DISCUSSION AND CORRESPONDENCE.

IS THE LOESS OF EITHER LACUSTRINE OR SEMI-MARINE ORIGIN?

TO THE EDITOR OF SCIENCE: Mr. Hershey, in your issue of May 14th, urges anew the claims of the lacustrine and submarine hypotheses for the origin of that still problematic deposit, the loess. The former has been considered for the last forty or fifty years, and the barrier has not yet been found to separate it from the sea. The latter has been discussed for twenty-five years or more, and no trace of marine fossils have yet been found to corroborate it, though if it were true nothing would seem easier.

The undersigned committed himself to the lacustrine view in 1875 by naming a hypothetical lake covering the loess of western Iowa and Nebraska, Lake Missouri.* Even as late as 1891† he argued for a similar body of water for the deposition of the extramorainic drift as well as of the loess of the same region. But a study of Lake Agassiz and of Lake Erie satisfied him that the position was untenable. Perhaps the strongest reason for changing his opinion was the absence of all shore lines, like beaches or cut slopes. These are a conspicuous feature in the cases studied, but none have been found connected with the loess. When we think how a single storm builds a beach ridge sometimes on the shores of lakes no larger than the one postulated; when we remember, also, how little eroded much of the plateau of northern Missouri seems to be, we can accept neither his suppositions that they may have been entirely removed by erosion, nor the still more improbable one that no beaches were formed, "because the shore line did not remain at one level a sufficient length of time." In his appeal to western Florida as an instance of the latter case he admits that the surface is 'undulating,' which rouses the suspicion that a more comprehensive study of it would prove that character to be the result of beaches much eroded, though probably modified by dune action, and possibly by solution of the underlying rock.

He refers to a deposit which he has observed 1,000 feet A. T. between Cuba and Pacific City, Mo., as closely resembling the 'upland loess' of northwestern Illinois. Before we admit the extension of a loess-depositing gulf to that altitude—for such a body of water as would cover that and the clayey loam of Illinois could not have been separated from the ocean—let us consider some of the things involved in such a view. It involves the submergence of St. Louis 500–600 feet, of northern Illinois nearly the same, unless there was an elevation in that direction instead of a greater depression, as has been more commonly argued. It implies strong wave action, especially around the Ozark uplift. It implies remarkably discriminating erosion to have removed so completely the loess and drift from the nooks of that irregular shore, when it failed to do so from the slopes and summits almost overhanging the gorge of the Missouri in Boone county, Mo., or that of the Mississippi, in Pike county.

Before entertaining so violent a supposition, why not refer the Cuba deposit to some local lake, such as may be found in any residuary area, or to an 'adobe' formation, or to 'æolian loess,' which no doubt accumulates in many localities to moderate thicknesses.

Moreover, the gulf theory demands that the sea submerged points, 1900–2000 A. T. in northeastern Nebraska, and 1300–1400 in northeastern Iowa. And this, too, in regions which shortly before and not long after had vigorous streams flowing at considerably lower levels.

Against the fluvio-lacustrine or flooded river theory for the Missouri 'upland loess' Mr. Hershey presents the objections, first, that it was 'laid down on an undulated upland, dissected by valleys,' and second, the 'inequalities, when considered over broad areas, of the surface of the sheet of loess or loam.' The former must be more or less true in any superimposed drainage. And any alluvial plain is far from even or level. The delta of the Mississippi has a general slope toward the sea of eight inches to the mile, with local slopes for a few miles five times as great. The fluctuations of water level have a range of 50 feet or more in some places. Moreover, when we become acquainted with the habitual creeping, or glacier-like, movement of clays and

*Proc. A. A. A. S., 1875.

†Proc. Iowa Acad. Sci., 1891, p. 5, and Am. Geol., 1892.

loams, it does not seem so incredible that the loess and clayey loam are the delta-like accumulation of great streams, fed from the glaciers on the north and the Tertiary silts on the west.

I am surprised to learn from Mr. Hershey's letter that in northwestern Illinois the 'upland loess' 'is present over the thick terrace-like deposits of true loess down along the streams.' Chamberlin and Salisbury, as I understand, make the terraces *subsequent* to the former, and however that may be in that region, there is clear evidence from fossils and rearranged material that such is the case along the Missouri. It is a common thing for all terraces to be capped by a finer loam, the last deposition of the flood which laid down the coarser material below, or of some subsequent flood which barely submerged them.

Mr. Hershey assumes without question the preglacial age of the troughs of the Missouri and Mississippi through this region. This has not yet been proved. The evidence to the contrary is given at some length in my report which he reviewed, and I need not repeat here. I would add only a few words. The rock bottom of the Missouri through the State of Missouri, and of the Mississippi below the mouth of the Des Moines, is nowhere known to be lower than is known to be sometimes reached by 'the scour' in floods of the present day, viz., 80 or 90 feet.

The interesting preglacial channel west of Keokuk, first reported by General Warren, is interesting, but instead of proving that most of the present Mississippi channel is preglacial, rather shows the contrary, for its course at Quincy and below corresponds in depth and size with the new channel at Keokuk rather than the old one, and that has evidently been cut since the glacial epoch. We may as reasonably search for the continuation of the old channel toward the east as toward the south, for bed rock opposite Quincy is 45 feet below low water.

Before closing I would state that I am not over-confident concerning the Osage-Gasconade divide, and am only sorry that circumstances have not permitted my further study of the problems involved. But as far as our present knowledge goes, it still seems to me much more tenable than the theory which I understand Mr. Hershey to propose.

J. E. Todd.

State University, Vermilion, S. D.,
May 31, 1897.

A MONUMENT TO THE LATE BUYS-BALLOT.

To the Editor of Science: The Royal Dutch Meteorological Institute is about to remove from the old buildings at Utrecht, where, during forty years Professor C. H. D. Buys-Ballot labored so indefatigably for meteorology, to the new establishment at de Bilt, near Utrecht. Buys-Ballot, who may be called the founder of meteorological science in the Netherlands, is known to students of that science the world over from the law bearing his name, which connects the direction of the wind with the position of the storm center. His noble character, combined with a charming personality, endeared him to his colleagues, and won the respect and affection of a wide circle of acquaintances, which included the writer. A provisional committee, composed of his former associates, believing that the memory of such a man is honored outside of his own country, has invited an international committee to aid in obtaining funds for the erection at Utrecht of a monumental bust of the great meteorologist. The American members of this committee are Professor Willis L. Moore, Chief of the United States Weather Bureau at Washington, and the undersigned. Subscriptions sent to either one of us will be acknowledged and forwarded to the Dutch committee.

A. Lawrence Rotch,
Director of the Blue Hill Meteorological Observatory, Readville, Mass.

ORGANIC SELECTION.

I am unable to agree with Mr. Robert M. Pierce that the passage he quotes from Mr. Herbert Spencer's 'Principles of Biology' sets forth the same conception that Professor Mark Baldwin dealt with in Science for April 33d. Mr. Spencer's position, I take it, is this: Acquired characters are inherited; there is a natural selection of acquirers, the fittest of whom survive to transmit their acquired characters; hence evolution is rendered more rapid than it would otherwise be. This is primarily