which are engaged in our commerce on the Great Lakes are three times as great in number, and twice as great in tonnage, as our entire merchant fleet engaged in the foreign trade. The tonnage which passes through the Detroit River yearly is five times as great as that which passes through the Suez Canal, and greater than the combined tonnage which passes through the Strait of Gibraltar, and the Suez Canal. The value of these lakes to the grain, lumber, and mining industries of the United States is beyond computation, and were it not for the water communications between the iron mines of the Lake Superior region and the coal mines of Pennsylvania and Ohio, we should not be able to dictate the steel and iron trade of the world, as we are likely soon to do.

By actually giving birth to the Great Lakes, and by making easy the construction of a canal to join them to the ocean, the Glacial Period has exerted a marked influence upon the development of our commerce, both domestic and foreign. The importance of the canal is no longer great, but that of the lakes increases yearly.

One has only to contrast the paucity of lakes in the southern states with their multiplicity in the northern, to appreciate how great a change in this particular the glacier brought about.

Says Russell: "Our greatest debt to the vanquished glaciers, so far as the revolution they wrought appeals to our artistic sense, is for the tens of thousands of placid lakes they left strewn over the land, and the tens of thousands of leaping waterfalls which sprang into existence at their retreat. The former are emblems of rest; the latter of ceaseless activity."*

Among the hills and mountains of New England and New York; of Wisconsin, Minnesota, and Canada; of the British Isles and Northern Europe, nestle myriads of lakes, glacier-given. Thirty-two hundred square miles of Maine are covered by them. In New York they not only have intensified the scenic beauty and tempered the climate, but with their connecting canals they formed, in the day of canals, one of the finest systems of internal waterways anywhere to be found. The lakelets of Northern New Jersey and Northern Indiana have added beauty and attractiveness to both. The lakes of Wisconsin have attained a national fame. Minnesota leads all her sisters in number of lakes, having no less than eight thousand within her borders.

As purifiers of running water, as reservoirs for the storage and supply of water, as modifiers of climate, as producers of fish, as means of navigation, and as seats of summer resorts, these lakes are geographical features of no small consequence.

Conclusion:

The influence of the Glacial Period in the geography of North America is manifested in three important particulars:

(1) In the waterfalls which it called into existence, and their consequent effect upon manufacturing.

(2) In the soil which the glacier made and distributed, and its consequent effect upon agriculture.

(3) In the resulting lakes which have had such an effect on climate, on transportation, and on agriculture.

* "Rivers of North America." Page 63.