

surface moving faster than the lower strata, thus producing the curved position of the dikes and rounded edges on one side and the acute angles on the other side of the dikes, where they join the main body of clay.

I do not recall any "pockets" of sand in the clay in this trench, but at that time I probably should have given little attention to them had they been there, and this may be an instance of "seeing without perceiving," but the facts above stated clearly indicate that frozen sand may be expected to act as other rocks act under like conditions.

No surprise would be occasioned by finding a sandstone boulder raised from its bed and incorporated in the drift clay. The grains of sand may be united as firmly by congealed moisture as by some of the cements that unite the grains of sandstone, and therefore, if it be conceded that frozen sand may be overridden by advancing ice, it is not unreasonable to conclude that masses of the frozen sand might be detached from the main body and raised and incorporated in the drift in the same manner.

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#### THE CADY MARSH. BY T. H. BALL.

Among the physical features of Lake County, Indiana, of interest to the scientific observer is one known as the Cady Marsh. It covers mainly what are now sections 28, 29 and 30, in township 36, range 8, west, and sections 25, 26, 27, 28, 29 and 30, in range 9, west, also in township 36.

It is now crossed by the Chicago & Erie Railway, and, in part, by the Grand Trunk. Three wagon roads now cross it, and one large ditch, the Hart Ditch, cuts its western expansion.

It was originally, that is, sixty-three years ago, when it was first seen by the white settlers, covered with water. It was considered dangerous for a man to undertake to cross it on horseback.

It lies between two of the great sand ridges of Lake County. These two ridges coming together some five miles from the east line of the county, define its eastern limit, and as the northern ridge runs nearly west into Illinois and the southern passes south of west also into the State of Illinois, the western expansion of this marsh joins with other lowland which on an early map of Indiana was called Lake George. The water in that so-called lake is said to have been from about two to seven feet in depth. This early Lake George has been drained by the great Hart Ditch, which passes from Dyer on the State line, and running a little east of

north across five sections of land, once water, into the Little Calumet, makes a broad, deep cut in the northern sand ridge one mile west from Highland.

The Cady Marsh proper may now be best examined by passing along the road from the present town of Griffith to the old stage road along the north sand ridge. The distance across is little more than a mile. The road crosses section 26 and has a ditch on each side.

It is not probable that the composition of this marsh, as to its surface, is uniform, but there is, first, a layer of peat, from ten to sixteen inches in depth, then four feet of sand, below this about sixteen feet of clay and then gravel or sand. The depth to rock no one as yet probably knows. In early times, when covered with water, of course fires did not run over this marsh, but since it has become comparatively dry fires get started in some way; they cannot well be extinguished; and they have destroyed large areas of the peat surface, burning sometimes through an entire winter. Several years ago quite a quantity of this peat was dug or cut out and prepared for market, but it could not compete with coal and the industry was abandoned. From the southern sand ridge, along the road mentioned, sand now washes in large quantities, filling up the ditches along the road for forty or sixty rods. The flow of the water is toward the north and west. The ridge along the north end of this road, where the east and west road is reached, is about forty rods wide at the base and about forty feet to the crest of the ridge, so that an immense bank of sand lies along the north of this marsh, and just north of this bank comes the Little Calumet bottom land, which, between Highland and Hessville, is often in the spring flood times covered with water for a mile in width. The Chicago & Erie Railway crosses the Cady Marsh between Griffith and Highland. At present portions of this once wet, impassable marsh are cultivated and the land is quite productive. A few houses have been built on it, and it is becoming a valuable part of the cultivated area of Lake County. It was a great resort once for "bobolinks," but they have nearly deserted it now.

As to its formation, if, as seems probable, the water of Lake Michigan many years ago extended to the southern large sand ridge of Lake County and remained for quite a time stationary north of the great Highland, or old Stage Road ridge, then the sand now over this depression between the ridges, which depression was left full of water, was washed

on probably from the southern ridge, as it is working on along the ditches still, as that ridge itself may have been washed up before the first recession took place, from the depths of Lake Michigan. The peat on that marsh now is a quite new or fresh formation, having come from the roots of the vegetation that sprang up when the water had largely receded.

But these operations of nature, of large interest always, and especially when we can observe them for a few years, are mostly speculative, rather than certain. The writer of this has had an opportunity to observe through the space of forty years, and therefore to know with certainty with what great rapidity, in some places, during heavy rainfalls, sand will be washed over a large area of bottom land. He has seen prodigious quantities of sand and gravel removed quite a distance by successive rainfalls.

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PRELIMINARY WORK FOR THE APPROXIMATE DETERMINATION OF THE TIME  
SINCE THE RETREAT OF THE FIRST GREAT ICE SHEET.

BY GLENN CULBERTSON.

It was with the desire of obtaining a close approximation to the time which has elapsed since the retreat of the Kansan or first great ice sheet that, during the past summer, the two most important waterfalls—Clifty and Butler—in the vicinity of Madison and Hanover, Jefferson County, Indiana, were visited by me and the work to be described was performed.

The well-known Clifty Falls, over which the water leaps a vertical distance of seventy feet, was the first visited. Into drilled holes steel rods were driven vertically to the depth of twelve or more inches in the solid limestone of the stream bed at a distance from the precipice over which the water falls, and accurate measurements from the rods to the edge of the precipice were made and recorded.

Butler Falls, which is located about one-half mile south of Hanover, and over which the water falls eighty feet, was also visited and similar measurements made and recorded.

The falls in both cases are caused by the presence in the stream beds of very durable strata of limestone, chiefly of the Madison and Clinton formations, and which is of very uniform texture and hardness over the region referred to. The rate of valley growth toward the head is governed by the erosion or undermining of these rocks.