Reindeer—were derived from beds underneath the Till does not imply that Scotland has been submerged since they lived in that country, for it is very probable, as Mr. Geikie has shown,¹ that the Till in some places is the result of the melting of land-ice, and not of icebergs floating on the sea." This statement is now entirely negated by the discovery of arctic marine shells in the sand-bed overlying that containing the mammalian remains at Kilmaurs. Besides, we think there is plenty of evidence, other than palæontological, to prove that the low-lying districts of Scotland were depressed under the level of the sea to a period as late as the formation of the arctic shell-beds of the Firth of Clyde, and, more recent, raised beach shell-beds, both of which are clearly seen to overlie the Till at various heights above the present sea-level. Such being the case, we think it is clear that the land has suffered a long submergence under the sea, since the Mammoth and Reindeer existed in the pre-glacial valley of the Carmel at Kilmaurs.

XX. *The POST-TERTIARY FOSSILIFEROUS BEDS OF SCOTLAND.*
BY REV. HENRY W. CROSSKEY, F.G.S., and Mr. DAVID
ROBERTSON, F.G.S.

(Continued from Part I., page 129.)

VI.—EAST TARBERT—LOCH FYNE.

ON the north side of Tarbert Loch, at the north-east corner, where the bay bends southwards, a small stream, called the Black burn, comes down and cuts into a bed of clay containing arctic shells, which can be traced from 12 to 15 feet above high-water mark.

The shell bearing bed, which is of a light grey colour, lies at an incline of 1 foot in 10, and is overlaid by 5 or 6 feet of brown stony mould, which appears to have been washed down from the hill side. In washing through a sieve of 96 meshes to the inch, 100 parts of the dry material lost 30; while 10 parts of the residue were retained in a sieve of $\frac{1}{8}$ -inch mesh, and consisted of coarse

¹ Trans. Geol. Soc., Glasgow, Vol. I., Part II., p. 70; Quart. Journ. Geol. Soc., Vol. xxi., p. 213.

gravel. The other 60 parts were composed of fine gravel and sand. The shells are few, both in number and species, in the part of the bed accessible at the time of our visit.

Trochus helycinus is remarkably prevalent, and in no other glacial bed have we yet collected so many specimens; many examples retain their full colour.

Saxicava rugosa is next in abundance, and the var. *arctica* also appears, although not of any marked size, few specimens reaching an inch. Portions of the epidermis are preserved.

A few fragments of *Mya truncata* are met with, chiefly however of young forms. It is somewhat remarkable that although we did not find a perfect specimen of *Mya truncata*, the fragments were covered with fresh epidermis.

Littorina littorea and *L. obtusata* are scarce, imperfect, and water-worn; and one example of *L. limata* is in the same condition.

Tellina calcarea is neither plentiful nor large, but water-worn and considerably corroded.

Axinus flexuosus is moderately common, attaining great size and strength, and covered with its epidermis.

The presence of water-worn shells belonging to different habitats leads us to suspect that many of the specimens in this deposit have not lived and died where they are now found, but have been brought after death from greater or less distances.

Ostracoda and Foraminifera are poorly represented, some 17 or 18 species of either only occurring.

There is one curious circumstance, characteristic of these local groupings, in which the facts connected with the fossils coincide with those connected with recent deposits, and which it is important for the geologist to consider when leading palæontological evidence regarding the different ages of the beds. Almost all the deposits have their peculiarly prevalent species. A rare species in one bed may be very abundant in another, belonging to precisely the same age.

In this East Tarbert bed, *Pseudocythere caudata* of Sars, is moderately common. It is recorded as rare between tide marks in the Channel Islands; rare in England, Scotland, Ireland, and Norway, in deep water, and not till lately has any example been discovered in a Post-Tertiary deposit.

Cythere emarginata (Sars), a still rarer species, is met with in the same bed.

The only British example hitherto known (so far as we are aware) was dredged by us in deep water at Shetland. In this bed, however, male and female specimens are moderately common.¹

CONCHIFERA.

<i>Axinus flexuosus</i> , Montagu.	Common.
<i>Tellina calcarea</i> , Chemn.	Moderately common.
<i>Corbula gibba</i> , Olivi.	Rare.
<i>Mya truncata</i> , Linn.	Rather rare; young and fragmentary.
<i>Saxicava rugosa</i> , Linn.	Common.
————— var. <i>arctica</i> , F. & H.	Moderately common.

GASTEROPODA.

<i>Chiton</i> , — ?	One plate.
<i>Trochus Grœnlandicus</i> , Chemn.	Rare.
———— <i>helicinus</i> , Fabr.	Common.
<i>Littorina littorea</i> , Linn.	Rather rare.
———— <i>obtusata</i> , Linn.	Rare.
———— var. <i>neritifforme</i> , Brown.	Rare.
———— <i>limata</i> , Loven.	Rare
<i>Purpura lapillus</i> , Linn.	Rare ; fry.

CRUSTACEA.

<i>Balanus crenatus</i> , Brug.	Plates ; rather rare.
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ANNELIDA.

<i>Spirorbis spirillum</i> , Linn.	Moderately common.
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ECHINODERMATA.

<i>Echinus Dröbachiensis</i> , Müll.	Spines and plates ; common.
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FORAMINIFERA.

<i>Cornuspira foliacea</i> , Sch.
<i>Quinqueloculina seminulum</i> , Linn.
———— <i>subrotunda</i> , Mont.

¹ We have, as in previous papers, to acknowledge our obligations to Mr. J. G. Jeffreys, Mr. H. B. Brady, and the Rev. M. Norman, for their assistance in verifying the species catalogued.

Lagena sulcata, W. & J.

——— *Jeffreysii*, Brady.

——— *globosa*, Mont.

Polymorphina compressa, D'Orb.

————— *gibba*, D'Orb.

————— *oblonga*, Brown.

Bulimina marginata, D'Orb.

Polystomella striato-punctata, F. & M.

————— *arctica*. P. & J.

Nonionina ——— ?

With one or two undetermined species. .

The lists of Entomostraca from this and other localities are necessarily reserved until the completion of our monograph upon them.

VII.—WEST TARBERT.

Our attention was first directed to this bed by Mr. James Thomson.

For a considerable distance along the loch on the south side, a little beyond where the new road begins near the head of the loch, it is seen to crop out, in some places abutting against the native rock, to which *Balani* and *Serpulæ* may be seen adhering in great abundance.

Further down, where the rocks stand out more steeply into the water, the old shell bearing clay disappears, and is seen again in the course of about a mile resting against the rock on the west side of the bay, near where the new road joins the old highway.

Considerable denudition has evidently therefore taken place. Many parts of the true bed are overlaid by 8 or 10 inches of a shell debris thickly mixed with clay. This covering is undoubtedly a wash thrown up in heavy storms, and is coated with grass. Many of the shells in the lower clay have attained a portly size, evidencing their growth under secure and favourable conditions. This is particularly the case with *Pecten Islandicus* and *Buccinum undatum*.

One hundred parts of the dry clay lost 66 per cent. in washing through a sieve of 96 meshes to the inch; 16 parts of the residue were retained in a sieve $\frac{1}{4}$ th inch mesh, consisting of small gravel and broken shells; the other 18 parts were composed of fine sand.

Ostracoda are well represented: 24 species occur, several of which are not yet determined.

Foraminifera are about a third fewer in number, and also comprise some undetermined forms.

CONCHIFERA.

<i>Anomia ephippium</i> , Linn.	Rather rare.
<i>Pecten Islandicus</i> Müll.	Common and large.
<i>Mytilus modiolus</i> , Linn.	Broken pieces; common.
<i>Nucula tenuis</i> , Mont.	Moderately rare.
—— <i>pernula</i> , Müll.	Rather rare.
<i>Axinus flexuosus</i> , Mont.	Moderately rare.
<i>Cyamium minutum</i> , Fabr.	Rare.
<i>Leda pygmæa</i> , Münt.	Rather rare.
<i>Cardium fasciatum</i> Mont.	Rather rare.
<i>Cyprina Islandica</i> Linn.	Rare.
<i>Astarte sulcata</i> , Da Costa.	Moderately common; fry; two large valves.
—— <i>compressa</i> , Mont.	Rare.
<i>Tellina calcarea</i> , Chemn.	Common, and some large.
<i>Scrobicularia alba</i> , Wood.	Rare.
<i>Saxicava rugosa</i> , Linn.	Rare; very thick specimen.

GASTEROPODA.

<i>Chiton</i> ——?	Common.
<i>Tectura virginea</i> , Müll.	Moderately common.
<i>Lacuna divaricata</i> , Fabr.	Rather rare.
<i>Littorina obtusata</i> , Linn.	Common.
—— <i>limata</i> , Loven.	Rare.
—— <i>littorea</i> , Linn.	Common, and very large.
<i>Rissoa parva</i> , Da Costa.	Rare.
—— var. <i>interrupta</i> , Adams.	Common.
—— <i>striata</i> , Adams.	Common.
<i>Skenea planorbis</i> , Fabr.	Moderately common.
<i>Homalogyra atomus</i> , Phil.	Moderately common.

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<i>Natica affinis</i> , Gmelin.	Common ; large and very fine.
<i>Purpura lapillus</i> , Linn.	Moderately common.
<i>Buccinum undatum</i> , Chemn.	Moderately common and large.
———— <i>Grœnlandicum</i> , Chemn.	Rare.
<i>Trophon clathratus</i> , Linn.	Rather rare.
———— <i>truncatus</i> , Ström.	Common.
<i>Fusus antiquus</i> , Linn.	Rather rare.
<i>Pleurotoma turricula</i> , Mont.	Rare.
———— <i>pyramidalis</i> , Ström.	Rare.
———— <i>Trevelyana</i> , Turt.	Rare.
<i>Utriculus obtusus</i> , Mont.	Moderately common.

POLYZOA.

Cellularia scruposa, Ellis.

CRUSTACEA.

<i>Claw</i> .	Not determined.
<i>Balanus porcatus</i> , Da Costa.	in large clusters.
———— <i>crenatus</i> , Brug.	1 plate.
<i>Verruca Strömia</i> , Müll.	Moderately common.

ECHINODERMATA.

<i>Echinus Dröbachiensis</i> , Müll.	Plates.
<i>Ophiura albida</i> ? Forbes.	Plates; common.

ANNELIDA.

<i>Serpula vermicularis</i> , Ellis.	Common.
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FORAMINIFERA.

<i>Quinqueloculina seminulum</i> , Linn.
<i>Lagena lævis</i> , Mont.
———— <i>striata</i> , Mont.
———— <i>semistriata</i> , Will.
———— <i>caudata</i> , D'Orb.
———— <i>distoma</i> , P. and J.
<i>Polymorphina compressa</i> , D'Orb.
<i>Textularia variabilis</i> , Will.

- Bulimina marginata*, D'Orb.
Bolivina punctata, D'Orb.
Truncatulina lobatula, Walker.
Polystomella striato-punctata, F. & M.
 ----- *arctica*, P. & J.
 ----- *crispa*, Linn.
 A few others not determined.

ALGÆ.

Melobesia polymorpha, Linn. On *Pecten Islandicus*.

VIII.—CRINAN.

We are indebted for the discovery of this bed to Mr. Fyfe, engineer, Ardrishaig. It occurs on a small plateau on a promontory at the north side of No. 11 Lock on the Crinan Canal. The section is exposed by a cutting made to lead off the water from the high level.

A few feet only of the clay are exposed, and the shell-bearing portion is a thin stratum, in which broken shells, Balani plates and spines of Echini are seen sparsely scattered. The shells are scarce and so fragmentary as to be determinable with difficulty. The Balani are more abundant and less broken, but of small size.

Thirteen species of Ostracoda were met with, and, with the exception of two, are all common.

Ten species of Foraminifera occur, two being undetermined.

The clay is reddish brown, and loses 66 per cent. in washing. The height of this bed above the sea is 30 feet.

CONCHIFERA.

<i>Mytilus modiolus</i> , Linn.	Fragments ; common.
<i>Leda pernula</i> , Müll.	Rare.
— <i>pygmæa</i> , Münst.	Rare ; fry.
<i>Axinus flexuosus</i> , Mont.	Rare.
<i>Astarte borealis</i> , Chemn.	Rare.
<i>Tellina calcarea</i> , Chemn.	Rare.

GASTEROPODA.

<i>Littorina littorea</i> , Linn.	Fragments; rare.
<i>Velutina lævigata</i> , Penn.	Rare.
<i>Purpura lapillus</i> , Linn.	Rare.
<i>Pleurotoma pyramidalis</i> , Ström.	Rare.

POLYZOA.

Crisia eburnea, Linn.

CRUSTACEA.

<i>Plates and Claw.</i>	Too small to determine.
<i>Balanus crenatus</i> , Brug.	
——— <i>porcatus</i> , Da Costa.	
<i>Verruca Strömia</i> , Müll.	

ECHINODERMATA.

<i>Echinus Dröbachiensis</i> , Müll.	Plates and spines.
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FORAMINIFERA.

<i>Lagena lævis</i> , Mont.
——— <i>distoma</i> , P. & J.
<i>Dentalina communis</i> , D'Orb.
<i>Cristellaria rotulata</i> , Lamk.
<i>Bulimina marginata</i> , D'Orb.
<i>Truncatulina lobatula</i> , Walker.
<i>Polystomella striato-punctata</i> , F. & M.
<i>Nonionina depressula</i> , W. & J.

Two others not determined.

IX.—DUNTROON.

We are indebted to the kindness of the Rev. Mr. Mappleton, Duntroon, for pointing out this deposit.

It occurs a little to the south of Duntroon Castle, and comes to the surface at about high-water mark. By clearing away a slight covering of gravelly sand, a stiff brown clay is reached, containing arctic species in considerable abundance. We have obtained more specimens of *Pleurotoma pyramidalis* from this than from any other bed except from one part of the Paisley clay.

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The clay when dry imbibes the water very slowly, pieces from three to four inches in diameter taking nearly 24 hours to dissolve, nevertheless it passes easily through the sieve and washes rapidly, losing 83 per cent. in the operation.

Thirty-seven species of Ostracoda and 33 of Foraminifera occur, in both cases comprising very interesting types.

CONCHIFERA.

<i>Anomia ephippium</i> , Linn.	Rare.
<i>Pecten Islandicus</i> , Müll.	Rare.
<i>Nucula tenuis</i> , Mont.	Rare.
<i>Leda pernula</i> , Müll.	Valves, united occasionally, common.
— <i>pygmæa</i> , Münst.	Common.
<i>Axinus flexuosus</i> , Mont.	Rare.
<i>Cardium</i> ——?	Rare.
<i>Macra solida</i> var. <i>elliptica</i> , Br.	Rare; fry.
<i>Cyprina Islandica</i> , Linn.	One large; a few small.
<i>Astarte compressa</i> , Mont.	Moderately common.
<i>Tellina calcarea</i> , Chemn.	Moderately common; rather small.
<i>Scrobicularia alba</i> , Wood.	Rare.
<i>Mya truncata</i> , Linn.	Common; young and fry.

GASTEROPODA.

<i>Lacuna divaricata</i> , Fabr.	Common.
<i>Littorina obtusata</i> , Linn.	Rather rare.
<i>Rissoa parva</i> , Da Costa.	Common.
———— var. <i>interrupta</i> , Adams.	Common.
———— <i>striata</i> , Adams.	Common.
<i>Skenea planorbis</i> , Fabr.	Common.
<i>Homalogyra atomus</i> , Phill.	Common.
<i>Natica affinis</i> , Gmelin.	Rare.
<i>Cerithium reticulatum</i> , Costa.	Rare.
<i>Buccinum undatum</i> , Linn.	Rare.
<i>Trophon clathratus</i> , Linn.	Common.
———— var. <i>Gunneri</i> , Loven.	Common.
———— <i>truncatus</i> , Ström.	Common.

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<i>Nassa reticulata</i> , Linn.	Rare.
<i>Pleurotoma pyramidalis</i> , Ström.	Moderately common.
———— <i>turricula</i> , Mont.	Moderately rare.
<i>Cylichna alba</i> , Brown.	Rare; young.
<i>Utriculus truncatulus</i> , Brown.	Rare.
———— <i>obtus</i> , Mont.	Common.
———— <i>hyalinus</i> , Turt.	Rare.

POLYZOA.

- Discorporella Grignoniensis*, Busk.
Tubulipora phalangea? Thompson.
Crisia eburnea, Linn.
Hippothoa catenularia, Jamieson.
Lepralia verrucosa, Esper.
Membranipora unicornis, Blainv.
Canda reptans, Linn.
Flustra avicularia, Mont.

Two others not determined, in bad condition.

CRUSTACEA.

- Balanus porcatus*, D'Costa.
 ————— *crenatus* Brug.
Verruca Strömia, Müll.

Fragments of plates not sufficiently large to identify.

ANNELIDA.

- Spirorbis spirillum*, Linn.
Spirorbis ——— ?

ECHINODERMATA.

- Ophiura albida*? Forbes. Plates.
Echinus Dröbachiensis, Müll. Plates and spines.

FORAMINIFERA.

- Cornuspira foliacea*, Phil.
Biloculina ringens, Lamk.
 ————— *depressa*, D'Orb.

- Spiroloculina limbata*, D'Orb.
Quinqueloculina semimulum, Linn.
 ————— *bicornis*, W. & J.
 ————— *subrotunda*, Mont.
Trochammina inflata, Mont.
Lagena lævis, Mont.
 ————— *sulcata*, W. & J.
 ————— *striata*, Mont.
 ————— *squamosa*, Mont.
 ————— *globosa*, Mont.
 ————— *distoma*, P. & J.
 ————— *biconica*, H. B. Brady.—Very fine.
 ————— *Iyellii*, Sequenza.
 ————— *marginata*, Mont.
Nodosaria scalaris, Batsch.
Dentalina communis, D'Orb.—Very fine.
 ————— *guttifera*, D'Orb.
Polymorphina compressa, D'Orb.
Globigerina bulloides, D'Orb.
Textularia variabilis, Will.
Bulimina marginata, D'Orb.
Bolivina punctata, D'Orb.
Discorbina globularis, D'Orb.
Truncatulina lobatula, D'Orb.
Polystomella crispa, Linn.
 ————— *striato-punctata*, F. & M.
Nonionina turgida?—Small; deformed.

X.—OLD MAINS, RENFREW.

In a cutting for a tramway between the Houston Pit, No. 5, and the farm of Old Mains, a bed of shells is exposed. The cutting is about six to seven feet at the highest point, and the bed of shells stretches along the section for about 20 yards, cropping out towards the farm and dipping towards the River Cart. It was first noticed by Mr. Bennie.

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The thickest part of the shell stratum exposed is from 18 to 20 inches. The cutting appears only to have touched the edge of the shell bed, as it is not seen on the opposite bank.

The deposit is made up of brown sand and earth crowded with stones, many of them covered with Balani. Sand predominates in the shell stratum.

Mytilus modiolus, *Saxicava rugosa*, *Astarte sulcata*, and *Axinus flexuosus* are found with united valves.

PISCES.

Small vertebræ of fish.

CONCHIFERA.

<i>Anomia ephippium</i> , Linn.	Moderately common ; small.
<i>Pecten Islandicus</i> , Müll.	Moderately common.
<i>Mytilus edulis</i> , Linn.	Moderately common ; large, but mostly broken.
—— <i>modiolus</i> , Linn.	Not uncommon ; large.
<i>Leda pernula</i> , Müll.	Rather rare.
—— <i>pygmæa</i> , Münt.	
<i>Cardium edule</i> , Linn.	Moderately common ; small.
<i>Cyprina Islandica</i> , Linn.	Common ; valves broken ; moderately large.
<i>Astarte sulcata</i> , Da Costa.	Common.
—— <i>compressa</i> , Mont.	Common.
<i>Tellina balthica</i> , Linn.	Rare.
—— <i>calcareæ</i> Chemn.	Moderately common ; average size.
<i>Mya truncata</i> , Linn.	Rare.
<i>Saxicava rugosa</i> , Linn.	Rare.

GASTEROPODA.

<i>Chiton marmoreus</i> , Fabr.	Rather rare ; plates.
<i>Tectura virginea</i> , Müll.	Common.
<i>Puncturella Noachina</i> , Linn.	Common.
<i>Trochus Grœnlandicus</i> , Chemn.	Rather rare.
—— <i>tumidus</i> , Chemn.	Rare.
<i>Mülleria costulata</i> , Müll.	Common.

<i>Lacuna divaricata</i> , Fabr.	Common.
<i>Littorina littorea</i> , Linn.	Common ; chiefly small.
——— <i>obtusata</i> , Linn.	Common.
<i>Rissoa parva</i> , var. <i>interrupta</i> , Adams.	Moderately common.
——— <i>striata</i> , Adams.	Common.
<i>Skenea planorbis</i> , Fabr.	Moderately common.
<i>Homalogyra atomus</i> , Phill.	Rare.
<i>Natica affinis</i> , Gmel.	Moderately common.
——— <i>Grænlandica</i> , Beck.	Rare.
<i>Velutina undata</i> , Smith.	Rare.
<i>Buccinum Grænlandicum</i> , Chemn.	Rare.
——— <i>undatum</i> , Linn.	Young ; common.
<i>Trophon truncatus</i> , Ström.	Common.
——— <i>clathratus</i> , Linn.	Common.
——— var. <i>Gunneri</i> , Loven.	Common ; well marked.
<i>Pleurotoma violacea</i> , Migh. & Ad.	Rare.

POLYZOA.

<i>Sphenotrochus Wrightii</i> ? Gosse.	Rare.
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CIRRIPEDIA.

<i>Verruca Strömia</i> , Müll.	Common.
<i>Balanus crenatus</i> , Brug.	Common.
——— - <i>porcatus</i> , D'Costa.	Moderately common.
——— <i>Hameri</i> , Ascanius.	Rare.

ECHINODERMATA.

<i>Echinus Dröbackiensis</i> , Müll.	Common ; spines and plates.
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SPONGE.

<i>Cliona celata</i> , Grant.

FORAMINIFERA.

<i>Lagena lavis</i> , Mont.
——— <i>semistriata</i> , Will.
——— <i>marginata</i> , Mont.

Lagena globosa, Mont.

Polymorphina compressa, D'Orb.

Dentalina communis, D'Orb.

Truncatulina lobatula, Walker.

Polystomella striato-punctata, F. & M.

XI.—PAISLEY.

In general, the Post Tertiary clays, both on the east and west of Scotland, containing arctic shells, rest on the old Boulder-clay, and are overlaid by a few feet more or less of gravel, or sand and gravel, followed by a few feet of mould or peat and mould.

The "Till," underlying the laminated clay in the Paisley district, is of the usual irregular character, rising up in hammocks here and there, to, and above the surface, and at other places formed into troughs of considerable depths. A superimposed patch of gravelly mud sometimes occurs. When dry it is difficult to dissolve, and when wet it feels hard, gritty, and heavy. When dissolved it washes through the fine sieve rapidly. Three lb. 13 oz. of the dry clay lost by washing through a sieve of ninety-six threads to the inch diameter 1 lb. 10 oz. ; of the 2 lb. 3 oz. residue 14 oz. was retained in a sieve of 1-8th inch mesh, which consisted of small gravel—this small gravel was remarkable for the profusion of scratchings almost over every piece—and many fragments were indented as if the smaller gravel had been forcibly crushed into them.

SECTION AT SHORT ROAD BRICK WORK (SOUTH SIDE OF ROAD).

- a. Mould 3 to 4 feet.
- b. Gravel $\frac{1}{2}$ upwards to 1 foot.
- c. Thick dark clay, 13 feet.
- d. Laminated whitish clay, $1\frac{1}{2}$ feet.
- e. ,, yellowish brown clay, 2 feet.
- f. Muddy sand not cut through.

The first seven feet, under the gravel, is brownish coloured, especially towards the top and contains few shells; amongst these, *Mytilus modiolus*, is found here and there, with the valves together.

The next six feet run into a dark gray clay with shells in considerable abundance.

Cyprina Islandica is common, and in this section is almost entirely confined to the tenth and eleventh feet below the gravel.

Under this at (d), is a layer of whitish soft clay, about a foot and a half in thickness, and more sharply defined below than above. This stratum is not found suitable for brick-making, the workmen say that it is *fusionless*, that it has no strength of body, and cannot be used for bricks by itself. When dry, it has little cohesion, and breaks down easily between the fingers like a piece of chalk.

It is finely laminated and washes almost wholly away through a sieve of 96 meshes to the inch across. In washing 100 oz. of dry clay, only two drachms were left as residue, which consisted of very fine sand, and a considerable number of *Polystomella strato-punctata* and *Nonionina depressula*.

When the dry clay is put in water and mixed up, no froth is produced on the surface as is generally the case with fossil clays. When dissolved, which it does readily, it washes through the sieve rapidly. The next two feet in the section (e) comprise a yellowish brown clay much more cohesive than the last; the layers are divided from an inch to half an inch apart by fine sand, and these again into excessively thin layers by lighter and darker coloured clays. In washing, this is similar to the last, and one Foraminifera only was met with. Underlying this (f), is a wet muddy sand, which at this place forms the base of the laminated clay. It loses 63 per cent. in washing, but the greater part of the loss is very fine sand. Three Foraminifera were met with and one valve of *Cytheridea punctillata*.

As water comes up through this sand when penetrated, the workmen had not cut through it at the time of our visits, and had no idea of its thickness. It is probably only a small bank of the same series as the clays above it, as it is similarly stratified. This is confirmed by the fact that the "Till" is met with at about the same level in a pit not more than a hundred yards distance.

The shells in the clay-beds around Paisley are mostly confined to the lower half of the deposit, and generally have their chief abundance within from one to three feet of the bottom.

In the upper portions of the clay, shells are met with sparingly within a few inches of the top. Foraminifera and Ostracoda are generally met with, less or more, from top to bottom, more constantly Foraminifera; but as a rule, both are found most profusely where shells mostly prevail. In many cases, the mussel (*Mytilus edulis*) occurs in considerable abundance below *Cyprina Islandica*, generally near the bottom of the section. This is pre-eminently the case in a clay-pit across the road, opposite the new coal-pit a little west of the town of Paisley, and at Jordan Hill—about three miles north-west of Glasgow—fourteen feet below the surface.

The position of the shells in the clay is not precisely the same in all the glacial beds. When the Greenock new docks were being excavated a few years ago, a section of clays was well exposed. The laminated clay was cut through for many feet into the unstratified "Till," showing the line of junction for a considerable length. The junction was beautifully marked by a thin layer of whitish coloured clay resting on the "Till," three or four inches thick, which contained Foraminifera. Immediately overlying this thin stratum of whitish clay, was a darker coloured clay, crowded with shells, amongst which were *Cyprina Islandica*, *Pecten Islandicus*, and *Tellina calcarea*, in great abundance.

At Kilchattan tile work, Buteshire, the shells are above the laminated clay, in a bed of sand, or gravelly sand, which lies between the clays and the top gravel.

At Elie, Fifeshire, the shells are plentiful near the top of the clay, a little under the gravel; and amongst them are *Pecten Islandicus*, *Leda arctica*, *Tellina calcarea*, and *Thracia myopsis*. In many other deposits an odd shell is only seen occasionally. This not unfrequently happens at different points of the Paisley beds. In a brick field, on west side of the river Cart, at a little distance from the new park, one or two specimens only, by diligent search, may be met with, although they are plentiful in cuttings quite near to the spot. In other sections they are absent altogether.

It may be of interest to remark that the shells of the same species, in the same layer, at very little distances apart may be in a very different state of preservation. At a brick-work close to Paisley (west side), we have seen all the shells of *Cyprina Islandica*

as soft as pulp, so that not one specimen could be taken from its matrix, whole; while at another part of the cutting, not a hundred yards distant, they were in beautiful condition, with the hinge-ligament entire, and with the epidermis retaining its natural colour over both valves so perfectly, that they might have been mistaken, on a cursory view, for shells still enclosing the living animals.

It will be observed that the laminated clay, which has been regarded as the unfossiliferous base of the shell clay, is *not* unfossiliferous, but contains Foraminifera, *Polystomella striato-punctata* being the common form.

The bed of unfossiliferous clay which was supposed to rest upon the shell clay also, can not be established. Fossils may occur in any part of the section at Paisley from the Boulder clay to the summit, although they are found most plentifully at the point we have indicated; and sometimes minute search is needed to trace them at the higher levels.

In the Boulder clay itself we have not yet succeeded in this neighbourhood in finding any sign of life, and throughout the whole district, as a *general* rule, it *underlies* the shell clay. In one or two cases, however, arctic shell beds occur beneath patches of Boulder clay. A bed of laminated clay near Paisley has been exposed beneath the Boulder clay, and some arctic shells occur in it. In Ayrshire, also, shell beds occur beneath Boulder clay. In these cases, however, it is not necessary to suppose that the overlying Boulder clay was of more recent date than the shell bed. It is quite possible that either the Boulder clay may have slipped over a younger bed, or have been brought down by land ice, and deposited over the mud of the existing glacial sea.

The following catalogue embraces the species collected within clay pits, belonging to the same geological horizon, in the immediate neighbourhood of Paisley. Being the first systematic attempt to catalogue the post-tertiary fauna of that district, it will necessarily be found imperfect; it is, however, as complete as the present state of our collections renders possible. The constant opening of fresh excavations will, in course of time, doubtless, enable observers to add many other species; and the present attempt may prove of service as a basis for future use. A catalogue of the contents of the *Post-glacial* bed which rests upon the glacial clays will be found in its proper place in a subsequent portion of this series of papers:—

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AVES.

Bones of a Bird—species as yet undetermined.

PISCES.

Small vertebræ of Fish—species as yet undetermined.

CONCHIFERA.

<i>Anomia ephippium</i> , Linn.	Common.
———— var. <i>aculeata</i> , Linn.	Rare.
———— var. <i>squamula</i> , Linn.	Rare.
<i>Pecten Islandicus</i> , Müller.	Moderately rare; colour preserved; in all stages of growth.
<i>Mytilus edulis</i> , Linn.	Common; elongated form; frequent.
———— <i>modiolus</i> , Linn.	Common.
<i>Nucula tenuis</i> , Montagu.	Moderately common.
———— var. <i>inflata</i> , Mörch.	Common.
———— <i>nucleus</i> , Linn.	Common.
———— var. <i>tumidula</i> , Malm.	Rare.
<i>Modiolaria discors</i> , Linn.	Rare; fry.
<i>Leda pernula</i> , Müller.	Common; very large.
———— var. <i>mucilenta</i> , Steenst.	Rare.
<i>Leda pygmæa</i> , Münster.	
———— var. <i>lenticula</i> , Müll.	Common.
<i>Axinus flexuosus</i> , Montagu.	
———— var. <i>Gouldii</i> , Phil.	Common.
<i>Cardium fasciatum</i> , Montagu.	Moderately common.
———— <i>echinatum</i> , Linn.	Rare.
<i>Cyprina Islandica</i> , Linn.	Common; in excellent preservation, hinge joint entire; and covered with epidermis. Sometimes so abundant as to interfere with the economical working of the clay.
<i>Astarte sulcata</i> , Da Costa.	Moderately common.
———— <i>compressa</i> , Montagu.	Common.
———— var. <i>globosa</i> , Müll.	Moderately common.
———— var. <i>striata</i> , Müll.	Rather rare.
<i>Tellina calcarea</i> , Chemnitz.	Common; large; of all ages.

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<i>Tellina balthica</i> , Linn.	Moderately rare.
<i>Mya truncata</i> , Linn.	Moderately common; fry; perfect adult valves rare.
<i>Saxicava rugosa</i> , Linn.	Moderately common; not large.

GASTEROPODA.

<i>Tectura virginea</i> , Müller.	Rare.
<i>Trochus helycinus</i> , Fabricius.	Fry; moderately common.
——— <i>Vahliei</i> .	Fry; moderately rare.
——— <i>Grœnlandicus</i> , Chemnitz	Rare; fry and one adult.
<i>Lacuna divaricata</i> , Fabricius.	Moderately common.
——— <i>puteolus</i> , Fab.	Moderately rare.
<i>Littorina obtusata</i> , Linn.	Common.
——— <i>littorea</i> , Linn.	Common; extremely large arctic form.
——— <i>rudis</i> , Maton.	Common.
——— <i>limata</i> , Loven.	Common and characteristic.
<i>Rissoa striata</i> , Adams.	
——— var. <i>saxatilis</i> , Möll.	Moderately common.
<i>Rissoa parva</i> , Da Costa.	
——— var. <i>interrupta</i> , Adams.	Common.
——— <i>globosa</i> , Mart.	Rare.
<i>Menestho albula</i> Fabricius.	Fry; rare.
<i>Hydrobia ulvæ</i> , Pennant.	Rare.
<i>Skenea planorbis</i> , Fabricius.	Common.
<i>Homalogyra atomus</i> , Philippi.	Common.
<i>Natica affinis</i> , Gmelin.	Common and large.
——— <i>pallida</i> , Brod. and Sow.	Moderately common.
<i>Purpura lapillus</i> , Linn.	Rather rare.
<i>Buccinum undatum</i> , Linn.	Common and large.
——— <i>Grœlandicum</i> , Chemnitz.	Fine specimens; moderately common.
<i>Trophon truncatus</i> , Ström.	Common; large.
——— <i>clathratus</i> , Linn.	Common; large.
——— var. <i>Gunneri</i> , Loven.	Common; large; developed so as to be characteristic.
<i>Fusus antiquus</i> , Linn.	Common.

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<i>Pleurotoma turricula</i> , Montagu.	Rather rare.
———— <i>pyramidalis</i> , Brown.	Common and characteristic.
<i>Cylichna alba</i> , Brown.	Rather rare.
———— <i>cylindracea</i> , Penn.	Rather rare.
<i>Utriculus obtusus</i> , Mont.	Moderately common.
———— <i>hyalinus</i> , Turton.	Rare.

CRUSTACEA.

<i>Balanus porcatus</i> , Da Costa.	Common; attached to large Boulders.
———— <i>balanoides</i> , Linn.	Common.
———— <i>crenatus</i> , Brug.	Common; attached to <i>Astarte compressa</i> , and covering the entire valve.
<i>Verruca strömia</i> , Müll.	Common; fragments.

ANNELIDA.

<i>Spirorbis spirillum</i> , Linn.	Rare.
———— <i>carinatus</i> , Flem.	Rare.

ECHINODERMATA.

<i>Echinus Dröbachiensis</i> , Müller.	Spines and plates common; one specimen nearly perfect.
<i>Ophiocoma bellis</i> , Link.	Spines and plates.

ZOOPHYTA.

<i>Membranipora craticula</i> , Alder.
———— <i>unicornis</i> , Fleming.
<i>Discopella hispida</i> , Flem.
<i>Crisia eburnea</i> , Linn.
<i>Canda reptans</i> , Linn.

FORAMINIFERA.

<i>Biloculina ringens</i> , D'Orb.
<i>Quinqueloculina seminulum</i> , Linn.
———— <i>agglutinans</i> , D'Orb.
———— <i>subrotunda</i> , Montagu.
———— var. approaching to <i>Hamerina compressa</i> .

Lituola scorpiurus, Montford.

Lagena striata, Montagu.

——— *levis*, Montagu.

—— — *distoma*, P. & J.

——— *marginata*, Montagu.

——— *globosa*, Montagu.

Polymorphina compressa, D'Orb.

Discorbina rosacea, D'Orb.

Truncatulina lobatula, Walker.

Rotalia Beccarii, Linn.

Patellina corrugata, Will.

Polystomella striato-punctata, J. & J.

Nonionina depressula, W. & J.

SPONGE.

Cliona celata, Grant.

ALGÆ.

Jania rubens.

Corallina officinalis, Linn.

Melobesia polymorpha, Linn.

XXI. *From GEOLOGY to HISTORY.* By Professor JOHN YOUNG.

(Read 28th October, 1868.)

NUMEROUS as are the writers on Man's relation to the Animal Kingdom, they may be divided into two great groups, according as the differences which are admitted on all sides, or the structural resemblances assume the greatest prominence. With the one school, the position of man is wholly exceptional among the animals. True he possesses the same organization as they: but his mind is asserted to be a new creation; nay, more, his gift of intelligence is not left to discover the means of utilising itself. He is provided with the elementary instruction, however slight, of Whately, the instinctive notions of smaller and weaker thinkers.