

NOTES ON THE SAND DUNES OF NORTH- WESTERN INDIANA

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Of the sand dunes of North America, few present more interesting phenomena than those bordering the southern shore of Lake Michigan. Not only do they illustrate all phases of dune activity but they have a significance in ecology and post-glacial history as well as rare scenic beauty. They are conspicuously developed in northwestern Indiana, their maximum development being confined to the 20 miles of shore between Gary and Michigan City. Heights of 100 feet are common and the height of the frontal ridge along the lake commonly ranges from 75 to 175 feet. Parts of the dune complex are fixed and forested, while in other areas the sand is being shifted. The dunes are limited largely to a belt about a mile wide along the shore, although in places low dunes extend several miles inland.

Along the western shore of Lake Michigan for 20 miles north of Chicago the waves are actively cutting into the thick drift, here composed of rather fine materials. This wave-cut cliff may be seen on the Highwood topographic map and in places is more than 80 feet high. A very considerable amount of erosion has taken place and some of the débris has been transported southward by the alongshore currents. Evidence of this movement is seen in the accumulations of sand on the northern sides of piers and the southerly deflection of streams entering the lake where unprotected by breakwaters. With the wear and sorting involved in the transportation, the material which reaches the southern end of the lake is almost exclusively quartz sand. Here the topography and prevailing winds are such that deposition takes place. The shore sands become the prey of the winds and the dunes reach their greatest development.

In order to examine the effect of the wind transportation on the sand grains, nearly fifty samples were gathered along seven lines

running back from the lake and at right angles to the trend of the shore. On the assumption that all of the dune sands had been blown inland from the present shore, it was anticipated that the sand would show increasing signs of wear with increasing distance from the shore. The microscope was used to determine the rounding of the grains, and for the gradations in size a tower of sieves was found most satisfactory. The customary procedure in the latter case was to weigh out 25 grams of sand and pass it through sieves of 60, 80, and 100 mesh to the inch, thus giving four grades of size, namely the sand retained in each screen and that passing through the 100 mesh sieve. These groups were then weighed and converted into percentages.

The percentage of coarse sand was found to decline back from the shore and there was a corresponding increase in the finer grades. At a distance varying from one-fourth to one-half mile from the beach, however, came a sharp increase in the proportion of coarse sand along most of the lines on which samples were taken. The change was quite regular, and reference to field notes showed that on the lakeward side of the location for each sample which showed the unexpected coarseness there was an area of muck or marsh. Subsequent field investigations showed a more or less continuous belt of this swamp or muck land between the dune belt nearest the lake and the next one to the south, the dunes to the south being lower and more rounded. Along the southern border of this flat there were in places topographic suggestions of an old beach ridge and from burrows of animals and holes which were dug, very coarse sand was found. In the analyses of the samples from the second dune belt, next south of the swamp belt, there was again a progressive decrease in size of grain grading to the south. The evidence, both topographic and petrographic, therefore points to an old shore line, the dunes immediately to the south having been built when the lake shore stood at its position, rather than having been blown inland from the present beach. The muck or marsh marks the approximate position of a former shore, and was perhaps developed behind a barrier beach.

The South Shore Electric Railway in the dune country runs parallel to the lake and about a mile south of it. Most of the dunes are north of the railroad but for much of the distance there

is a definite beach ridge, together with low dunes, just south of the road. Analyses of sand along section lines through this third belt of dunes showed an increase in the size of grain as compared with the sand immediately to the north, and on later search shells and pebbles were found. The evidence for a former strand line in this position is strong.

South of the third dune belt just referred to, especially in the neighborhood of Johnsville, there is another pronounced beach line banked with low dunes on the south. The beach here is well marked and strewn with beach-worn pebbles. None of these shore-line evidences were anticipated but were first suggested by variations in the coarseness of the sand. Since the interruption in the gradation of size was a rather regular phenomenon and scarcely to be accounted for if the sand had been subjected to greater wear, search was made for additional evidence of shore lines. In connection with each of the three suspected beach lines, additional criteria were found in the form of beach gravels or coarse sands, and in the case of the two beaches most distant from Lake Michigan the topographic evidence was strong.

The history of the dunes therefore appears to be closely associated with the development of Lake Michigan. With the northward retreat of the Late Wisconsin ice sheet a lake was formed in the Michigan basin, known as Lake Chicago. Since the present northern outlet was blocked by the ice, the water level was higher than now, the overflow being to the south through the Illinois River, as is well known. With the lowering of this channel and the uncovering of other outlets by the retreating ice front, there followed successive levels of the water. These halts are known as the Glenwood, Calumet, and Tolleston stages of Lake Chicago, the level of the water above Lake Michigan being respectively 56, 32, and 17 feet. In the absence of topographic maps or precise elevations in the area under consideration, determinations of the elevations of the old shore lines have not been made. Judging from the gradient of the two streams which cross the dunes and by the positions of the beaches in adjacent areas, it is thought best to assign the four belts of dunes to the various stages in the history of the lake, including the present. On this basis, each dune belt in the complex

dates back to a distinct period in post-glacial history, and while sand from one tract has been blown into the other belts, in places obscuring the evidence of a beach, each tract is on the whole distinct.

The exact locations of the shore lines have not been mapped in the region involved, and in some places this will be impossible because of the moving dunes; their approximate position, however, is as follows: Tolleston Beach passes through the southern border of Miller and along the southern margin of Long Lake. At Wicliffe it is doubtless north of the station on the electric line and beginning with the eastern border of the broad opening through the dunes at Wilson it is marked by the southern edge of the marsh or muck tract within the main body of the dunes; this continues almost to Michigan City. The Calumet Beach is just south of the Little Calumet River in Lake County, and as far west as Wilson where Lake Chicago had an extensive embayment. Beyond this it parallels the South Shore Electric Railway as far as Johnsville, being immediately south of it. The Glenwood Beach is south of the Michigan Central Railroad in the eastern portion of Porter County and after swinging south in a semicircle about the former embayment, strikes west south of Hobart, some seven miles from Lake Michigan.

Due to the complex processes which have shaped the sand it is difficult to make more than generalizations as to the rounding and polishing of the grains, and shifting winds render it impossible in some places to ascertain whether the sand at any given point has recently arrived or is part of the original material of the dune. Microscopic examination of the beach sand shows it dominantly sub-angular. It is generally rather transparent and little pitted, the corners frequently being sharp with little rounding. Back from the beach the characteristic description would be subspherical, many of the grains being well rounded and bean-shaped. All sand which has been subjected to sand-blast action is pitted and frosted, this being quite noticeable in the dune sand. Within the older dune belts this gradation from the former shore line landward is also apparent, but on account of the longer period of exposure and consequent aeolian wear of all the sand, the contrast between beach and dune sands is here less pronounced.