CHAPTER II

THE ORIGIN AND PHYSICAL FEATURES OF THE FOX-WINNEBAGO VALLEY

HOW THE ROCKS OF THE VALLEY WERE MADE

In very remote ages—to be reckoned in millions of years—a broad, shallow sea extended into the very heart of the present continent of North America. North of this sea lay an ancient land-mass which makes up a large part of what is now Canada, and from which a shield-shaped portion projected southward. Part of that shield of ancient rock now forms northern Wisconsin. During this period, much (if not all) of Wisconsin was covered by the sea. From the old land-mass at the north, the streams eroded rock waste and carried it to the ocean, as streams are now doing. This rock-waste was spread upon the bottom of the adjacent sea and slowly built up layers of sediment, which in time became beds of sandstone, made of sand; beds of shale, made of clay; and beds of limestone, made of limey matter which settled from the sea-water or accumulated from the skeletons of corals and other lime-using creatures. In this way the old shield became enclosed on three sides by beds of sediments which accumulated in the sea around it, and which lapped over one another like shingles. The layers which were deposited first rest upon the seaward part of the shield, while those next deposited rest upon the ones laid down first, the third upon the second, and so on.

THE UPLIFT OF THE ROCKS

All of these layers of rock, together with the still older shield which was well-nigh buried under the sediments, were in a later period gradually uplifted into dry land. The sea slowly withdrew and land took its place. This uplift caused a gentle warping of the land now included in Wisconsin, so that the highest ground is in the northern part of the state, while the rock layers gently dip, or slope, toward the south, southeast, and southwest.
THE DIFFERING CHARACTER OF THE ROCKS

As already stated, some of the rocks are sandstone, some are shale, and some are limestone. Most people who live in the Fox River Valley know the limestone, for it may be seen in many places. The shale is soft and is readily eroded. The limestone is more resistant to wear than the shale, and some beds of the limestone are harder than others. And so it has come about that where softer beds of rock are exposed to the wearing action of streams and weather, valleys have been made, and between them the harder layers form low ridges, though none of these are conspicuous except the one which forms the bluff along the east side of the Valley.

CAUSE OF THE VALLEY

The Valley of the Lower Fox and Lake Winnebago is due partly to the less resistant shale which lies under the limestone, while the cliff of the Niagara limestone which forms the steep eastern side of the Valley is due to the resistant character of that rock.

It is noteworthy that the two main rivers of eastern Wisconsin, the Fox and the Rock, do not take short-cuts directly to Lake Michigan, but flow respectively north and south; the latter from the Horicon marsh flows southward into Illinois and thence to the Mississippi River. The reason for this longer journey to the sea is the presence in eastern Wisconsin of the Niagara limestone ridge which extends north and south roughly parallel to the shore of Lake Michigan, and prevents the streams from the interior of the state from flowing directly to the lake; thus the Fox is turned northward to Green Bay and the Rock southward to the Mississippi River.

![Diagram of Valley and Upland](image)

**FIG. 1. CROSS SECTION OF VALLEY AND UPLAND ON THE EAST**

Note the depth of the glacial drift in the Valley and the shallowness of Lake Winnebago.

*Diagram by Martin*
But the Valley of Lake Winnebago and the Lower Fox is not alone due to erosion by a river. It is altogether probable that from an early geological period, a river has flowed in this valley—in fact eroded the valley in the weaker rocks which have already been referred to. Even before the Glacial Period, the hard Niagara limestone stood out as a ridge or cliff. At that time there was no Lake Michigan and, of course, no Green Bay, although there probably was a valley occupied by a river* where Lake Michigan now is, and a river probably flowed in the present Fox-Winnebago Valley.

At a comparatively recent period, as geology counts time, the climate of North America became so cold that great glaciers spread over the northern part of the continent and an enormous body of ice crept southward from Canada as far as the present Ohio and Missouri rivers; this was the Ice Age or Glacial Period. It was made up of several cold epochs and between these were warmer ones during which the glacial ice melted back to the north, only to return long afterward with the return of another cold epoch. Each of these alternating periods of warm and cold climate was tens of thousands of years in duration; it is quite possible that we are now living in one of the warm epochs and that this may be followed, thousands of years hence, by another return of the glacial ice, another Ice Age.

**THE GLACIATION OF THE VALLEY**

The mass of slowly-moving ice which spread over northern and eastern Wisconsin had its center of supply in Labrador, and the front of the glacier was in the form of great lobes. If a part of the ice flowed in a valley which extended in the same general direction as the ice was moving, then that part of the glacier was able to move more freely, and a lobe of ice pushed forward a little more than it did where uplands or ridges retarded it. Thus, lobes of ice developed in certain valleys and gave the front of the glacier a lobate shape. (Fig. 2). It is now possible to discover where these lobes were by the great loops of terminal moraine, or ranges of rounded hillocks, which were built of the debris transported by the ice and heaped up along its margin as it melted.

A good reason for believing that valleys existed in the Lake Michigan and Green Bay depressions before the coming of the glaciers is the fact that the front of the glacier in eastern Wis-

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* It is suggested that this river probably flowed southward. See Martin, Lawrence, *The Physical Geography of Wisconsin*. Bull. XXXVI, Wis. Geol. & Nat. Hist. Survey.
consin was divided into two lobes such as are shown in (Fig. 2). There is equally good reason for believing that the scouring action by the ice lobes in these valleys both deepened and widened them. The Fox-Winnebago Valley is therefore due, first, to the presence of alternating soft and hard layers of rock; second, to the erosion of a valley in the softer layers by an ancient river; and, third, to the somewhat further deepening and widening of that valley by glacial erosion.

Fig. 2. Sketch map showing the various tongues or lobes, of the glacier in Wisconsin at one period of the Ice Age.
GEOLOGIC MAP OF THE FOX-WINNERAGO VALLEY

From Geologic Map of Wisconsin, Plate I, Bulletin XXXV, Wisconsin Geol. and Nat. Hist. Survey (Weidman)
Scale: 1 to 1,000,000 — about 16 miles to the inch
THE ORIGIN AND PHYSICAL FEATURES

CAUSE OF THE GENTLE SLOPE ON THE WEST AND THE STEEP SLOPE ON THE EAST

The cross section of the Valley shown in Fig. 1 brings out the fact that the Winnebago-Lower Fox Valley is not of the usual valley-shape, but that the eastern slope is steep, almost precipitous in places, while the western slope is very gentle. The drawing (Fig. 1) shows why this is so. The Valley has been widened by the slow wearing back (toward the east) of its steep eastern side. The layers of the bed rock themselves dip or slope toward the east, so that the river and the glaciers have always done their eroding mainly against the eastern side of the Valley, and this side is kept steep by the slow wearing back toward the east of the Niagara limestone cliff and the underlying shale, while the western slope of the Valley is very gentle, due to the gentle eastward dip of the underlying rock. Seldom is a valley so definitely bounded on one side as is this one, and seldom does a valley have a boundary less conspicuous than that of the Lower Fox on the west. For the most of the distance, so far as the traveler can see, there is no water-shed between the Lower Fox and the Wolf, which drains the land immediately west.

THE VALLEY AT PRESENT

The Winnebago-Lower Fox Valley is a lowland with

(1) a shallow depression in the southern half which is mostly covered by Lake Winnebago;

(2) a north-sloping plain from the foot of Lake Winnebago to Green Bay.

Through this sloping plain the Fox River has cut a channel down to the bed rock upon which it flows with many rapids. Near Lake Winnebago and again near Green Bay the river has very low banks, but throughout three-fourths of its length it flows between steeply rising banks of red clay averaging thirty or forty feet in height. The present river channel shows by the steepness of its earth banks that it is youthful. The flat surface of the upland on either side of the channel is somewhat cut up by ravines, the courses of temporary or extinct tributaries; it is a rich farming region with little waste land.

The average width of the valley of the Lower Fox between the inconspicuous divide on the western side and the steep limestone ridge on the eastern side, is twelve or fourteen miles, and the river flows a little east of the median line. Southward from
Fond du Lac the valley floor gradually rises for 10 or 12 miles until a low divide is reached from which the drainage is southward to the Rock River.

**Natural Resources**

Originally, hard wood forests covered most of the land near the Fox and Lake Winnebago, but there were prairie-like openings, some of which were utilized by the Indians for corn fields. The greatest timber resources tributary to the Fox River Valley were, however, the Wolf River pineries, which were among the finest in the state or in any state. Although the forest products have dominated the manufacturing industries at every stage, the soil of the Fox-Winnebago Valley is its greatest natural resource. In addition to these natural resources are the brick clays and the limestone, the basis of small industries. So far as the river itself is concerned, the two geographical conditions which cause the Fox to stand out prominently are

1. its great waterpower, and
2. its use as a waterway.

No other stream in the state except the Wolf is or ever has been used to any extent for steamboat navigation, and no other river has its waterpower so fully developed, or has so much waterpower in so short a distance. Growing out of these two conditions is a third fact—in no other valley of the state is there such a chain of cities in close succession. Only along the Lake Michigan shore has city-growth been more rapid than in the Fox-Winnebago Valley.