

GEOLOGIC HISTORY OF MICHIGAN

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The state of Michigan is richly endowed by Nature with varied geologic phenomena. There is evidence to show that within the state there were lofty peaks of active volcanoes, that prevailing westerlies ruffled the waves of the shallow seas that once covered it, and that in turn, deserts, jungles and ice ruled where now the genus *homo* ekes out a living.

in the upper Peninsula the bedrock formations include some of the oldest rocks known. Many of these were originally gravels, sands, marls and silts, deposited in the shallow seas or on great outwash plains that existed in this region a billion or more years ago.

Life was not abundant in those ancient times, but humble forms of the plant and animal kingdom were present. Some of these lowly organisms formed reefs that are similar to deposits of a much later date; other remains formed carbonaceous or graphitic layers, but nothing like coal.

A unique feature of these oldest rocks are the iron formations. The total quantity of iron-bearing minerals deposited in the shallow seas of this period has never been repeated. A comparatively small amount, much less than 1%, of this iron formation was later concentrated into commercial iron ore by natural processes. For many years the iron deposits of the Lake Superior region have yielded 80-90% of the iron produced in the United States. Since 1840 Michigan has been a steady producer.

After great thicknesses of the iron formation and associated deposits were laid down, the district became the site of a profound crustal disturbance. The beds were contorted and broken, high mountains were formed, and great masses of molten rock surged within the earth's crust and broke out to the surface in the form of volcanoes. In the center of Lake Superior, where deep cold water now conceals the remnants of this activity, large fissures poured forth lavas that flowed as far as the present shores of this great lake. Intermittently, layers of gravel and sand spread over lava flows. Spent by all this activity the area then sank, leaving the outer part of the volcanic series as rims round the present Lake Superior.

Within the porous and fragmental part of the lavas and the interstratified gravels now found in the Keweenaw peninsula, native copper was deposited in veins, long famous for their unique character, the only large deposits of native copper in the world. The purity of the copper is such that it can not be improved by metallurgical treatment; and the lodes are among the most persistent known in the world, continuing down along the incline for a distance of 10,000 feet and horizontally for distances measured in miles. How much farther they go down into the earth is unknown. The

working have been limited by mining and economic factors rather than by the continuity of the deposits.

This copper lured man of the stone age, evidenced by crude implements found in shallow pits where shafts now go a mile or more deep.

Several of the mines in the Upper Peninsula have the distinction of being the deepest in the United States. The Quincy at Hancock attained a depth of 9,009 feet along the incline, or 6,254 feet vertically. The Red Jacket of the Calumet and Hecla Co. at Calumet had a 5,690-foot vertical shaft. Auxiliary shafts reach to 9,500 along the incline.

A million years or more after the eruptions of the Keweenaw an epoch the Michigan basin began to develop. During Paleozoic time this large basin slowly filled with sediments from nearby landmasses, along with chemical precipitates and shells of an infinite number of marine creatures.

In shallow bays and arras of the sea toxic conditions prevented complete destruction of accumulating dead vegetable or animal remains. Natural distillation of some of these organic materials formed crude natural oil and gas. Oil and gas, being mobile, migrated into anticlinal structures formed in the more porous rock beds.

Strata of gypsum and salt, interbedded with various other sedimentary rocks, were precipitated during several of the many flooding of the basin. These sediments furnish raw material for such important industries as Portland Cement, gypsum, salt and brine. The Dow Chemical Company at Midland alone produces several hundred products from natural brines.

By the end of Paleozoic time, the basin became a broad floor plain of low swampy nature. Life had made enormous strides in development. Fishes, crustaceans and mollusks were abundant. Plant life was very conspicuous. The luxuriant vegetation of tree ferns, giant mosses and horsetails, growing in the warm moist climate transformed this low land into jungle swamps exceeding those today.

One economic product of these former swamps is coal. It represents accumulation of vegetation under conditions that prevent complete oxidation. As vegetation accumulates on the surface it forms peat, composed of partly decayed stems, leaves, and woody materials, along with an amorphous black jelly-like substance which results from complete decomposition. When buried and covered with mud and sand, however, the partially decomposed substance is compacted by pressure to form lignite coal at first, and after long burial, bituminous or soft coal.

After the disappearance of the last of the Paleozoic seas, Michigan may not have been submerged again. However, the state was covered several times by enormous sheets of ice, as Greenland is today. These glaciers modified the appearance of the land. As they moved ahead, they grooved and polished the resistant rock outcrops, picked up and carried away the residual

soil and acted as large ball mills pulverizing the granite, forming "rock flour" rich in potash and phosphates -- ideal plant foods. As the glaciers retreated the load was deposited in chaotic fashion, leaving hills, gravel beds and shallow lakes.

As a result of geological process, the Upper Peninsula of Michigan is favored with enormous deposits of iron ore and copper, while the Lower Peninsula can boast of its salt, oil wells, gypsum beds, coal mines and good farming lands. The scenic wonders, sandy beaches, forests, streams and lakes beckon the traveler, fisherman and hunter, and the state is one of the nation's favorite playgrounds.

So reads the fantastic tale, the terse natural biography of our state. To the little boy who might ask, "Do you expect me to believe this?" I reply, using the phrase of another little boy, "You are blind in one eye, and can't see with the other". Nevertheless, come be a good sport. Master the alphabet so you can read the things you see.

It may be that a crystal, a fossil, a pebble, or perhaps a scenic feature is waiting to be described or interpreted. Their underlying causes are found in the records of the past. The ability to properly interpret these records depends upon the knowledge of the forces which produce them. Thus, the study of geology leads one to the understanding of the laws which contribute to our daily welfare, for these processes have been in operation from the beginning and are in operation now, and will continue.

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