## DISCUSSION AND CORRESPONDENCE

### ORIGIN OF SINK-HOLES

THE writer has read with much interest Professor A. H. Purdue's paper in the issue of SCIENCE of July 26, 1907, on "Origin of Limestone Sink-holes." In this connection it may be of further interest to call attention to a type of sink-hole very frequently met with in Florida formed under conditions apparently not included in Professor Purdue's discussion.

The surface deposits throughout much of the interior of Florida consist of sands and clays with occasional limestone layers. These deposits are variable, being in some places almost entirely absent, while in others they are of considerable thickness. Beneath these surface accumulations occurs a limestone of undetermined thickness. This foundation limestone, which is for the most part porous, holds inexhaustible supplies of water, and is traversed by solution cavities.

When first formed, the typical sink throughout this area is an opening leading from the surface through the superficial deposits to or into the limestone below. Many of these sinks are perfectly cylindrical, not funnel-shaped. This is especially true of the smaller sinks. As a result of subsequent caving of the banks, the bottom usually becomes clogged and the sides sloping. The formation of these sinks is practically instantaneous and results from a sudden caving of the earth. In size they vary from a few feet to many rods in diameter. So frequent is their formation in certain sections, notably the phosphate mining area of Alachua and Columbia counties, that one must be on the lookout in driving through the country for newly formed sinks. Indurated layers exposed along the sides of the sink are rough-edged and bear evidence of fracture due to the sudden giving away and breaking under the weight of the load above. The depth of the sinks is probably quite variable. As a rule, they reach through and connect with the permanent underground water horizon. Some reach much below the water line.

The type here described is not merely a modification of the type described by Professor Purdue. This is evident from the fact that the static head of the water in many, though not all, of these sinks is such as to bring it above the top surface of the limestone. There is abundant evidence of solution in the limestone at all depths, both above and below the static head of the underground water. It is apparent, however, that the conditions existing in the limestone below the water level are not such as to bring about a funnel-shaped cavity. This point would scarcely seem to call for emphasis were it not that Professor Purdue considers the cave-in sink the rare exception.

A sink of this type was examined by the writer within a few hours after its formation about one mile south of Juliette in Marion County in 1905. This was a small sink, not more than eight feet in diameter, and of the usual cylindrical form. The sides down to the water level were, so far as could be determined, entirely of clay. The sink which had formed directly under the railroad track was caused possibly by the jar of a passing train, the engine of which had passed safely over. The water rose immediately in the sink to the static head of the water of that locality.

The writer recalls having often seen similar tubular openings reaching from the surface to the runway of abandoned coal mines, the "cave-in" occurring in these cases through a thickness of forty or fifty feet of clays and shales. From analogy it seems probable that the formation of the sinks in question results from a gradual caving of the clay from the bottom, assisted, perhaps, by the removal mechanically of a part of the material by underground water. Finally a point is reached at which the entire remaining mass suddenly gives way. While some of these sinks are in clay formations entirely, others break through considerable thicknesses of limestone.

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## SPECIAL ARTICLES

### NOTE ON THE MAGNETIC FIELD DUE TO AN ELECTRIC CURRENT IN A STRAIGHT WIRE

The force in dynes on a unit magnetic pole at any point outside an infinitely long straight