

NOTE.—Samples of the beds were preserved by Mr. Strain, and kindly shown to me, when copying the bores. The mud is identical in character with that in the railway cutting, but some samples taken from near the bottom of the bed have more the character of a fine brown-coloured brick clay. The six feet of stony clay in Nos. 2 and 3 bores has a brownish colour, and strikingly identical to the “red till” in Nos. 6 and 7 bores. The clay marked “red till” here by the borer is the *boss* of lower boulder clay which divides the two sections of laminated beds. Its colour, when first laid open, was dark, with a slight tinge of brown, but exposure to the atmosphere heightens the tinge, as it does in most boulder clays. The bed marked “broken whin” in the first bores is water-worn gravel, identical with a bed that rose from under the soft beds in the northern bank, and the “whinstone” in No. 7 is very likely a boulder; in fact, it is almost certain to be so, as from the formation of the valley the rock surface will lie at a much greater depth at this place.

III. *The POST-TERTIARY FOSSILIFEROUS BEDS OF SCOTLAND.* BY
THE REV. HENRY W. CROSSKEY, F.G.S., AND MR. DAVID
ROBERTSON, F.G.S.

(Continued from Part II., page 341.)

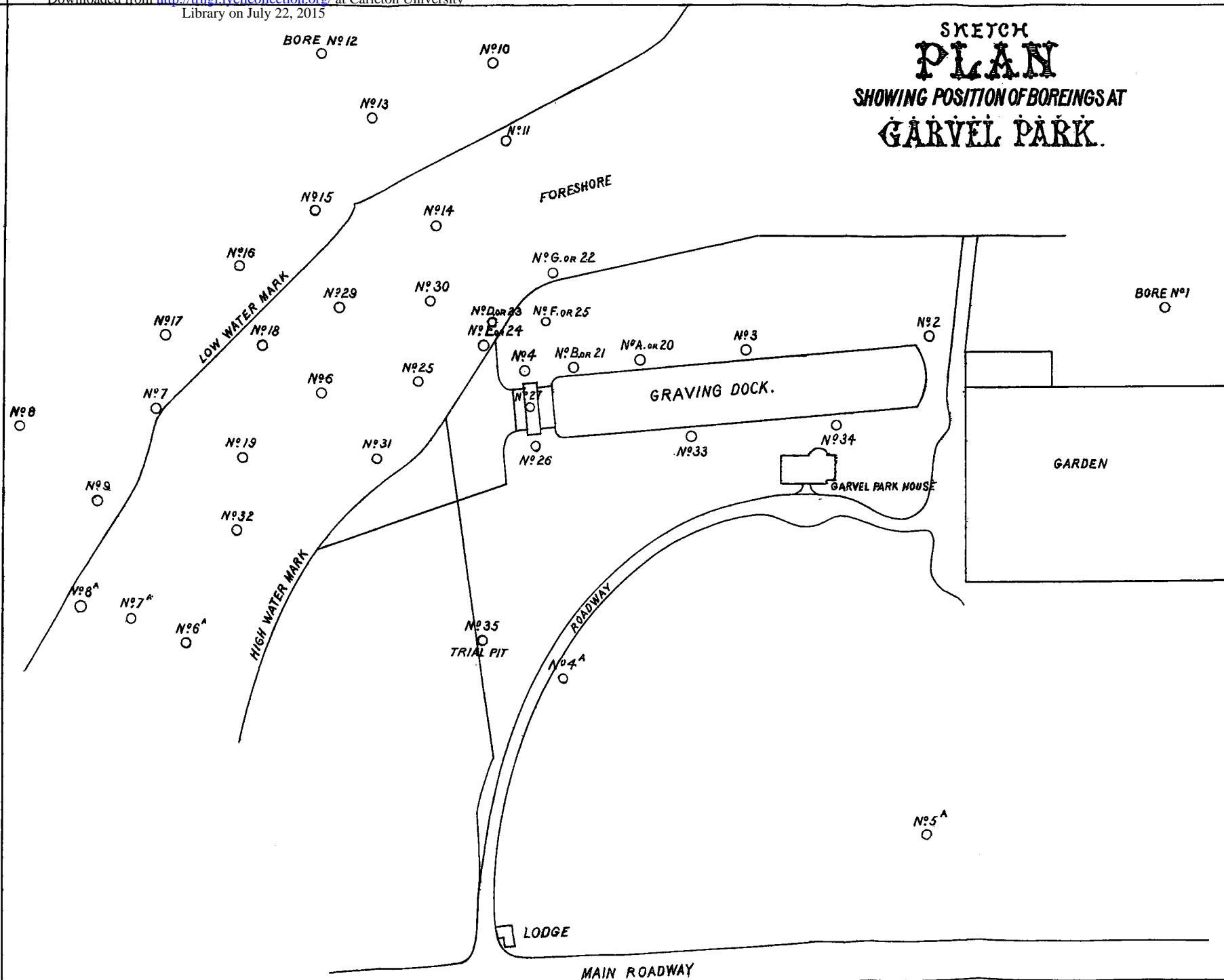
XII.—GARVEL PARK NEW DOCK, GREENOCK.

CONSIDERABLE discussion has been occasioned by the unusual appearance of this deposit. It has been regarded as doubtful whether the animals, whose remains are embedded in it, lived and died where they are now found, or whether this mass of fossiliferous clay might not have been removed from its original position, and transported thither either by the labour of man, or by some other agency, such as ice action.

The Dock, which is now in course of construction, runs nearly parallel with the Clyde, and cuts through a slightly-inclined bank of compact boulder clay, about sixty yards from the shore.

The bottom of the section is forty feet beneath the surface. The first ten or fifteen feet are crowded with large boulders, many of them striated on one or more sides. Towards the bottom boulders of large size are fewer, one only being seen here and there; but the clay is closely packed with small pebbles, few of them exceeding an inch in diameter. The great majority of the larger boulders throughout are sandstones of the neighbourhood; the remainder being of quartz, mica-schist, etc., from the Argyshire mountains to the north-west.

SKETCH
PLAN
SHOWING POSITION OF BOREINGS AT
GARVEL PARK.



These latter blocks, derived from a distance, seem, in general, considerably water-worn, and not unfrequently show much cross striation.

The boulder clay is of the usual stiff consistence, and so great is the difficulty of working it that blasting with gunpowder has been tried, without very promising results. The deep section of the dock is about five hundred feet in length, and in that distance the colour of the clay varies a good deal at different places; the junction of grey and reddish-brown clays at some points being very decidedly marked, both vertically and horizontally. Besides the alternate layers of different coloured clays, the red clay at one place, in the form of an obtuse inverted cone, reaches nearly to the bottom of the section, and thus accounts for the irregular position of the red and grey clays, as described in the journal of the bores.*

The colour of the reddish till is, no doubt, due to a large admixture of the soft old red sandstone on this portion of the coast.

A sample of the red till, taken from a depth of 14 feet, consisted of 76 per cent. fine mud; 10 per cent. sand; 14 per cent. gravel, or small pebbles.

A sample of the grey till, taken from a depth of 30 feet, consisted of 56 per cent. fine mud; 9 per cent. sand; 35 per cent. small gravel.

In the upper red till, the West Highland rocks entering into its composition constitute less than one-third; while in the lower division of the grey till, at the depth of thirty feet, they form more than the half of the bulk of the washing.

The bores made preparatory to the construction of the dock, extending over a radius of about six hundred feet, show that the different coloured clays overlies each other, subject to many irregularities.

* By the term "*Till*," throughout these descriptions of the borings, is meant the special deposit, which is termed in this series of papers, "boulder clay." It is important that this should be carefully understood, since "*Till*" is the term frequently used to denote the whole series of glacial deposits, and indiscriminately applied to the lower boulder clay and the upper laminated clay. In these pages we restrict the term *boulder clay* to the older deposit of the Scotch glacial series containing striated blocks, and throughout the beds of the Clyde district, except in a few special cases of a peculiar character, underlying the shell clay.

JOURNAL OF BORES AT GARVEL PARK.

		Ft. In.				Ft. In.	
No. 1.				No 12 (in River).			
Soil, - - -	-	1	0	Sand, - - -	27	0	
Light till, - - -	-	29	0	Light till, - - -	9	0	
		30			36		0
No. 2.				No. 13 (in River).			
Soil and sand, - - -	-	2	6	Light till, - - -	20	0	
Light till, - - -	-	38	6		20		0
		41					
No. 3.				No. 14 (in River).			
Soil, - - -	-	1	0	Light till, - - -	24	0	
Sand, - - -	-	2	0		24		0
Sand and gravel, - - -	-	5	0				
Light till, - - -	-	32	0	No. 15 in (River).			
		40		Dark sandy till, - - -	6	0	
				Light till, - - -	14	0	
					20		0
No. 4.				No. 16 (in River).			
Soil, - - -	-	1	0	Red till, - - -	7	6	
Gravel, - - -	-	1	6	Sandstone rock, - - -	2	6	
Light till, - - -	-	5	6		10		0
Red till, - - -	-	4	0				
Sandstone rock, - - -	-	3	0	No. 17 (in River).			
		15		Sand and shells, - - -	4	0	
				Dark sandy till, - - -	7	0	
No. 5 (in River).				Red till, - - -	9	0	
Sand, - - -	-	2	0		20		0
Red till and stones, - - -	-	6	0				
Sandstone rock, - - -	-	1	0	No. 18 (in River).			
		9		Dark sandy till, - - -	6	0	
				Red till, - - -	4	0	
No. 6 (in River).				Sandstone rock, - - -	1	0	
Dark sand, - - -	-	3	0		11		0
Light till, - - -	-	3	0				
Red till, - - -	-	11	0	No. 19 (in River).			
		17		Red till, - - -	6	0	
				Light till, - - -	13	0	
No. 7 (in River).				Mud (firm), - - -	6	6	
Dark sand and shells, - - -	-	3	6		25		6
Light till, - - -	-	8	0				
Mud - - -	-	1	6	No. 20, or No. A.			
Red till, - - -	-	6	0	Soil, - - -	1	0.	
		19		Silt and shells, - - -	6	6	
				Light till, - - -	26	6	
No. 8 (in River).					34		0
Sand and shells, - - -	-	18	0				
Red till, - - -	-	2	0	No 21, or No. B.			
		20		Soil, - - -	1	0	
				Light till, - - -	34	0	
No. 9 (in River).					35		0
Light till, - - -	-	4	0				
Red do., - - -	-	15	0	No. 22, or No. C. (in River).			
		19		Light till, - - -	30		
					30		0
No. 10 (in River).							
Sand and shells, - - -	-	7	6	No. 23, or No. D. (in River).			
Light till, - - -	-	17	6	Light till, - - -	30	0	
		25			30		0
No. 11 (in River).				No. 24, or No. E. (in River).			
Sand, - - -	-	9	0	Light till, - - -	30	0	
Light till, - - -	-	11	6		30		0
		20					

CROSSKEY AND ROBERTSON—POST-TERTIARY BEDS.

35

No. 25, or No. F.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Gravel,	- - -	3	0		
Light till,	- - -	27	0		
				31	0
No. 26.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Light till,	- - -	33	0		
Red do.,	- - -	3	0		
Light do.,	- - -	3	0		
				40	0
No. 27.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Light till,	- - -	1	6		
Sandstone block,	- - -	1	0		
Light till,	- - -	36	6		
				40	0
No. 28.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Light till,	- - -	3	0		
Red do.,	- - -	15	6		
Hard white sandstone,	- - -	0	7		
				20	1
No. 29.		Ft.	In.	Ft.	In.
Red till and stones,	- - -	4	0		
Light do. do.,	- - -	13	0		
				17	0
No. 30.		Ft.	In.	Ft.	In.
Red till and stones,	- - -	10	6		
Light do. do.,	- - -	13	8		
Red do. do.,	- - -	5	2		
Red sandstone	- - -	3	2		
				32	6
No. 31.		Ft.	In.	Ft.	In.
Red till and stones,	- - -	3	3		
Light do. do.,	- - -	9	0		
Red sandstone,	- - -	6	1		
				23	4
No. 32.		Ft.	In.	Ft.	In.
Light till,	- - -	14	7		
Fire-clay,	- - -	1	9		
Red sandstone (soft),	- - -	4	7		
Do. do. (hard),	- - -	1	5		
				22	4
No. 33.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Light till,	- - -	34	5		
Do. do., with blocks,	- - -	6	1		
				41	6
No. 34.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Light till and stones,	- - -	6	4		
Sandstone block,	- - -	1	6		
Light till and stones,	- - -	2	6		
Sandstone block,	- - -	2	3		
Light till and stones,	- - -	24	4		
White sandstone,	- - -	0	1		
				38	0
No. 35, TRIAL PIT.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Yellow clay,	- - -	7	6		
Grey till and stones,	- - -	13	6		
Red, do. do.,	- - -	3	0		
Grey till,	- - -	2	0		
White sandstone,	- - -	0	11		
				27	11
No. 4a.		Ft.	In.	Ft.	In.
Soil,	- - -	1	0		
Yellow clay,	- - -	5	6		
Grey till,	- - -	18	0		
Red sandstone,	- - -	3	6		
				28	0
No. 5a.		Ft.	In.	Ft.	In.
Soil,	- - -	0	9		
Yellow clay,	- - -	4	6		
Grey till,	- - -	8	3		
Red till,	- - -	2	3		
Red sandstone,	- - -	3	2		
				19	11
No. 6a.		Ft.	In.	Ft.	In.
Red till and stones,	- - -	3	9		
Soft white sandstone,	- - -	1	6		
				5	3
No. 7a.		Ft.	In.	Ft.	In.
Sand and stones,	- - -	1	6		
Red till and stones,	- - -	4	0		
Darker do. do.,	- - -	6	0		
				11	6
No. 8a.		Ft.	In.	Ft.	In.
Light grey till,	- - -	1	0		
Fine red till,	- - -	6	6		
				7	6

Looking at these forty bores, and confining ourselves to the clays only, which vary from nine to thirty-eight feet in thickness—in nineteen of these, what is termed light till (*grey unstratified clay*) is only met with. In six bores, what is termed red till (*reddish unstratified clay*) is only met with. In other six both

occur, and the light-coloured till overlies the red. In three the red overlies the light, while in the remaining six the clays alternate variously. For example, taking them in the ascending order, in one bore, No. 26, light till, three feet; red till, three feet; light till, thirty-three feet. In another, No. 30, red till, five feet; light till, thirteen feet; red till, ten feet.

Three of the bores, lying between the dock and the highway, have the addition of what is termed yellow clay. Taking them in the same order as above, in No. 35, light till, two feet; red till, three feet; light till, thirteen feet; yellow till, seven feet.

In another, No. 4, light till, eighteen feet; yellow clay, five feet. Again, in No. 5a, red till, three feet; grey till, five feet; yellow till, four feet.

In all these bores, some of which extend two hundred feet beyond low water, the same varieties of boulder clay have been met with in varying proportions.

In bore No. 8, sixty yards beyond low water, eighteen feet of sand and shells overlie the red till; but we regret that we cannot learn whether the shells belong to the glacial or recent period.

About the same distance beyond low water, No. 12, twenty-seven feet of sand overlies light till; another bore, about half-way between this and low water, No. 13, gives twenty feet light till.

The manner in which these different coloured clays alternate with each other is full of interest, and worthy of careful study.

The fossiliferous clay lies in a trough or oblong hollow in the boulder clay crossing the longitudinal section of the dock, and shallowing at both ends. On the south it terminates near the surface about two hundred yards west of Garvel Park House, and on the north, at the embankment near the surface, close to the Clyde.

The length of the trough is about three hundred feet, its breadth twenty-four feet, and its depth, near the middle, fourteen feet. This trough is filled with a remarkable fossiliferous clay, crowded with post-tertiary shells and other marine organisms, which, like those found in other "Clyde beds," are of arctic type. It is this deposit which, in some of its aspects, has perplexed so many observers, and on which, after careful scrutiny, we venture to submit the following observations:—

The chief objections that suggest themselves to the natural character of the deposit are—(1), the disorderly manner in which

the shells are distributed, and (2), the soft, loose state of the clay in which they are embedded, and which certainly bears a striking resemblance to material that has been roughly tumbled in rather than regularly deposited.

We think, however, the facts of the case not unfavourable to the conclusion that these shells lived and died where they are now found.

With regard to the apparent disorder in which they lay, it is well known that where mollusca congregate, dead shells often preponderate largely over the living, and that a great number in this deposit accumulated as dead shells is evident from the numerous valves having their internal surfaces grown over with marine organisms. Although, on a cursory view, they look as if tossed about, and promiscuously heaped together, yet, on closer examination, this irregular appearance seems to arise chiefly from the presence of so many large valves of dead shells, and, taking the general arrangement, they alternate very distinctly in layers.

The soft, loose state of the clay is perhaps a more difficult problem, but the following suggestion may help to explain it. This fossiliferous deposit unquestionably rests in a hollow or trough formed in the boulder clay. The open shelly clay of the deposit would take in more water from the surface than the stiff compact clay on which it reposes could withdraw, and an excess of water, accordingly, would be retained in the trough. This being cut through at the deepest part by the excavation of the dock, and the superfluous moisture to some extent drained off, would naturally bring the deposit much to its existing state.

Similar cases are by no means uncommon. In uncultivated moorlands, our footing is often insecure, owing to impermeable hollows filled with silt, or other porous material, and grown over with turf, which may remain in this state indefinitely, while the surface continues to supply the water, and the basin to retain it. Such conditions are well known to agriculturists, whose skill is exerted in discovering how they can best draw off the imprisoned water which impedes the fertility of their lands over particular areas.

We may add that the boulder clay immediately under the laminated clay at the bottom of the trough is softer for fifteen or twenty inches downwards than at a greater depth, doubtless owing to contact with the moister clay above. There are facts,

moreover, which it is difficult to reconcile with any mere drifting agencies.

(1.) The large boulders embedded in the shelly deposit. Many of these, before they were blasted—and we refer only to those which had marine organisms adhering to them—could not be less than half a ton in weight.

Such boulders could not have been scooped up by any dredging machine, nor brought from any other source without great labour, and it is very unlikely that such large and unwieldy materials would have been selected, and brought for some distance for leveling purposes by man during any previous operations. Indeed the contractors inform us, that with all their improved appliances they should never think of removing one of these large blocks without blasting, and not one of these when uncovered was seen with the slightest mark of a mallet, or bore of a blast upon it.

(2.) Had the fossiliferous material been dug up from one place and carried to another by human agency, unmistakable tool marks, cuts and indentations of pike and shovel, would have been visible on the shells in their crowded condition; but not a single mark of this kind has been found.

(3.) Although the great mass of the shelly deposit lies in some apparent disorder, the under portions of it are distinctly laminated. Resting on the boulder clay there is an unevenly thin bed of reddish-brown clay, made up of very fine layers. Overlying this is a layer of whitish clay, about six inches thick, which is again covered by a layer of light grey clay, about one inch thick. These layers can be traced over the bed and up both sides of the trough, and it is impossible that sediment washed down through the loose materials above, as has been supposed, could have been accumulated in this manner. Again, had the layers been the immediate washings of the upper material, they would have been similar in colour and composition; but all three differed largely from the overlying clays, as well as amongst themselves in colour, constitution, and fossil contents.

The thin light grey layer lying between the whitish six-inch layer and coarser shell clay above, contains one polyzoon (*Idmonea*), far more abundantly than we have found it elsewhere in the section. In this thin layer also occur the asbestos-like fibres of the shell of the common mussel (*Mytilus edulis*), of which we have not found a vestige in the overlying clays. The six-inch

stratum of whitish clay is, when dry, of an extremely friable character, and very like a stratum of clay met with in some of the Paisley brick-fields, and at Jordanhill, in the same relative position, and the reddish-brown clay underlying this corresponds with the thinly-laminated clays frequently found at the base of the fossiliferous clays of the Clyde district. Further, these underlying strata all contain organisms of marine and arctic character, without the least admixture of those decided brackish-water forms so common in the present neighbouring lagoons of the Clyde.

(4.) At the south end of the hollow, lying between the shell clay and the upper mould, a bed of brown clay is disclosed, about two feet in thickness, which Mr. Robert Craig, of Beith, and Mr. Kirk, contractor of the works (who examined it along with us), agreed in concluding has never been disturbed since it was deposited.

As all these circumstances are incompatible with the supposition that the deposit has been filled in by human agency, they are equally so with the theory of its having been transported from some neighbouring locality by the action of ice. This (as Mr. John Young has pointed out) in no way agrees with the condition of the contained fossils, which bear no trace of having been rolled and crushed, as they would infallibly have been from such a cause. The other facts we have adduced seem no less conclusive against this hypothesis.

Traces of a thin irregular bed of small shells have been seen near the surface along the south-east side of the dock; and about one hundred yards from this, in an easterly direction, another shelly deposit, belonging to the same series, has been exposed on the side of a sandstone quarry, where the shells and other organisms, though fewer in number and variety of species, and different in their proportions, are similar in character to those we have described. Quite recently, yet another shell bed, also of arctic type, has been brought to light in making the channel way to the west end of the dock, rather below half-tide. That these beds at one time were all connected is highly probable, but there appears no evidence that any of them were ever covered by the boulder clay.

We mention this because at first sight the deposit in the hollow seems to dip under the boulder clay, but on further examination it is clearly seen to thin out to the surface.

The whole Frith of Clyde, on both sides, is patched with beds of laminated fossiliferous clay, which, doubtless, at one time covered

the bottom from side to side, and reached the various heights on which we find their remains above the level of the sea. The whole deposit has evidently suffered much since it was first laid down from currents, change of level, and other causes.

The clays are generally found cut away between low tide and high water mark, where the abrading power of the water is greatest. Examples may be seen at Langbank, Helensburgh, Roseneath, Fairlie, Cumbrae, &c. In these localities the truncated edges of the fossiliferous clays are exposed to view here and there in the more sheltered hollows along the tidal belt.

The trough that we find at Cartsdyke has, doubtless, been separated from the deposit existing close by, near low water mark, by the agencies determining the distribution of the beds through the whole frith.

The Cartsdyke deposit is remarkable, not only for its puzzling appearance, but for the great abundance and diversity of organisms found crowded within its narrow limits.

The dry fossiliferous clay consists of 76 per cent. fine mud ; 19 per cent. fine and coarse sand ; 5 per cent. gravel and shell *debris*.

The gravel, chiefly sandstones of the neighbourhood, the remainder being quartz, mica-schist, &c., the greater portion less or more water-worn and striated.

In our list of mollusca sixty-one species and seven varieties have been identified. The two prevailing shells are *Pecten Islandicus* and *Mytilus modiolus*, but perhaps the shell of most geological interest in this deposit is *Pecten maximus*, as it has been considered doubtful whether it lived at the same time in the Clyde beds with *Pecten Islandicus* or at a subsequent period.

There is one circumstance connected with this shell which may be mentioned. That is, we have never seen nor heard of *Balani* being attached to *Pecten maximus* in the Clyde beds ; yet, in the same beds *Balani* are common on *Pecten Islandicus*, and as *B. porcatus* and *B. crenatus* do not in any way seem fastidious in their choice of attachment, whether to a stone or shell, we may reasonably infer that most of the shells of *Pecten maximus*, found in our Clyde beds, were not cohabitants with *Pecten Islandicus*. It may be further remarked that *Pecten maximus* is not uncommon in the Frith of Clyde, and its valves abound in our silts and raised beaches, and many specimens, really belonging to younger beds, may have been accidentally mingled with the older fossiliferous clays beneath.

From such mixtures, we fear, records of glacial shells from the Clyde have been too often augmented.

The specimen of *Pecten maximus* from Cartdyke, although one valve only was met with, is of considerable interest, as the deposit is beyond the influence of the tide; whereas the other beds in which they have been found in the west of Scotland, Fairlie, Kyles of Bute, and Ettrick Bay, are all between high and low water mark, and ever since these beds were discovered they have been zealously dug over in search of fossil remains, and re-arranged again and again by every storm and tide. Under such circumstances all attempts to determine the true position of shells that are common to both the recent and the older clays are quite unreliable, and conclusions drawn from such data must at all times be highly questionable.

PISCES.

A few small vertebræ, and otolites. Rare, undetermined. The vertebræ were from a fish probably not exceeding six inches in length. The otolite seemed to be from a fish about the size of a herring.

CONCHIFERA.

<i>Anomia ephippium</i> , Linn.	Common; small.
————— var. <i>aculeata</i> .	Moderately common.
————— var. <i>squamula</i> .	Moderately rare.
<i>Pecten maximus</i> , Linn.	One valve.
————— <i>Islandicus</i> , Müller.	Common; many with valves together.
<i>Mytilus modiolus</i> , Linn.	Common, do. do.
————— <i>edulis</i> , Linn.	Fibres only of shell structure.
<i>Modiolaria nigra</i> , Gray.	Rare in Clyde beds.
<i>Nucula tenuis</i> , Montagu.	Moderately common.
<i>Leda pernula</i> , Müller.	Common.
————— var. <i>mucilenta</i> , Steenst.	Moderately common.
——— <i>pygmaea</i> , var. <i>lenticula</i> , Müller.	Moderately common.
<i>Axinus flexuosus</i> , var., Gouldii.	Common.
<i>Cardium fasciatum</i> , Montagu.	Moderately common.
————— <i>edule</i> , Linn.	One fragment.
————— <i>exiguum</i> , Gmel.	Moderately common.
<i>Cyprina Islandica</i> , Linn.	Moderately common.
<i>Astarte sulcata</i> , Da Costa.	Common.
————— <i>compressa</i> , Mont.	Common.
————— var. <i>globosa</i> .	Rare.
<i>Tellina calcarea</i> , Chemnitz.	Moderately common; rather small in size.
<i>Scrobicularia alba</i> , Wood.	Moderately common.

42 TRANSACTIONS OF THE GEOL. SOC. OF GLASGOW.

<i>Mya truncata</i> , Linn.	Moderately common; impression of the siphon was found in the clay.
<i>Saxicava rugosa</i> , Linn.	Moderately common; full average size.
———— var. <i>arctica</i> , Linn.	Moderately common.
<i>Pholas crispata</i> , Linn.	Fragments; moderately rare.

GASTEROPODA.

<i>Chiton marmoreus</i> , Fabr.	Plates ; common, and large.
———— <i>ruber</i> , Linn.	Moderately rare.
———— <i>cinereus</i> , Linn.	Common.
<i>Tectura virginea</i> , Müller.	Common, and large.
<i>Puncturella Noachina</i> , Linn.	Moderately common.
<i>Trochus helacinus</i> , Fabr.	Moderately common.
———— <i>Grœnlandicus</i> , Chem.	Common, and large
———— <i>tumidus</i> , Chem.	Moderately common, & in fine condition
———— <i>cinerarius</i> , Linn.	Moderately rare.
<i>Lacuna divaricata</i> , Fabr.	Mature individuals, moderately common; young, abundant.
———— <i>puteolus</i> , Turt.	Moderately rare.
<i>Littorina littorea</i> , Linn.	Moderately common.
———— <i>rudis</i> , Maton.	Moderately rare.
———— var. <i>saxatilis</i> .	Rare.
———— <i>limata</i> , Loven.	Moderately common.
———— <i>obtusata</i> , Linn.	Moderately common.
<i>Rissoa parva</i> , Adams.	Moderately rare.
———— var. <i>interrupta</i> .	Very common.
———— <i>striata</i> , Adams.	Very common.
———— var. <i>arctica</i> .	Moderately rare.
<i>Skenea planorbis</i> , Fabr.	Common.
<i>Homalogyra atomus</i> , Philippi.	Common.
<i>Odostomia Lukisi</i> , Jeffrey.	Rare ; new to Clyde beds.
———— <i>unidentata</i> , Montagu.	Moderately common.
<i>Natica Grœnlandica</i> , Beck.	Moderately common.
———— <i>affinis</i> . Gmel.	Moderately common.
<i>Velutina lævigata</i> , Linn.	Moderately common.
———— <i>undata</i> , Smith.	Rare.
<i>Trichotropis borealis</i> , Brod.	Moderately common, & in fine condition
<i>Buccinum undatum</i> , Linn.	Moderately common.
<i>Trophon clathraus</i> , Linn.	
———— var. <i>Gunneri</i> .	Moderately common.
———— <i>truncatus</i> , Ström.	Very common.
<i>Fusus antiquus</i> , Linn.	Rare.
<i>Pleurotoma violacea</i> , Migh. and Ad.	Moderately common.
———— <i>turricula</i> , Mont.	Moderately rare.
<i>Cylichna alba</i> , Brown.	Moderately common.
<i>Utriculus hyalinus</i> , Turt.	Moderately common.
———— <i>obtusus</i> , Mont.	Rare.

POLYZOA.

<i>Caberea Ellisii</i> , Flem.	Moderately rare.
<i>Membranipora Flemingii</i> , Busk.	Moderately common.
<i>Lepralia Peachii</i> , Johnst.	Moderately common.
——— <i>concinna</i> , Busk.	Moderately rare.
——— <i>annulata</i> , Fabr.	Moderately common.
——— <i>hyalina</i> , Linn.	Moderately common.
——— <i>verrucosa</i> , Esper.	Moderately rare.
——— <i>crystallina</i> , Norman.	Moderately common.
——— <i>cruenta</i> , Norman.	Moderately common.
——— <i>tubulosa</i> , Norman.	Moderately common.
<i>Tubulipora patina</i> , Linn.	Moderately rare.
<i>Idmonea fenestrata</i> , Busk.	Common. The only other in which this species has been met with in Scotland is on the opposite side of the Frith.
<i>Crisia eburnea</i> , Linn.	Moderately common.

CRUSTACEA.

<i>Claws and plates.</i>	Various ; not determined.
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OSTRACODA.

Thirty-five species.

CIRRIPEDIA.

<i>Balanus crenatus</i> , Brug.	Common.
——— <i>porcatus</i> , Da Costa.	Common.
——— <i>Hameri</i> , Ascan.	Rare. It occurs in the Lochgilp beds (Argyllshire), and in a cutting at Old Mains sparingly (Renfrewshire). In Uddevalla deposits (Sweden), it is the prevailing cirriped, and of great size, and contributes largely to the bulk of the deposit.
<i>Verruca Strömia</i> , Müll.	Very common ; and great numbers still attached to the objects they had selected in life, which we do not commonly find with this species in the fossil state.

ANNELIDA.

<i>Filograna implexa</i> , Berk.	So far as we know, this species is new to the post-tertiary clays. It is not rare in this deposit : two or three specimens have been obtained, and the debris of the broken up fascicles is of frequent occurrence amongst the clay.
<i>Spirorbis spirillum</i> , Linn.	Common.
<i>Serpula vermicularis</i> , Ellis.	Common on shells and stones.

ECHINODERMATA.

<i>Echinus Dröbachiensis</i> , Müll.	Common. Some of the plates have one or two of the rows, having six pairs of pores in the row, instead of the normal number, five; but there are other plates containing six pairs of pores in all the rows. This, we think, may imply a further deviation of the occasional pair, instead of five, rather than a specific difference.
———— <i>sphæra</i> , Müll.	Moderately common.
<i>Spatangida</i> .	One spine.
<i>Ophiura texturata</i> , Lam.	Plates.
———— <i>albida</i> , Forbes.	Ray plate.
<i>Ophiocoma bellis</i> , Link.	Ray and disk plates.
<i>Sipunculus Bernhardus</i> (?), Forbes.	Moderately common.

FORAMINIFERA.

<i>Cornuspira foliacea</i> , Philippi.	Moderately common.
<i>Biloculina ringens</i> , D'Orb.	Moderately common.
<i>Triloculina tricarinata</i> , D'Orb.	Rare.
———— <i>oblonga</i> , Mont.	Rare.
<i>Quinqueloculina agglutinans</i> , H. B. Brady.	Moderately common.
———— <i>seminulum</i> , Linn.	Common.
———— <i>subrotunda</i> , Mont.	Common.
<i>Lagena sulcata</i> , W & J.	Common.
———— <i>lævis</i> , Mont.	Rare.
———— var.	Rare.
———— <i>striata</i> , Mont.	Rare; very fine.
———— <i>apiculata</i> , H. B. Brady.	Moderately common.
———— <i>distoma</i> , P. & J.	Moderately rare.
———— var.	Rare.
———— <i>gracillima</i> var. Seg.	Rare.
———— <i>globosa</i> , Mont.	Common.
<i>Dentalina communis</i> , D'Orb.	Rare.
<i>Cristellaria rotula</i> , D'Orb.	Moderately common.
<i>Polymorphina compressa</i> , D'Orb.	Rare.
———— <i>lactea</i> var. <i>oblonga</i> .	Rare.
———— <i>communis</i> .	Rare.
<i>Verneuilna polystropha</i> , Reuss.	Common.
<i>Bulimina marginata</i> , D'Orb.	Rare.
<i>Truncatulina lobatula</i> , D'Orb.	Common.
<i>Patellina corrugata</i> , Will.	Rare.
<i>Nonionina depressula</i> , W. & J.	Moderately rare.

SPONGES.

Cliona celata, Grant.

Common.

ALGÆ.

Melobesia polymorpha, Linn.

Common on stones and shells.

INORGANIC PRODUCTIONS.

In company with Mr. S. B. Murdoch we found a valve of *Pecten Islandicus*, having a greenish coloured patch spreading over the inner surface of the shell. On examination this was found to be made up of small points of iron pyrites, some of which may be observed extending into small branch-like processes. In the Gault we find both Ostracoda and Foraminifera, having their cavities filled with iron pyrites. Mr. J. Wallace Young, in a paper contributed to our Proceedings, mentions the presence of iron pyrites in drift-wood found in post-tertiary sands. Since writing the above we have met with iron pyrites on the inner surface of shells in estuary clay from Cardiff New Docks. At a depth of eight feet, and forty feet beneath the surface, valves of the small ostracoda are numerously filled with it; but at the depth of fifteen, twenty, and thirty feet, slight traces of it only can be seen.

We have to acknowledge our obligations to Mr. J. Gwyn Jeffreys, to Mr. H. B. Brady, to the Rev. A. M. Norman, for their assistance in verifying doubtful specimens catalogued, and to Mr. Kirk, contractor of the works, and his assistants, for their kindness in furthering our inquiries and furnishing us with information regarding the bores and excavations.

IV. *On the BOULDERS found in Cuttings on the BEITH BRANCH RAILWAY, considered in relation to their parent rock; with remarks on the local character of the BOULDER CLAY.* By Mr. ROBERT CRAIG, Langside, Beith, Corresponding Member.

(Read February 2, 1871.)

IN making the branch railway from Beith to the Crofthead extension line at Waterland, Dunlop, various sections of boulder clay were laid open. This line (now in course of formation) runs nearly south-east from Beith, but changes, as it reaches Waterland, to direct east. The striations upon the glaciated rock-surfaces in the district have a general compass bearing of nearly north-east by east to south-west by west—the line accordingly at its western