

2. *Notes on the GEOLOGY of a Portion of the NILE VALLEY NORTH OF THE SECOND CATARACT IN NUBIA, taken chiefly with the view of inducing further Search for FLUVIATILE SHELLS AT HIGH LEVELS.* By A. LEITH ADAMS, A.M., M.B., Surgeon H.M. 22nd Regiment. *With a Note on the SHELLS*; by S. P. WOODWARD, Esq., F.G.S.: *and a Note on some TEETH of Hippopotamus*; by HUGH FALCONER, M.D., F.R.S., F.G.S.

[Communicated by Leonard Horner, Esq., V.P.G.S.]

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I. *Introduction.*—The following observations were made during November 1862 and the two following months, when engaged with my friend the late Mr. A. H. Rhind, F.S.A., in making the usual boat-voyage from Cairo to the Second Cataract and back*. That distinguished antiquary's knowledge of ancient Egyptian history, and his having formed a design of investigating the Nile-levels with reference to the records of the country, afforded me great advantages in carrying out my intentions in connexion with the still older memorials of the river-valley. Although well aware of the imperfections of these notes, I am not without hope that they may prove of interest to the scientific inquirer. Every field-naturalist knows how difficult it is to work at two widely different subjects at the same time,—such was my case on the above occasion; for with gun and hammer (as former experiences have taught me) I found it no easy matter to fulfil the requirements of an ornithologist and also to study the minutiae of geology, especially as during our late excursion I seldom remained more than a few hours in any one locality; moreover, when starting for Egypt, I had no idea of the nature of the geological work before me, and, therefore, I was not provided with the necessary instruments for the exact determination of heights. I am conscious, however, that any error in this respect falls short of the truth, inasmuch as, in each case, I invariably adopted the minimum of our united surmises. This confession I consider absolutely necessary with reference to such an important discovery as the finding of freshwater Shells at the altitudes herein recorded.

Before proceeding to my subject, I may remark that my late companion continued his survey to the Delta. Being sensible of the great amount of care and diligence Mr. Rhind brought to bear on

* The specimens accompanying the paper are in the Society's Museum; the names of Shells quoted are on the authority of Mr. S. P. Woodward: see p. 19.

his portion of our inquiries, I cannot help expressing a hope that his valuable researches will soon be published.

II. *Physical character of the Nile Valley in Nubia, from Selsileh to the Second Cataract.*—After passing Selsileh, about thirty-six miles below the First Cataract, and proceeding southwards, the physical aspect of the Nile Valley is seen to change rapidly. The bed of the river gradually narrows, until it is hemmed in on both sides by rocks and steep banks, either of sandstone or granite, which appear as bold crags and rugged and worn cliffs, and, as you approach Wadi Halfeh, as isolated conical hills of sandstone; and hogs' backs, or elevated plateaus, alternate with wide expanses of desert covered, as usual, with a reddish-white sand.

1. *Sandstone and Sand-drift of Nubia.*—The siliceous sandstone of Nubia has a perfectly parallel stratification, and, except at its junction with the granitic rocks, very few traces of disturbance are observable; on the contrary, the absence of fissures and rents is remarkable, and would appear, in conjunction with other facts, to indicate that the rate of upheaval had been slow. There is likewise reason to suppose, from the wear and tear so evident everywhere on the surface, that the degradation and denudation have been enormous, perhaps far beyond what the geologist would expect from atmospheric influences alone; the sandstone of Nubia, however, crumbles readily, especially the grits and large-grained varieties. The finer particles are drifted about by the wind, and, from the proximity of the desert to the river, the latter is constantly receiving materials which mix with its mud, and form soil and sand-banks, which are ever being added to or removed, according to the direction and force of the currents. The physical aspect of Nubia is therefore undergoing considerable change, especially in the neighbourhood of the Nile; so that the even and perfectly horizontal stratification of the high lands is continuous with that of the flat-topped isolated hills in the neighbourhood, showing vast valleys of denudation, and what a tremendous scouring the country has undergone at one time or other. Although a great portion of the Nile-deposit is evidently the result of denudation going on towards its origin, the vast degradation taking place even between the First and Second Cataracts affords ample materials for the formation of alluvial and arenaceous deposits along its course northwards. The sandstone is of various sorts, and differs in consistence, being either fine-grained* and of divers shades of colour, most frequently of a light yellowish white, or a gritstone†, of considerable variety as to the size of its rounded pebbles, which are mostly composed of quartz and hornblende, and are frequently as big as walnuts. The finer particles, forming the matrix, become the sport of the winds; thus the plain is often observed covered with pebbles or angular fragments of the harder portions of the sandstone. The drifting of the sands of the Nubian desert in certain localities, as at Faras (the Phtharis of Pliny), below Wadi Halfeh, and for some distance along the left bank, produces remarkably constructed dunes, composed of a mixture of fine sand with the de-

* See Specimen No. 1.

† See Specimen No. 2.

cayed twigs of the tamarisk, which grows abundantly in the district. These sand-hills have a rounded appearance, and vary as to size, many being fully 90 feet in height: on their sides and tops are tamarisk-bushes, which, being constantly enveloped in the sand-drift, get packed so closely that a perpendicular section of the mound has the exact appearance of a hay-rick, the small twigs being deposited anyhow, whilst fresh bushes are sprouting up on the surface. To all appearance, these accumulations are very old. Again, along the edge of the desert, and in the arable tracts, the acacia and other bushy trees and shrubs form obstacles to the sand, which is seen extending in long tails and wreaths behind them. It takes much labour to prevent the encroachment of the Nubian desert, and now that the population has been decreasing of late years by the emigration of the able-bodied men to Lower Egypt, the advance of the sand on the cultivated districts is becoming more apparent; for instance, north of Ibrim, 65 miles north of Wadi Halfeh, I noticed that the desert has covered a great alluvial plain, which had formerly been under cultivation, and is approaching the river, so that the trunks of the palm-trees are completely surrounded with sand for upwards of 15 feet from their roots.

2. *Alluvial Heaps of lateral Water-courses.*—Although rain seldom falls in Nubia, yet, when such is the case, the fall is remarkable for its violence, as testified by the water-courses and their heaps of alluvium, &c. At the embouchures of these torrents high banks of soil are to be seen, doubtless the washings from the ancient Nile-deposits on the higher grounds, where the organic remains, to be noticed presently, are found. A breccia of great hardness, and formed of rounded as well as angular fragments, may be often traced at intervals along the bottom and sides of these water-courses, and, from its always underlying the alluvial deposits, it would appear to be more ancient. I have no doubt that it has also been formed by these torrents, which, however, are often local, and only flow occasionally and during thunderstorms. The alluvial heaps have been mistaken for ancient deposits of the Nile; it is therefore important to distinguish them from what are, without question, the result of the river's currents. There is a peculiarity of these torrent-made heaps which I found to be regular; they are situated at the entrances, and have been deposited on one side, as if caused by back-water,—a result of the current receiving a check, and being dammed back by the cultivated land, which runs across the mouths of the ravines, and is often very much higher than the bed of the torrent. On the surface, and throughout the alluvial banks, is observed a *hard, concretionary, tufaceous, and nodular substance*, which effervesces readily with acid, and has all the appearance of containing a large amount of carbonate of lime; it is usually met with in small fragments, which are strewed over the surface, or it runs in veins throughout the bed; sometimes it is found in masses upwards of a foot in thickness, or forming sticks* or small tubes run together† in irregular-shaped masses. It is plentiful all over the alluvial banks of Nubia and northwards, wherever

* See Specimens Nos. 3 and 4.

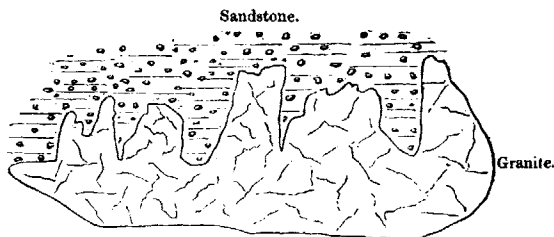
† See Specimen No. 5.

the soil has been undisturbed and exposed to the action of the atmosphere for a length of time. The formation is going on at present, and is caused, no doubt, by some affinity between the air and the chemical components of the river-alluvium. When met with on the sands of the desert, it indicates an alluvial deposit underneath. Among the ancient river-deposits on the plain eastward of Wadi Halfeh, at the foot of the Second Cataract, this substance abounds, either in the shape of nodular fragments * on the surface, or in masses mingled with the soil. It has a great resemblance to the *Kunkar* of India, with which it appears to me almost, if not absolutely, identical †.

3. *Terraces of the Valley; their Cliffs and Caves.*—Taking a general view of the Nile Valley between the First and Second Cataracts, one is struck with the regularity with which *terrace-cliffs* and *flats* continue; indeed, except at broken intervals, these appearances are pretty clearly defined even as far down as Selsileh, about 36 miles below the First Cataract. At first there may be some difficulty in tracing these levels, but after a little experience their presence becomes evident; and, except where the soil has been removed by the action of rain, &c., I had no difficulty in finding abundance of river-shells at altitudes of at least 120 feet above the highest Nile of the present time.

The junction between the sandstone and granitic rocks is not always observed to be even or regular, as we find the latter often, as it were, dovetailing into the sandstone above, as here represented (fig. 1).

Fig. 1.—*Diagram showing the Line of Junction of the Granite and Sandstone in Nubia.*



In this way we can suppose the insular prominences of the Cataracts to have been caused by the softer sandstone being washed away.

The point of junction between the two rocks is often marked by layers of rounded water-worn pebbles, or coarse gravelly sand, which, however, may be frequently seen running in veins throughout

* See Specimen No. 6.

† Veins of oxide of iron are common between Thebes and Gofu, and are best seen on the face of the recent alluvial banks, where they run horizontally for several miles in the form of reddish bands.

beds of fine-grained sandstone. Purple-coloured veins likewise pass through the latter, and fine particles of hornblende and various-coloured grains of quartz give a variegated appearance to certain cliff-sections.

Along the Nile Valley, north of the First Cataract, where the rocks come close to the river, are numerous caves and caverns, both in the Sandstone and in the Nummulitic Limestone of Lower Egypt. At Gebel Aboofaydee, near Siout (280 miles below the First Cataract), I noticed water-worn caves 60 to 70 feet above the highest Nile; and below Ibrim, in Nubia, on the right bank, under the old stronghold (supposed to be the *Primis Parva* of the Romans), are numbers of cavities, at various levels above the surface of the river, and at heights far exceeding the reach of its greatest inundations in the present day. The larger caves show the characteristic alternation of contraction and dilatation of water-worn openings; those within reach of the river contain a fine clay, formed from that held in solution by the river, and not the washings of currents. This mud is evidently the accumulations of years*; it is much sought after for making the excellent water-jugs of Egypt, and is moreover exceedingly well adapted for preserving organic remains, which, however, from the nature of the Nubian climate, are never likely to be found in the caverns inland. I examined several Fox- and Hyæna-dens among the Nubian and Egyptian ravines, and, although they contained abundance of bones of animals recently killed, there was no dripping from the roofs or any soil to cover them up, as would have been the case in countries where rain falls in quantity and with regularity.

4. *Relation of Temples and Caves to the River-level.*—We were enabled to record undoubted changes in the direction and bed of the river at several points by means of the temples and stelæ, and by an examination of its present action. Close to the famous rock-temple of Abu-Simbul is a smaller temple where the Nile at its height washes the door-sill. Again, in the little square-shaped excavation on the face of the rock, a stone-throw further northwards, there is a seated figure, said to be of the same period as the last, sometime between B.C. 1322 and 1388, on the legs of which, about midway between the knees and ankles, I marked the limit of the high Nile of the present day; moreover the deep soundings along the left bank close by these two records, and the shallows and sand-deposits going on on opposite banks, show very clearly that the current continues to set in on the left bank, which it is wearing away up to the cliffs in which the above memorials are constructed.

The old temple at Ombos (22 miles north of Assuan), founded in the reign of Ptolemy Philometor (about B.C. 200), is built on a heap of alluvium which is now being rapidly undermined, whilst the ancient course of the stream is clearly traceable on the left bank, where sand-banks and shallows are now being formed.

At Selsileh the river has evidently changed considerably within

* The sedimentary deposits, when dried, split up into fine horizontal laminae of great thinness. See Specimen No. 8.

the historical period, and is still encroaching on the left bank; for at high Nile it rises halfway, or nearly so, up the inner wall of a grotto of the time of Amenophis III., about B.C. 1430; and there is a stele on the face of the rock to the north, where the lower lines of the hieroglyphics have been worn away by the river, during the annual inundations, up to the first line, which marks the present limits of the Nile, and contains the above king's oval: further northwards, at a short distance, is a grotto bearing the oval of Tuthmosis III. (the predecessor of Amenophis), where the Nile once every year washes the bodies of a set of River Triads up to their necks, or about $4\frac{1}{2}$ feet above the threshold of the grotto. Soundings showed the river deepest along the left bank, and a deposit of sand going on in the centre and towards the right bank. These examples are given with a view of showing the local changes in the river's course within the historical period; in fact, the Nile is constantly changing, and clearing away and making new channels, often running afresh on ground it may have abandoned several times in its history.

5. *The Granitic Rocks of the Nile Valley.*—The first appearance of granitic rocks north of the Second Cataract is at Abhôr, where some masses of syenite rise above the water, about three miles below Kallabshe (35 miles south of Assuan); and again, a short way further down, a ridge of syenite, or red felspathic granite, with veins of quartz, rises to a height of several hundred feet, through which the river runs. The strike is E.N.E. and W.S.W. This ridge is about two miles broad. Along the line of junction the sandstone, which occurs on both flanks, north and south, is tilted up and much disturbed, showing evident marks of the granitic rocks having protruded through the latter rock. The Nile flows placidly through the ridge, with perpendicular cliffs on either side, and makes its exit at a gorge not more than 250 yards broad, where, at midchannel, our lead-line ran out 63 feet. Following the line of contact between the two rocks on the left bank, the polished "slickensides" of the granite is seen rising at a high angle, with the sandstone shattered and broken up in rubbly disordered masses. The joint-planes of the granite appeared to be perpendicular. Throughout the river's course among these cliffs, many projecting rocks narrow its channel, but do not increase the velocity of the current. Here and there bulgings and bays occur, made, perhaps, by back-waters and swirls, when the river stood at much higher levels; all testifying to a former state of things, and offering a strange contrast to the orderly course the river is now pursuing. On the south flank of the ridge the junction between the unstratified rocks and the sandstone is clearly shown; on the left bank, above two Sheiks' tombs, in a narrow gorge, the same phenomena as those just noticed on the north side are observed. Looking northwards from the tombs, numerous granitic masses stand out on the bank of the river, through which ravines may be seen, containing huge heaps of alluvium; the latter run along the sheltered windings far above the reach of the highest modern inundation of the Nile, and clearly point to ancient channels, long since abandoned,—the most westerly being upwards of half

a mile from the river, and the surface of its alluvial banks some 50 to 60 feet above the modern level of high water.

Syenite is the chief rock at the Second Cataract. Like the Cataract of Assuan, the waters flow placidly for some distance through the rocky barrier to a ridge of granite, through which they burst with great force and considerable noise. Afterwards the waters disperse in numberless rock-channels, where the velocity is gradually lost, to again unite and form the steady slow river which flows on at a uniform rate until it is again sent dashing through the granitic rocks of the First Cataract, when all its troubles cease, and hence to the Mediterranean scarcely a ripple disturbs its even surface. At the termination of the Second Cataract or Rapid, a short way above Wadi Halfeh, the last pinnacle of syenite is seen jutting up, with a sand-bank forming the usual "crag and tail," which on a larger scale have produced the Island of Philæ above, and that of Elephantine below, the Cataract of Assuan.

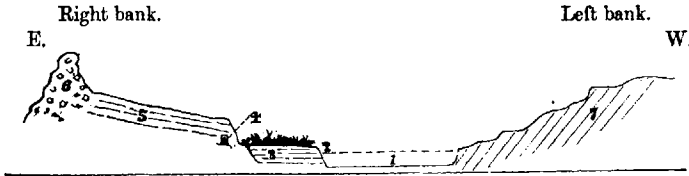
6. *Freshwater Shells on the Terraces.*—An examination of the older rocks of the Second Cataract shows former levels of the river, more especially on the left bank, south of the sandstone-cliff at Abusir, around the base of which the river is now excavating, as is evident from the masses of rock which have fallen down. On the above-named levels and for a long way southward, and upwards of a mile inland, I noticed abundance of river-shells* (*Unio pictorum*, *U. lithophagus*, and *Paludina bulimoides*) strewn over the surface of the sands. On the right bank of the river there are indications of old channels, perhaps better marked than those noticed on the left. I did not, however, examine that locality, and the Shells found in the above situation did not then, as afterwards, attract my attention to seek for them among the soil underneath the sand-drift, whence, I have now no doubt, they were washed. At Derr, the capital of Nubia (eighty miles north of the Second Cataract), the cultivated tract of alluvium extends from the river eastward about 600 or 700 yards, until bounded by a rough and steep face of sandstone, 40 to 50 feet in height, in which is excavated a temple of the time of Rameses the Great, about B.C. 1355. On the top is a level plain, extending north and south, and gradually rising eastward, towards a bare range of conical hills. The surface of this plateau is very stony, and, as usual, is covered with angular fragments of hard sandstone and rounded pebbles from the grit, and coarser varieties of that rock. Under these occurs a scanty reddish-brown soil, containing natron, which the natives use as a top-dressing for their fields. In the excavations, and throughout this soil, I found abundance of *Cyrena fluminalis*†, a species identical with the common Shell of the Nile. It occurred in great numbers from the margin of the plateau, immediately above the temple, eastward for upwards of a mile and a half. The height of this flat land varies, according to our estimations, from 130 to 110 feet above the highest mark of the Nile's inundation in the present day. The following sketch will

* See Specimens Nos. 1 and 2.

† See Specimen No. 3.

perhaps better explain the appearances of this portion of the country (fig. 2).

Fig. 2.—Diagram-section of the Nile Valley at Derr.



1. Nile. 2. Highest reach of the modern inundation. 3. Alluvial plain of Derr, cultivated to near the Temple (4). 5. The plateau containing the Fluvialite Shells. 6. The rounded, irregularly shaped sandstone-hills. 7. The Desert and its sand-drift, down to the limits of the Inundation.

The left bank was not examined.

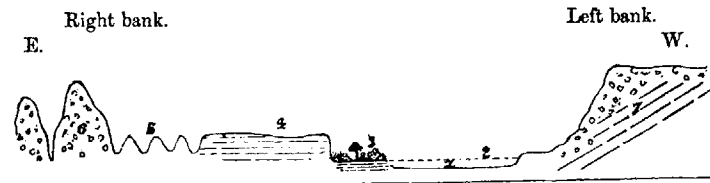
Below the level of the above plateau, and a little further down the river on the opposite bank, is the Temple of Amada, which existed in the time of Tuthmosis III., about B.C. 1490.

Looking southward from Korosko, forty-four miles north of Derr, an excellent view of the above flat can be obtained, and its sweep around the river-valley can be easily traced. About 25 miles northward on the same terrace-flat, and at elevations of 100 feet and more, I found the same *Cyrena** in the same reddish sandy soil, and in excavations made by the natives. Along with these, strewn on the surface, in crannies of the rocks, and under detached masses, I found quantities of the small spiral univalve, *Bulimus pullus*.

This species and the above-mentioned *Cyrena* were traced inland for upwards of three-quarters of a mile from the river, and until the country became broken up into ravines and rugged worn cliffs. The abrupt appearance of the left bank, rising rapidly to an eminence, and the flat plateau opposite appeared to indicate that the ancient bed of the river was on the right side.

The following (fig. 3) is a sketch of the above district at the village of Gharbea, in the Wadi el Arabi, a few miles north of Korosko.

Fig. 3.—Diagram-section of the Nile Valley at Gharbea, north of Korosko.



1. Nile. 2. High Nile. 3. Cultivated tract. 4. Plateau containing *Cyrena fluminalis* and *Bulimus pullus* †. 5. Broken country. 6. Conical hills of sandstone. 7. Sandstone-hills and desert down to the water-mark (2).

* See Specimen No. 4.

† Specimen No. 5.

The flat on the right bank at Dakke (172 miles north of Wadi Halfeh) was found to be not quite 100 feet above the level of the river; and, as usual, it was covered with the same soil and loose stones noticed at Derr, Korosko, and the last-named locality. I traced the *Cyrena fluminalis** among the natron-soil for upwards of a mile inwards, and the *Bulimus* for another half-mile to several hills, and to a desert plain which was covered with drifted sand. *No trace of Shells could be met with at corresponding heights on the left bank.* The alluvium extends from the river for a long way beyond the Temple of Dakke, which, like that at Maharraka, is built upon it. I may here remark that neither the *banks* of alluvium now forming nor these more ancient accumulations seem to contain many Shells; it is only on ancient bottoms, where the currents were not strong, and depositing much, that these remains appear most abundant. The great alluvial heaps seem to have been deposited by rapid currents, which may not have carried Shells along with them. I have often been struck with the absence of any traces of animal structures in the *alluvial banks* of the river, which fact I cannot account for in any other way.

The above-mentioned high levels were traceable along the slopes at broken intervals on to Gertassee. On a plateau behind the village, some 60 to 80 feet above high Nile, *Cyrena fluminalis*, *Unio lithophagus*?, and *Paludina bulimoides* † were found in abundance.

The granitic rocks, reappearing about six miles below Gertassee, continue on both sides of the river, in the shape of high rugged ridges, to Debod, 18 miles south of Assuan, on the left bank, where there is an excavation or bay, from the granite not having protruded so high as in other situations; in consequence of this the sandstone overlies the latter. West of the village is observed a terrace-cliff, more or less covered with sand and shingle; it is traceable around the basin to where the river narrows again southwards. There, at various points, some 60 to 70 feet above the river's level, were found abundance of the three last-mentioned Shells ‡. The desert has intruded greatly on the plateaus and alluvial banks; the latter rise in great heaps along the side of the old basin, so that it is now scarcely possible to define the limits of either. This is an interesting locality for several reasons. There stands the ruined temple, probably at least 2000 years old, on comparatively recent river-deposits, over which are strewed the tuffaceous nodules so frequently noticed on the surface of these beds. In these banks the ancient race excavated their catacombs and caverns, whose ghastly remains are now spread at the entrances, and bleach on their sunny slopes; whilst a few feet higher is the above-mentioned plateau, with its immeasurably more ancient memorials spread over or in the now scanty soil, in the hollows and the crevices of the granitic rocks.

7. *Ravines east of Philæ, with Alluvium and Freshwater Shells.*—From Debod the river runs between hills of granitic rocks, having high bands of alluvium on each side, to the top of the First Cataract.

* Specimen No. 6.

† Specimens Nos. 7, 8, 9,

‡ Specimens Nos. 10, 11, 12,

Opposite Philæ are banks and heaps of river-deposit, some 30 feet higher than the modern limit of the inundation; eastward a fine broad valley opens out and stretches in that direction, curving gently northwards, when it sweeps round to join the river below Assuan, as will be noticed presently; its northern side, for some distance from the river, is formed of granitic eminences, with valleys which run northwards in divers windings to meet the former at Assuan. The above-mentioned valley is more or less covered with sand-drift and washings from the slopes on each side. A perpendicular section of 25 feet is well seen in the bank of a torrent-bed, about a mile from the river, on the southern side of the valley; and this shows the following succession:—

1. River-alluvium overlain by sand-drift.
2. Stratified sand and gravel.
3. Conglomerate.
4. Coarse white sand.

A similar section is perceived in another part of the valley to the north, showing much the same order of beds. The height of the first section may be from 35 to 40 feet above high Nile. Among the alluvial beds and ancient deposits in the ravines northwards, also strewn the surface where the rain had washed down the slopes, were abundance* of *Etheria semilunata*, *Iridina Nilotica*, and *Bulinus pullus*, at heights varying from 40 to 60 feet above the level of the river.

Nowhere in the Nile Valley is the vast force and fury of the storms that now and then burst on Nubia better attested than among the shattered rocks and ravines eastward of the First Cataract. I penetrated several miles in that direction, finding abundance of river-shells either among the soil in the hollows or strewn on the surface, impressing me strongly with a belief that the river had at one time forced its way through these ravines, just as it now makes its way through the others westward. The sandstone was again noticed between the pinnacles of granite, and even topping them in many places; whilst (as at Kalabshe) upturned masses lay along their flanks. These appearances led me to infer that, in all probability, these granite-rocks had been united at one time by sandstone, and that the river had washed away the intermediate and softer rock; moreover, that the sandstone, between the granitic projections in the present course of the stream, had given way to a greater extent, causing the river to sink to lower levels and thus abandon its ancient channels eastward. Is such a result likely to have taken place more readily during a general rise of the river-valley?

8. *Philæ*.—Opposite Philæ, on the left bank, which is very steep, the remains of a terrace-cliff are definable, but so overwhelmed by drift as to render our endeavours to procure remains a failure. The monuments of Philæ show that, at least within the last 2200 years, the river has changed very little in any way. There is an opening

* Specimens Nos. 13, 14, 15.

in the western wall for entrance at high Nile; and there are many holes in its south-western angle for attaching boats at different levels of the water, all suited to the present rise and fall of the river. Midway in the easternmost channel, opposite Philæ, we found a depth of 50 feet. That the river has subsided much since it flowed through its eastern channels is most probable; moreover, to account for the enormous sinking which has taken place, we can, according to what has been shown with reference to its ancient levels at and above the cataract, come to some such a conclusion as this—that the *primæval Nile* was a larger and more rapid river than the Nile is now.

9. *Assuan and vicinity*.—Proceeding down the river, terrace-cliffs are visible on the left bank. On one of these, nearly opposite Assuan, I found a few specimens of *Cyrena*; but I had not leisure to institute a careful inspection of the higher plateaus, some of which seemed fully 100 to 120 feet above the river. Proceeding eastward from Assuan, in a direction parallel to the valley opposite Philæ, I met with abundant proofs of ancient levels. Granitic ridges and boulders were observed interspersed among the old banks of alluvium in the ravine near the town; further east, a long ridge of sandstone runs northwards (with a white tomb at its extremity); from this point a vast valley runs north and south, marked by mounds of alluvium, being the continuation of the great valley opposite Philæ, which concentrates, with the other ravines, in one great plain, debouching on the river a little way below the town, as already stated. Abundance of river-shells strew the beds, and are met with along the banks, chiefly along the eastern side of the largest channel, as it sweeps round towards the river. Another excellent panorama of the Cataract may be seen from a Sheik's tomb on the top of a hill directly opposite Assuan. From the terrace-cliffs on the left bank to the eastern bank of the great ravine, the distance, in a straight line, may be about $2\frac{1}{2}$ miles.

After leaving Assuan the river-valley opens out; and along its right bank, at divers elevations, from 20 to 30 feet above the highest Nile, may be seen abundance of freshwater Oysters (*Ætheria semilunata*)*, not only scattered in enormous quantities throughout the soil, but adhering in numbers to their old rocky bottoms. At the village of Bahveeh, opposite the Island of that name, I met with beds of these Shells among the old alluvium now being dug out of the crevices of the rock, besides *Cyrena* and *Iridina*, which were likewise plentiful.

10. *Ombos and vicinity*.—The temple of Ombos has been already mentioned (p. 10) with reference to the wearing away of its alluvial foundation and the change of the river's course within the historical period. Standing among the ruins and looking on the fine broad valley, we noticed numerous high beds and banks of soil dotting the surface. One in particular is well worthy of attention, being perhaps the greatest alluvial accumulation visible throughout the river's course from Wadi Halfeh to the sea; it runs along the left bank a short way below Ombos, at a place called Maneche, display-

* Specimen No. 16.

ing a perpendicular section of stratified mud, which I ascertained by measurement to average between 80 and 90 feet in height*. The lines of bedding are not always parallel, but, as the accompanying sketch (fig. 4) shows, are also oblique, which I conceive might result from the mud having been deposited by eddies and swirls.

Fig. 4.—Diagram-section of an Alluvial Bank at Maneche, below Ombos.



The surface is, as usual, covered with drifted sand and pebbles. I found no organic remains in this bed; but my examination was not sufficiently extensive to enable me to speak confidently on that point.

Besides the above, I noticed, for the first and last time, on its southern flank, a great bed of stratified sand, red and variegated; throughout were interspersed rounded and oval masses† of sandstone, of a black colour externally, becoming paler towards their centres, and varying in size from small oblong sticks to flat oval-shaped lumps several feet in length. In consistence this sand-bank appeared firm and indurated. Again, on the opposite bank, a mile below Ombos, we noticed quantities of a white substance‡, in the shape of roots of trees, interspersed throughout the alluvial deposit.

The before-mentioned old mud-beds are in all probability the deposit of the river; but the variegated red sand and its nodules are very different from any formation that I have seen in the Valley of the Nile. From the general appearance of the surrounding country, it seemed to me an excellent locality for studying the earlier deposits of the river. No doubt between Assuan and Selsileh, where the country opens out, the early Nile had time to deposit the débris which it could not lay down in its narrow mountain-course above the First Cataract.

11. *Selsileh and vicinity.*—The white limestone of Thebes is seen for the first time on the right bank above Selsileh, but disappears before you reach the sandstone-gorge through which the river passes. This opening is made in a ridge of fine-grained sandstone crossing the valley almost due east and west. At the entrance to the river's channel, on each side, for some distance, are great banks and dome-shaped hillocks of alluvium, evidently washed against the flanks of the ridge by the river in former times; as usual, these are covered with nodules of the concretionary tufaceous substance. On the right bank a great bed of alluvium has banked up what had evidently been an old river-channel, as the Shells found in the neighbourhood and other appearances indicate. Again, abundance of *Cyrenæ* were

* Specimen No. 7, to contrast with the usual sedimentary deposit No. 8.

† Specimen No. 9.

‡ See Specimen No. 10.

found on terrace-cliffs throughout the river's course, especially on the ridge on its left bank, some 80 to 90 feet above the most ancient of the temples and grottos, and, wherever any soil has been left, also strewing the surface of the loose sand. I noticed in the above situation several great rents and slips in the rocks, running N.E. and S.W.: these are rarely observed in the sandstone, unless in the neighbourhood of the granitic protrusions, none of which could, however, be seen, at least in the neighbourhood of the gorge. With reference to Sir Gardner Wilkinson's hypothesis, that the barrier at Selsileh dammed back the river and produced the rise recorded at Semneh, there can be but one opinion. When the locality has been even casually examined, it is evident that, supposing the height of the river to have been equal to that of the plateaus above-mentioned, its waters would not only flow through the large gorges right and left of the present entrance, but almost to the ridge altogether; moreover, granted even a barrier as high as the very summit of the ridge, then even the utmost effect on the rise of the river southwards could not have extended beyond a few miles. I believe a closer examination of the locality than I had an opportunity of making will afford more convincing proofs of the impossibility of any obstacle so far down affecting the rise of the river even at the First Cataract.

After leaving Selsileh, terrace-cliffs are seen running along both banks to within a few miles of Edfu, and wherever the hills approach the river, until the limestone appears near Esneh, where the river-valley opens out and all traces of high grounds are lost.

III. *Conclusion.*—From the evidences adduced, it appears to me that there is reason to infer that the Nile in early ages was a rapid river; and that the force of the stream has been steadily declining, at least since the upheaval (?) of the valley ceased; therefore the wearing process has diminished: for this reason the bottom contains more mud, and in consequence may even be rising, on the whole; and this latter opinion Mr. Rhind seemed disposed to hold. His observations, however, tend to show that the change has been scarcely perceptible within the long historical period furnished by the records, excepting, as already shown, at certain points, caused by a change in the direction of the river's force: perhaps a similar change, or the giving way of a barrier close to Semneh, as Mr. Horner remarks*, might explain the fall of the river there.

* "Observations on the Discovery, by Professor Lepsius, of sculptured marks on rocks in the Nile Valley in Nubia; indicating that, within the historical period, the river had flowed at a higher level than has been known in modern times," by Leonard Horner, Esq., F.R.S., &c. *Edinburgh New Philosophical Journal* for July 1850.

See also 'Letters on Egypt,' &c., by Lepsius (Bohn, 1853, 12mo), pp. 30 and 238, and his reply to Mr. Horner's "Observations," p. 530.

Note on the FRESHWATER SHELLS collected in NUBIA by Dr. LEITH ADAMS. By S. P. WOODWARD, Esq., F.G.S., A.L.S.

The Shells and fragments of Shells from Egypt collected by Dr. Leith Adams are not all determinable—at least with such materials for comparison as are contained in the British Museum.

The fragments of a *Unio* resembling the British *U. pictorum* may belong to a species called "*U. lithophagus*" in the National Collection. The little *Bulimus* is identical with the common Indian *B. pullus*, but we have no Egyptian specimens. The remaining four species are common Nile Shells of the present day. The following is a list of the species, the numbers attached referring to those on the specimens:—

Fossil Specimens.

- | | | |
|--------|---|---|
| No. 7. | { | <i>Unio</i> "lithophagus" ?. |
| | | <i>Paludina</i> bulimoides. |
| 8, 9. | | <i>Cyrena</i> fluminalis, var. trigona. |
| 10. | | <i>Bulimus</i> pullus; Wadi el Arabi. |
| 11. | | <i>Cyrena</i> fluminalis, var. |
| 12. | { | <i>Cyrena</i> fluminalis, var. |
| 13. | | <i>Unio</i> "lithophagus" ?. |
| | | <i>Paludina</i> bulimoides. |
| | | <i>Ætheria</i> semilunata. |
| 14. | { | <i>Cyrena</i> fluminalis. |
| | | <i>Iridina</i> nilotica. |
| | | <i>Bulimus</i> pullus. |
| 15. | { | <i>Ætheria</i> semilunata. |
| | | <i>Unio</i> "lithophagus" ?. |

Recent Specimens.

Cyrena (*Corbicula*) fluminalis; Nile above Thebes.
Paludina bulimoides; First Cataract.

[S. P. W.]

Note on some TEETH of HIPPOPOTAMUS from NUBIA.

By HUGH FALCONER, M.D., F.R.S., F.G.S.

(Abstract.)

Dr. Falconer described two molars imbedded *in situ* in a fragment of the left maxillary of a very large Hippopotamus. The specimen is reported to have been dug up near the old temple of Kálábshé in Nubia, and it was forwarded to the Society by Dr. Leith Adams with his paper. Dr. Falconer was of opinion that although the teeth are as large as in the majority of fossil specimens of *Hippopotamus major*, the Kálábshé remain does not present characters sufficient to distinguish it from the existing species of that country—*Hippopotamus amphibius*.—[H. F.]