determine where it is lodged, and how it is injected. I incline to the hypothesis, that the cavity of the *ecthoræum* in its primal inverted condition, while it yet remains coiled up in the *cnida*, is occupied with the poisonous fluid, and that it is poured out gradually, within the tissues of the victim, as the evolving tip of the wire penetrates farther and farther into the wound.

The paper is illustrated by figures of the organs described.

February 11, 1858.

Major-General SABINE, Treasurer and V.P., in the Chair.

The following communication was read :—

"An Account of some recent Researches near Cairo, undertaken with the view of throwing light upon the Geological History of the Alluvial Land of Egypt."—Part II. By LEONARD HORNER, Esq., V.P.R.S. Received January 25, 1858.

(Abstract.)

In the first part of this Memoir, read on the 8th of February, 1855, and published in Part I. of the Transactions of that year, the author states the main object of the inquiry to have been, to endeavour, by probing the alluvial land in appropriate places, to discover the probable time that has elapsed since the lowest layer of Nile sediment was deposited, and thus to connect geological and historical time. This object, in the opinion of the author, can only be attained by means of shafts and borings of the soil in the immediate neighbourhood of monuments of a known age. The places he selected for these excavations were the vicinity of the Obelisk of Heliopolis, and the site of ancient Memphis. The general introductory matter, and the analyses of the various soils penetrated, together with a description of the researches at Heliopolis, are given in the first part of the memoir; but the author deferred his general conclusions, and all inferences as to the secular increase of the alluvial deposits, until he should have an opportunity of laying before the Society an account of the more extensive researches in the district of Memphis. That

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account, together with the author's general conclusions, form the subject of this second part.

The practical part of the whole inquiry has been conducted under the immediate direction of Hekekyan Bey, an Armenian engineer officer in the service of the Viceroy of Egypt; and a brief biographical account of him is given, showing his eminent scientific qualifications for such researches. The author had the advantage of obtaining the zealous cooperation of our Consul-General in Egypt, the Honourable Charles Augustus Murray, and his successor, the Honourable Frederick Bruce, on whose representations the late Viceroy Abbas Pacha, and the present, not only gave a ready assent to the undertaking, but, with a rare and most exemplary liberality, ordered that the whole expense should be defrayed by the Egyptian Government.

As at Heliopolis the Obelisk is all that remains above ground of that city, so, at Memphis, there is one solitary monument of its former greatness, a fallen colossal statue of the great king Ramesses II., the Sesostris of the Greeks. All testimony appears to concur in assigning the foundation of Memphis to Menes, the first king of the first dynasty, who, according to Lepsius, began his reign 3892 years B.C. The same authority assigns the dates of 1394 to 1328 B.C. for the reign of Ramesses II. The site of Memphis presented therefore a peculiarly fit situation for prosecuting the inquiry, by sinking pits to the greatest practicable depth near this colossal statue, and around it.

The surface of the ground, for some distance around the statue, being uneven, it became necessary, in order to ascertain the variable depth of water during an inundation, at the mouths of the pits, intended to be sunk in various parts of the area, that the level of the highest rise of the water over the ground at a given time should be determined. This was done for the inundation of 1851, and it proved to be somewhat above the 24th cubit mark of the Rhoda Nilometer, a height of water which covers the entire surface of the valley, leaving above it artificial elevations. The inequalities of the ground are such, that in any section, under the 24th cubit level, the surface varies from where it coincides with that level to nearly 20 feet in the deepest part; so that, while in one part of the district there might be a depth of nearly 20 feet of turbid water, in another it might be

less than an inch; and consequently, the same period of time would be represented by very different degrees of thickness of the sediment.

Two pits were sunk close to the fallen colossal statue, sections of both of which are given. In the deepest, the shaft was continued to the depth of 24 feet 5 inches, when further progress was stopped by filtration water. This interruption to excavations occurred in every other pit that was sunk. From the bottom of the shaft, a boring tool was applied, and cores of soil were brought up from successive depths, the lowest being 41 feet 4½ inches from the surface of the ground. The sections given of the two pits in this locality show, that the soil consists of varieties of loam and sand in irregularly alternating layers; and the Nile sediment from the lowest part of the boring was found, by a careful analysis, to be nearly identical in composition with that deposited by the inundation of the present day. At a depth of 5 feet 8 inches from the surface of the ground they came upon the upper surface of the platform on which the colossus had stood, consisting of two courses of cyclopean masonry, together 5 feet 6 inches thick, resting on an artificial bed of sand, the sand resting on Nile sediment. Throughout the excavation various objects of art and some bones of domestic animals were met with, and the boring instrument brought up from the lowest depth a fragment of pottery.

The author next proceeds to describe, with references to detailed sections, seventeen pits and borings sunk in the area of Memphis, and also a series of seven pits opened in ground below the inundation level of 1851, in a line across the valley from the foot of the Libyan Hills on the west of the Nile, to the skirt of the Arabian Hills on the east of the river, embraced within an area of about five miles from west to east, and a mile from north to south.

In 1854 another series of pits and borings were sunk in the parallel of Heliopolis, above eight miles above the apex of the Delta, in ground below the inundation level of 1853, which was very nearly the same as that of 1851, the line including fifty-one pits in a distance of about sixteen miles, eight miles on the right, and eight miles on the left bank of the river; two of them near the river were carried to a depth of 50 feet, and one to a depth of 60 feet from the surface of the ground. This last reached to within 7½ inches of the mean level of the Mediterranean.

The author then reviews the chief facts made known by the ninety-five probings of the alluvial land above described, and gives the following results:—

1. That the alluvium consists of two principal kinds, viz. an argillaceous earth or loam more or less mixed with fine sand, and of quartzose sand, which is probably brought from the adjacent deserts by violent winds;

2. That the Nile sediment found at the lowest depth reached is very similar in composition to that of the present day;

3. That in no instance did the boring instrument strike upon the solid rock, which may be presumed to form the basin between the Libyan and Arabian Hills, containing the alluvium accumulated through unknown ages;

4. That, except minute organisms discoverable only by a powerful microscope, few organic remains were found, and those met with were recent land shells and bones of domestic animals;

5. That there has not been found a trace of an extinct organic body;

6. That at the same level great varieties in the alluvium have been found in adjoining pits, even when the distances between them were very moderate;

7. That there is an absence of all lamination in the sediment. The author points out the causes that account for this,—chiefly the rapid drying of the soil, so soon as the inundation water has subsided, the operations of agriculture, and the violent winds that sweep over the valley forming vast clouds of dust;

8. That in many places the disintegrations of sun-burnt bricks have contributed largely to the soil;

9. That in nearly every part of the ground penetrated, artificial substances have been found, such as fragments and particles of burnt brick and pottery, and at the lowest depth reached.

The author then enters, at some length, into the circumstances which modify the deposition of the sediment in different parts of the valley, showing how the coarser and heavier matter held in suspension in the inundation water must be deposited in greatest amount in the higher parts of the river's course, in its bed, and near its banks; that this must be further caused by the slight fall, which between Assouan and Cairo is less than $6\frac{1}{2}$ inches in a mile, the Nile

in its whole course from the first cataract to the sea not being used as water power; that the vast heat must cause an evaporation that lets fall the solid matter more abundantly in the southern latitudes; that the river from 42 miles below the first cataract is nowhere allowed to overflow the land, but is confined by embankments, so that the waters of irrigation are spread by canals, by which and by the irregularities of the ground eddies are formed. From all these causes affecting the distribution of the sediment over the land, the depth of the annual deposit by the inundation is very different in different parts of the valley, and consequently the same lapse of time may be represented by very different depths of the soil.

The author next treats of the rate of secular increase of the alluvial land. Before entering upon the results at which he arrives by these recent researches, he refers to the operations of the French engineers at the end of the last century, who state the mean of the rise of the land between Assouan and Cairo to be 5 inches in a century. From that conclusion, and especially from the application of it, the author dissents, and states his reasons at considerable length in the Appendix to his Memoir. He considers that in every situation where a calculation is to be made of the rate of secular increase, we must have a fixed point in time to start from; that is, the known age of a monument, the foundation of which rests upon Nile sediment, and upon the sides of which the latter has accumulated by subsequent inundations. If there have been no local causes to disturb the probability that the sediment above and below the foundation has accumulated at the same rate, we divide the amount above the foundation by the number of centuries known to have elapsed from the erection of the monument to the present time, and then apply the same chronometric scale to the greatest ascertained depth of sediment below the foundation. Estimated by this rule, the researches at Heliopolis gave the result of a rate of increase of 3·18 inches in a century. But a degree of uncertainty arises at this place, because of the city appearing to have been built upon a portion of land somewhat raised above the level of the rest of the skirt of the desert, and advancing into the low ground then inundated by the Nile; whereby it became doubtful whether a bed of sand penetrated was sedimentary or a part of the desert land.

In the excavations near the colossus of Ramesses II. at Memphis,

there were 9 feet 4 inches of Nile sediment between 8 inches below the present surface of the ground and the lowest part of the platform on which the statue had stood, after making a due allowance for the foundation of the platform having been below the then surface. It is assumed that the platform was laid in the middle of the reign of that king, that is, in the year 1361 B.C., which, added to A.D. 1854, when the observation was made, give 3215 years during which the above depth of sediment was accumulated; and supposing that no disturbing cause had interfered with the normal rate of deposition in this locality, and of which there is no evidence, we have thus a mean rate of increase within a small fraction of $3\frac{1}{2}$ inches in a century. Below the platform, there were 32 feet of the total depth penetrated, but the lowest two feet consisted of sand, below which it is possible there may be no true Nile sediment in this locality, thus leaving 30 feet of the latter. If that amount has been deposited at the same rate of $3\frac{1}{2}$ inches in a century, it gives for the lowest part deposited an age of 10,285 years before the middle of the reign of Ramesses II., 11,646 years B.C., and 13,500 years before A.D. 1854.

The author then observes, that these recent researches, taken in conjunction with those of a similar kind by the French engineers at the close of the last century, high in Upper Egypt, afford strong presumptive evidence that the whole of the land of Egypt between the bounding hills, from the first cataract to the sea, extending nearly 700 miles—that land which is associated in our minds with all that is most ancient in history or tradition—belongs entirely to the recent geological period. No trace of an extinct organism has been turned up to take the formation of the alluvial land of Egypt beyond that modern epoch from which we are used to carry back our geological reckonings.

The author concludes with some remarks on the evidence which these researches seem to afford of a very early existence of man in Egypt. In a large majority of the excavations and borings the sediment was found to contain at various depths, and frequently at the lowest, small fragments of burnt brick and of pottery. In the lowest part of the boring of the sediment at the colossal statue in Memphis, at a depth of 39 feet from the surface of the ground, consisting throughout of true Nile sediment, the instrument brought

up a fragment of pottery. [This fragment was exhibited when the paper was read.] Having been found at a depth of 39 feet, it would seem to be a true record of the existence of man 13,371 years before A.D. 1854, reckoning by the before-mentioned rate of increase of $3\frac{1}{2}$ inches in a century; 11,517 years before the Christian era; and 7625 years before the beginning assigned by Lepsius to the reign of Menes, the founder of Memphis; of man, moreover, in a state of civilization, so far, at least, as to be able to fashion clay into vessels, and to know how to harden them by the action of a strong heat.

February 18, 1858.

LEONARD HORNER, Esq., Vice-President, in the Chair.

In accordance with notice given at last Meeting, the Lord Talbot de Malahide was balloted for and duly elected a Fellow of the Society.

The following communication was read:—

"On the Functions of the Tympanum." By JAMES JAGO, A.B. Cantab., M.B. Oxon., Physician to the Royal Cornwall Infirmary. Communicated by Prof. STOKES, Sec. R. S. Received January 23, 1858.

(Abstract.)

As in my present effort to obtain further light upon some of the still obscure points in the physiology of the ear I have been *primarily* guided by observations made upon my own ears, I should premise that both are very efficient for hearing; but that they differ from each other in the important particular that the faucial orifice of the right Eustachian tube closes much less tightly than that of the left, insomuch that there are times when the former becomes quite patent, with no disposition to collapse. Again, having lately been troubled for above five weeks with a *tympanic* deafness, I carefully registered a series of auditory phenomena resulting therefrom, and