

are bent over, and dragged down the slope of the hill, is particularly well shown."

Perhaps, if Mr. Strahan had seen this section open as I did, he might not have said in the discussion that "in drawing a section through Bincombe he found there was not room for the whole of the chalk below the Tertiary outlier"—for it is not an "outlier" in the usual sense of the word. The chalk and these Tertiaries are, in fact, both tilted together. The chalk at the mouth of the tunnel, about a quarter of a mile to the west, is distinctly vertical. I watched the construction of the tunnel, and am certain of this. I think, therefore, that the Tertiaries above Bincombe are a V-shaped mass, let in along a fault where nearly vertical beds abut on nearly horizontal chalk, as is the case at Ballard Head; although at that place there are no Tertiaries, only vertical chalk abuts on horizontal chalk. But there are localities in the same run of country where vertical chalk is backed by Tertiaries; for instance, at Arisk Mell, and at West Lulworth. Section No. 2 of Sheet 22 of Horizontal Sections of the Geological Survey shows a small patch of Tertiaries, caught in between the vertical chalk of Bindon Hill and horizontal chalk north of it. At all these places I suspect the structure to be as at Bincombe, and much as is indicated in Diagram No. 2.

If my theory be correct, then the coarse subangular gravel at the south end of the section is the lower, and the sandy pipeclay to the north the higher, part of the series which was exposed.

IV.—NOTE ON SOME CRETACEOUS FOSSILS FROM THE DRIFT OF MORESEAT, ABERDEEN.

By G. SHARMAN and E. T. NEWTON.

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IN the year 1856 Mr. J. W. Salter and Mr. W. Ferguson described before the Geological Society (Q.J.G.S., vol. xiii, p. 83, 1857) a series of fossils which had been collected from Drift material at Moreseat and other localities near Aberdeen, and seemed to indicate the occurrence of Cretaceous rocks *in situ* at no great distance from this locality.

These fossils were divided into two sets—a series contained in flint, which was referred to the Chalk, and a series preserved in fine sandstone, which was regarded as Upper Greensand.

The genera and species recognized in the flints doubtless included both Lower and Upper Chalk forms; and those recorded from the sandstone, fairly indicated an Upper Greensand facies; but it will be seen from the additional specimens lately collected, that beds of Lower Greensand age are likewise represented.

Mr. D. J. Mitchell, of Black Hills, Aberdeen, and Mr. A. M. Insch, have recently collected fossils from the same locality of Moreseat, Cruden, Aberdeenshire; and these, through the kind offices of Prof. J. W. Judd, have been forwarded to the Geological Survey for identification, and present points of interest which at the first were not apparent.

The specimens sent, which number between two and three hundred, are all in the condition of internal and external moulds, in a light-coloured, fine-grained sandstone; and although slight differences may be noticed in different pieces of the rock, they are all so similar that one can scarcely question their having been originally derived from the same bed. Notwithstanding this the fossils clearly indicate more than one horizon.

Most of Salter's type specimens are preserved in the Museum of Practical Geology, having been presented by Mr. Ferguson; and the matrix of those referred to the Upper Greensand is like that of the specimens which form the subject of this note.

Several forms, in addition to those mentioned by Salter, have been identified; and as some indicate lower horizons than the Upper Greensand, some remarks upon certain of the species are called for. These specimens being, as above stated, in the condition of moulds, it has been necessary to take impressions of the cavities; and these give the external forms of the shells, some of which are thus reproduced in a beautifully perfect manner; this was especially the case with the *Trochus pulcherrimus* and *Echinocyphus*. At first we were prepared to find these fossils to be of Upper Greensand age, as stated by Salter; and when we became aware that several of the forms were of a Lower Greensand or Speeton Clay type, we consulted with our friend and colleague, Mr. Lamplugh, who for years has been familiar with the Speeton fossils, and he at once recognized in the Ammonites and some other forms a distinctly Speeton facies. We are much indebted to him, not only for valuable suggestions, but also for the opportunity of comparing our specimens with his large series of Speeton fossils.

CEPHALOPODA.

Ammonitidæ.—Three Ammonites were recognized by Salter, but only one specific name was given in the list, namely, *Ammonites Selliquinus*, Brong.? and this with doubt. We have seen nothing that could be referred to Brongniart's species.

Ammonites (Olcostephanus) Speetonensis, compressed variety.—The two forms figured by Salter, but not named, we have recognized. One of these (Salter, pl. ii, fig. 10) was said to be allied to *Ammonites Jeannotii* (D'Orb., Terr. Cret., pl. lvi); but we recognize a closer relationship to *Ammonites Speetonensis*, and it seems to us to come nearest to the form called by Pavlow *Olcostephanus (Simberskites) Payeri* (Bull. Imp. Soc. Moscow, 1891, pl. xviii, fig. 1); but although flatter forms than that figured by Pavlow occur at Speeton, none are so much compressed as some we have from Moreseat; this, however, may be due to pressure in the rock. The obliquity of the ribs varies in different specimens. We regard this Ammonite as a flattened variety of *A. Speetonensis*. The *Olcostephanus Phillipsii* (Neumayer, Palæont., vol. xxvii, pl. xv, fig. 7) from the Hilsbildungen, is another closely allied form.

The second specimen figured by Salter (pl. ii, fig. 9) is related to the flattened variety of *Speetonensis*, and this we have also recognized,

but only by fragments which prevent a definite determination. Our specimens do not allow us to see so near an alliance with *Ammonites Pailletteanus*, as Salter and Baily seemed to recognize (Q.J.G.S., vol. xiii, p. 87).

Ammonites (Hoplites) Mortilleti, Pictet and De Loriol.¹—Several fragments, and one or two more perfect specimens, indicating Ammonites of from one to two inches diameter, we refer to this species. At first we thought they were *A. noricus*; but the ribs upon the back do not tend to meet at an angle as they do in that species. The specimens all seem to show that the shell was compressed to about the same extent as, or even more than, in *A. noricus*; that the umbilicus was very open, there being scarcely any overlap of the whorls; the outer ones doing little more than touch the inner ones. Around the umbilicus the ribs are nodular, and upon the sides they quickly divide into two or three ribs which pass to the back with a slight sigmoid curve; the curve is probably more marked in larger shells. On each rib, where it bends over to the back of the Ammonite, there is a small but distinct tubercle. The ribs extend a short way towards the middle of the back, and at right angles to it, but a smooth space is left along the middle line. There is no evidence of the ribs upon the back being angulated as they are in *Ammonites noricus*. This Moreseat Ammonite has some resemblance to *Ammonites splendens*, but in that species the back is more definitely flattened, the tubercles are really swollen terminations of the ribs, and the umbilicus is very small.

There is one specimen in Mr. Lamplugh's collection from the upper part of the *Noricus* beds at Speeton, about one inch in diameter, which we believe to be specifically identical with the form now being considered; and there is a second which M. Pavlow has referred to *A. (H.) Mortilleti*. It seems very probable that the two Speeton forms are the same species; but the one seen by M. Pavlow, which is nearly $1\frac{1}{2}$ inches in diameter, has the tubercles, upon the outer part of the last whorl, placed at irregular intervals.

Crioceras Duvalii?—Several fragments, some indicating whorls $1\frac{1}{2}$ inches wide, and others much smaller, are doubtless referable to this genus: the large transverse ribs, with several smaller ribs in between them, and the presence on some of the larger ribs of spines, irregularly placed, give to these specimens a strong resemblance to *Crioceras Duvalii*; but the evidence is not sufficient for definite determination.

Belemnites.—Several pieces of *Belemnites* have been detected, but they are too small and fragmentary for determination; one may, perhaps, be *Belemnites minimus*. Mr. Lamplugh, comparing these with Speeton forms, detects nothing that could be referred to *Belemnites lateralis*, but thinks it just possible one or two may be portions of *B. jaculum*.

¹ Paléont. Suisse, Neocomien des Voirons, 1858, p. 21, pl. iv, fig. 2.

GASTEROPODA.

Trochus pulcherrimus, Phil.—Several specimens, about one-third of an inch in length, referable to this species, have been recognized; Phillips' figure of a specimen from the Speeton Clay is scarcely sufficient to allow of identification; but examples in the Museum of Practical Geology and in Mr. Lamplugh's collection seem to be identical with the Moreseat specimens. There is some slight variation to be traced among the specimens from each locality; but all seem to be characterized by two keels, more or less crenulated, one at the lower part and another at the upper part of each whorl, between which there is a broad, concave area, marked by numerous fine, oblique threads, running in the direction of the lines of growth, and crossed by a few longitudinal threads. The flattened base is similarly marked by two sets of lines, which, being much coarser, give a more cancellated appearance to this part of the shell. There is no umbilicus, and the mouth is nearly round.

Trochus, sp.—Another form, about half an inch in length, which we refer to this genus, is likewise represented in the Speeton Clay; its sides are flat, and the sutures are not depressed, so that it forms an almost complete cone with flattened sides. At the top and bottom of each whorl there is a slightly crenulated ridge, and between these there appear to have been fine, oblique lines of growth.

Acteon, sp.—Two or three specimens referable to this genus have been noticed: the body-whorl is inflated and marked by a few (four or five) impressed lines; the spire is little more than half the height of the body-whorl.

Cerithium aculeatum, Forbes MS., var.—There is one mould of a *Cerithium* very well preserved, which agrees so closely with the specimens from Speeton, to which Prof. Forbes attached the above name, that we feel assured it is the same species, or, at most, a variety of it; and we gladly adopt the name, although no description of the species has yet been published. The Moreseat specimen is $\frac{7}{16}$ ths of an inch long and $\frac{1}{8}$ th of an inch wide at the largest part; and one may count 13 or 14 whorls. Each whorl has a strongly-marked nodular ridge near the top, and another, slightly smaller, at the base; between these are two, sometimes perhaps three, thread-like lines, and there are indications of a fine line at the top and another at the base between the suture and the larger ridges. The base of the last whorl is rounded and marked by four to six longitudinal lines. The whorls are crossed obliquely by strong ribs, eight of which may be seen at one time on the lower whorls. The ribs are large above and rapidly attenuate below, and where they cross the longitudinal lines produce nodular markings.

Compared with the Speeton Clay *C. aculeatum*, it will be noticed that in the latter the ridges and ribs are more sharply cut, and the thread-like lines at the top and base of each whorl are more definite; and, further, each whorl has three longitudinal lines between the two larger ones; also, about nine ribs may be counted on one side of each whorl.

LAMELLIBRANCHIATA.

Astarte (Venus) striato-costata, Forbes.—There are several small specimens of an *Astarte* with few and strongly-marked ribs, which without doubt are the same as some from the Lower Greensand in the Museum of Practical Geology, and there is no question as to these being the forms called by Forbes *Venus striato-costata*. One of the Moreseat specimens, however, shows a very definite lunule, and the margins of the shell are crenulated; so that its reference to *Astarte* seems to us necessary. The correctness of Forbes' reference of these to *Astarte striato-costata* of D'Orbigny may be open to doubt, but for the present that name is retained.

Trigonia vectiana, Lyc.—Two or three small pieces of a *Trigonia*, which so far as they are preserved agree better with *Trigonia vectiana* than with any other form, are referred to that species.

Goniomya, sp.—One fragment of a *Goniomya* has been detected; but while there is no question as to the genus, it is not sufficient for specific determination; it might be *Goniomya Villercensis*, a doubtful example of which is in the Cunnington Collection in the Museum of Practical Geology.

Cyprina Fergusoni, Salter.—Many fragments appear to us to represent Salter's species, the type of which has been compared; but with them there are portions of another form, having similar thread-like markings, but a different outline, and these we refer to the following genus.

Lucina, sp.—Several fragments, and one or two nearly perfect moulds of the exterior, indicate the genus *Lucina*. The markings on these specimens are fine, concentric thread-lines, so like those of *Cyprina Fergusoni* that it is uncertain to which genus many fragments belong. The more perfect examples, however, have less prominent umbones than *Cyprina Fergusoni*, and they overhang the lunule; the entire shell is nearly orbicular. We have been unable to refer this definitely to any described species; the markings are similar to those of *Lucina Dupiniana* of D'Orbigny (pl. colxxxii), but the produced anterior extremity of that shell, and its prominent umbones, are unlike ours. There are some specimens from the Upper Greensand, in the Museum of Practical Geology, somewhat resembling these Moreseat specimens, which have been doubtfully referred to *Lucina Dupiniana*.

Cucullæa carinata, Sby.—This is, perhaps, the most abundant fossil among the Moreseat specimens, and occurs both as internal and external casts, the largest being a little more than an inch long; it seems to us to agree with the true *C. carinata*, the strong ribs both at the front and back of the shell being of uniform size and not as described in *Cucullæa securis*, D'Orb., which is one of the forms occurring at Speeton.

Cardium Raulinianum, D'Orb.—Two or three examples of a finely-striated *Cardium*, about half an inch in diameter, are referred to this species.

Arca Raulini?, D'Orb. — One specimen, showing part of both valves, is in all probability this species.

Plicatula placunea, Lamk. — There are many specimens, more or less fragmentary, which are referred to *Plicatula placunea*; they are very strongly marked, and agree closely with examples in the Museum of Practical Geology. The variable nature of this genus may lead to doubt as to the correctness of this determination; but none of the Upper Greensand species are so coarsely marked as these from Moreseat, while those from the Lower Greensand agree precisely.

Lima Dupiniana, D'Orb. — Two specimens from Moreseat agree better with this species than with *Lima semisulcata*; the outline of the shell is less equilateral than in the last-named species, the ribs are sharp and fine, with little or no ornamentation, and the interspaces are wide. Salter gives *Lima semisulcata* in his list, but it is just possible that it may be the same form as the one we now have.

Gervillia solenoides, DeFr. — This species is represented by one very perfect specimen, about two inches long, which agrees very closely with specimens from the Gault, and consequently is thus named.

LIST OF FOSSILS (CRETACEOUS) FROM MORESEAT, ABERDEEN,
SHOWING RANGE OF THE SPECIES.

Mitchell Collection.	Innes Collection.	Ferguson Collection.		Lower Greensand, Speeton Clay, etc.	Gault.	Upper Greensand.	Chalk.
			<i>Cœlenterata.</i>				
		F.	<i>Micrabacia coronula</i> , Goldf.	—	—	x	x
			<i>Echinodermata.</i>				
		F.	<i>Ananchytes</i> [<i>Holaster</i>]	—	—	—	—
		F.	<i>Diadema</i>	—	—	—	—
		F.	<i>Discoidea</i>	—	—	—	—
		F.	<i>Galerites</i> [<i>Echinoconus</i>] <i>castanea</i> , Brong. ..	—	—	x	x
M.		F.	<i>Enallaster</i> (<i>Toxaster</i>) <i>Scoticus</i> , Salt. ..	—	—	—	—
M.			<i>Echinocyphus difficilis</i> , Ag.	—	—	x	x
			<i>Annelida.</i>				
	I.		<i>Serpula</i>	—	—	—	—
			<i>Polyzoa.</i>				
	I.		<i>Entalophora?</i>	—	—	—	—
			<i>Brachiopoda.</i>				
		F.	<i>Rhynchonella compressa</i> , Lam. [?= <i>dimidiata</i>]	—	—	x	—
M.	I.		<i>Rhynchonella sulcata</i> , Park.	x	x	x	—
M.	I.		<i>Terebratula</i>	—	—	—	—
M.	I.		<i>Waldheimia hippopus var. Tilbyensis</i> , Dav. ..	x	—	—	—

Mitchell Collection.	Insch Collection.	Ferguson Collection.		Lower Greensand, Speeton Clay, etc.	Gault.	Upper Greensand.	Chalk.
<i>Lamellibranchiata.</i>							
M.			<i>Arca Raulini</i> ?, D'Orb.	x	?	—	—
M.	I.		<i>Astarte</i> (<i>Venus</i>) <i>striato-costata</i> , Forbes	x	—	—	—
M.	I.	F.	<i>Avicula simulata</i> , Baily	—	—	—	—
M.			<i>Crassatella</i> (probably)	—	—	—	—
M.			<i>Cardium Raulinianum</i> , D'Orb.	x	x	—	—
M.			<i>Corbula</i>	—	—	—	—
M.	I.	F.	<i>Cucullæa carinata</i> , Sow.	—	x	x	—
M.	I.	F.	<i>Cyprina</i> <i>Fergusoni</i> , Salt.	—	—	—	—
M.	I.		<i>Exogyra</i> ?	—	—	—	—
M.			<i>Gervillia</i> (near to <i>rostrata</i> ?)	—	—	—	—
M.			„ <i>solenoides</i> , DeFr.	x	x	x	—
M.	I.		<i>Goniomya</i> , sp.	—	—	—	—
M.	I.		<i>Inoceramus</i>	—	—	—	—
M.			<i>Lima Dupiniana</i> , D'Orb.	x	—	—	—
M.	I.	F.	„ <i>semisulcata</i> , Sow.	—	—	x	—
M.			„ (near to <i>abrupta</i>)	—	—	—	—
M.	I.	F.	<i>Limopsis texturata</i> , Salt.	—	—	—	—
M.	I.		<i>Lucina</i> ?, sp.	—	—	—	—
M.			<i>Nucula</i> , sp.	—	—	—	—
M.			<i>Ostrea</i> ?	—	—	—	—
M.	I.		<i>Panopœa</i>	—	—	—	—
M.			<i>Pecten orbicularis</i> , Sow.	x	x	x	x
M.		F.	„ (probably the <i>P. corneus</i> of Nils., not of Sow.)	—	—	—	—
M.		F.	<i>Pectunculus umbonatus</i> , Sow.	—	—	x	—
M.	I.	F.	<i>Pinna tetragona</i> , Sow.	x	x	x	—
M.	I.		<i>Plicatula placunea</i> , Lam.	x	x	—	—
M.	I.		<i>Spondylus</i>	—	—	—	—
M.	I.		<i>Trigonia vectiana</i> , Lye.	x	—	—	—
<i>Gasteropoda.</i>							
M.			<i>Actæon</i>	—	—	—	—
M.	I.		<i>Cerithium aculeatum</i> , Forbes MS.	x	—	—	—
M.	I.		<i>Phasianella</i> (near to <i>eryvna</i> , D'Orb.)	—	—	—	—
M.	I.		<i>Trochus pulcherrimus</i> , Phil.	x	—	—	—
M.		F.	„ (small elongated form) [? = <i>pulcherrimus</i>]	—	—	—	—
M.	I.		<i>Trochus</i> (conical species)	—	—	—	—
M.		F.	<i>Dentalium cœlatum</i> , Baily	—	—	—	—
<i>Cephalopoda.</i>							
M.	I.		<i>Ammonites Mortilleti</i> , P. and De Lor.	x	—	—	—
M.	I.		„ <i>Speetonensis</i> (<i>cf. Payeri</i> , Pav.)	x	—	—	—
M.		F.	„ <i>Selliguinus</i> , Brong. ?	—	—	—	—
M.	I.		<i>Belemnites</i>	—	—	—	—
M.	I.		<i>Crioceræas Duvalii</i> ?, Lev.	x	—	—	—

BRACHIOPODA.

Rhynchonella sulcata, Park. — Several fragments of a coarsely-marked shell are believed, with little doubt, to represent this species.

Waldheimia hippopus var. *Tillyensis*, Dav.—Two moulds of this brachiopod have yielded casts, so exactly resembling examples of this variety in the Museum of Practical Geology, that we have no doubt as to the determination.

ECHINODERMATA.

Enallaster (Toxaster) Scoticus, Salt.—Several more or less fragmentary specimens doubtless belong to the species thus named by Salter and Baily, which seems to be nearly allied to *E. granosus*, from the Neocomian; but as the Moresat specimens are too imperfect to speak of positively, we prefer to allow the above name to remain.

Echinocyphus difficilis, Ag.—One very perfect example of this form we have detected in these collections, and its agreement with Upper Greensand specimens is so close, that it must be referred to this species. This specimen supplies the most definite evidence we have in the Moresat collections of a form only recognized hitherto in the Upper Greensand, or newer beds.

A study of the list on pp. 252–3, with the distribution of the species, will suffice to show that the Moresat fossils represent more than one of the horizons recognized in the southern parts of Great Britain; for while the *Echinocyphus difficilis*, *Micrabacia coronula*, *Galerites castanea*, and *Pectunculus umbonatus* indicate an Upper Greensand fauna, the *Ammonites*, *Crioceras*, *Trochus pulcherrimus*, *Astarte striatocostata*, *Trigonia vectiana*, *Cardium Raulinianum*, *Arca Raulini*?, *Plicatula placunea*, and *Lima Dupiniana* point even more strongly to a Lower Greensand age. As already pointed out, the rock in which these fossils occur is so similar throughout—although some pieces, it is true, are a little harder than others, and some are stained with iron—that it is difficult to understand their being from different beds; it would seem, therefore, that the faunas which in the south mark the distinct horizons of Lower Greensand, Gault, and Upper Greensand, are, here in Aberdeenshire, included in one bed of nearly uniform character throughout. However that may eventually prove to be, it is clear that these Drift specimens have been derived from beds where a large part of the Cretaceous series of strata occurs; not only Upper and Lower Chalk, and Upper Greensand, as pointed out by Salter, but also beds of Lower Greensand or Speeton Clay age; but nothing so old as the *Belemnites lateralis* beds of Speeton has been detected.

What relations these beds may have to the Lower Cretaceous of Sweden, or to the Neocomians of Heligoland and North Germany, which are now occupying the attention of Dr. Dames and Prof. von Könen, it will be of interest to know; but this must await future investigation.

Note.—Salter's list of "Fossils found in Chalk-flints from Aberdeenshire" (Quart. Journ. Geol. Soc., vol. xiii, p. 84) includes some from Moresat.