flat, sloping, striate continuously with the ribs of the disc; no very distinct anterior area. Teeth very prominent.

This easily distinguished and handsome little species is related to the recent *L. jamaicensis*. It is without the large well-defined, anterior dorsal area which that species seems to have. It is also allied to *L. ornata*, D'Orb.

Upper Miocene, Jamaica.

VI.—*Leda incognita.* (Fig. 1.)

Shell transversely-ovate, compressed, with rounded concentric ribs; rostrated posteriorly. Dorsal areas broad, distinct, circumscribed by the keels which run from the umbones to the extremities.

Lower Miocene, San Fernando, Trinidad.

VII.—*Mactra subovalina.* (Fig. 6.)

Shell triangularly sub-oval, transverse, nearly equilateral, rather thin, compressed, concentrically striate by lines of growth; posterior slope large, and well-defined by the keel running from the umbo to the posterior end; anterior slope smaller, and less defined, the carination running from the umbo becoming obscure towards the extremity.

This belongs apparently to the group of true *Mactræ*, of which the British *M. stultorum* is an example, somewhat allied to the present shell.

Lower Miocene, San Fernando, Trinidad.

V.—On the Belgian Tertiaries.

By Dr. A. von Koenen, of the University of Marburg.

SINCE Sir Charles Lyell published his most accurate and detailed paper "On the Tertiaries of Belgium and French Flanders," geologists could only differ in their opinions on the facts mentioned by him. New discoveries have been made in Belgium only in the last few years; besides the splendid cuttings in the ditches for the fortification of Antwerp, about which I am going to speak afterwards, there has been found, near Mons, by sinking a well, a thick bed of lime and limestone at the base of all hitherto-known Belgian Tertiary beds, containing numerous and well-preserved Tertiary marine and fresh-water mollusca. The discoverers, MM. Cornet and Briart, Engineers of Mines, and most zealous geologists, described very carefully the geological position[1] and afterwards the extension[2] of these lowest Tertiary beds in Hainaut. In their first paper they had tried to determine the Molluscan fauna of this basement bed, after Deshayes' works; but, out of 150 species, they could name only 22, and amongst these there are still some very doubtful ones. These 22 species, belonging to beds superior to the "Glauconie inférieure" and to the "Sables de Bracheux" of the Paris basin, they concluded that the new beds at Mons corresponded in age with a part of the "Calcaire grossier," and with the Upper part of the "Sables inférieurs" (Cuise-la-Motte).

Now the Calcaire grossier and the Sables de Cuise contain a very rich and well-known fauna, so that I concluded,[3] from the small number of species identical to them and to the beds of Mons, that they were of different age, rather than of the same, and the fauna of the

[1] Bull. del Acad. roy. de Belg. 2me serie t. xx. No. 11 and t. xxii. No. 12.

[2] See also Geol. Mag., 1866, Vol. III. p. 174.

[3] Zeitschr. d. D. Geol. Ges., xix., pg. 32.

Sables de Bracheux being very small and little known, and bearing a different aspect, it is not surprising that the correspondence in age of the Sables de Bracheux with the lime-beds of Mons cannot yet be proved by Palæontology, whereas Geology indicates it.

Mr. Cornet has written me recently that he has since recognized his error, and that he is going to rectify it. I have thought it desirable to make this statement in order to save the honour of Palæontology, because Mr. Whitaker[1] has cited the paper of Messrs. Cornet and Briart as a proof that it is unsafe to trust to Palæontological evidence.

I wish, in passing, to say a few words on the ferruginous sandstones from Kent, about which Mr. Whitaker l. c. does me the honour to cite my opinion.

The commonest and best determinable fossil, or rather cast, in Mr. Prestwich's collection was *Arca lactea*, Lin., which I mistook at first sight for *A. pretiosa*, Desh., a species peculiar to the Middle and Upper Oligocene beds, but after careful examination, I recognized that it was the recent species, and in this opinion I was confirmed by the superior knowledge of the late Dr. S. P. Woodward. Besides this species, I believe there were *Terebratula grandis*, *Scalaria foliacea*, and *Emarginula fissura*, L., so that I thought it probable that those beds corresponded with the Red Crag, and in this the late Dr. S. P. Woodward, one of the best judges of this matter, was also of the same opinion. Unhappily I made no list of the determinable fossils, but I hope Mr. Prestwich, who so kindly allowed me to make gutta-percha casts from his specimens, will find them out again, and confirm my statement.

Mr. E. R. Lankester[2] has published a paper "On the Tertiaries in the neighbourhood of Antwerp," by which he introduces into English literature the discoveries and observations made by Messrs. Nyst, de Wael, and Dejardin. He adopts the old division of the Antwerp beds, by Nyst, Dumont, etc, into:

Système Scaldisien.	Sable jaune.
	Sable gris.
Système Diestien.	Sable vert.
	Sable noir.

He calls the Système Scaldisien, Upper and Middle Pliocene; the Système Diestien, Lower Pliocene, not Miocene, (as I had published it two years before), and he tries to prove the correctness of this opinion by the per-centage of recent species in the different beds, and by the resemblance of the fauna of the Système Diestien to that of the Système Scaldisien, and of the Coralline Crag, after the lists published by Mr. Nyst. Now the list of Mr. Nyst of the fossils from the Système Diestien was not intended as a monograph, but purely to illustrate a new locality, so that it is not extraordinary if a number of names are erroneous. On the contrary, it is most natural that Mr. Nyst should have identified the new-found fossils

[1] Quart. Journ. Geol. Soc., 1866, p. 432.
[2] Geol. Mag., 1865, pp. 103-6 and 149-52.

as much as possible with the well-named fossils of his country, in this case especially, with the shells from the Scaldisien. On the other side I must maintain that every Tertiary horizon has as many[1] species in common with the succeeding as with the preceding horizon, that is to say, if they are analogous deposits, and provided there be no sharp lines of division separating them, either into two, three, or four periods, according to the author followed, whether it be Dr. Hœrnes, Sir Charles Lyell, or Professor Beyrich. The division of Professor Beyrich into four periods is in accordance with the geological distribution of the different beds, and has the advantage that the names of the periods, Eocene, Oligocene, Miocene, Pliocene, joined to the words Upper, Middle, and Lower, are sufficient to distinguish all the principal horizons of the Tertiaries.

If, therefore, the Système Diestien resembles the Coralline Crag as much as the Coralline Crag resembles the Red Crag, that is not a reason to put the Système Diestien rather into the Pliocene than into the Miocene. Mr. Lankester proposes to put certain beds of the Vienna basin, which he concedes to be coeval with the Système Diestien, also into the Pliocene; but in doing so, in order not to withdraw one of the Antwerp beds from the others, he tears in two the Vienna beds, which are most certainly identical with the "Faluns de la Touraine," the type of the Miocene, and older than the Subapennine and Crag beds, which are the type of the Pliocene.

I must, say at the same time, that the name of Crag noir ought not to be employed instead of Sable noir or Système Diestien, because these beds do not correspond, either in age, condition, appearance or contents with the English Crag.

The sub-division of the Sable vert ought to be abandoned, because the greenish colour is caused only by the weathering of the black glauconite of the Sable noir, and because the Sable vert lies sometimes below the Sable noir, and contains, moreover, the same fossils, though generally only in the state of casts, the oysters (*Gryphæa navicularis*) alone having the shell preserved. In short, Mr. Lankester very correctly states the difference of the Système Diestien from the Coralline Crag, and its identity with beds generally reputed to be of Miocene age; an identity first announced by me in 1863.[2] But I have since then found that Professor Reuss, of Vienna (one of the best authorities upon *Foraminifera*, *Anthozoa*, and *Bryozoa*), had already pointed out (in his paper "On the *Foraminifera*, etc., from the Système Diestien and from the Miocene of the North of Germany), the great analogy between their fauna. The identity of the Sable noir with the beds of Recken and Winterswyk in the South-east of Holland has been long ago recognised by Messrs. Nyst and Bosquet. A few miles from Winterswyk, near Dingden[3] (north of Wesel), there appear black marly sands (not passed through by a well-boring, in a thickness of 120 feet), containing a very rich fauna, quite similar to that of the Système Diestien, but containing, besides

[1] About 40 per cent, it appears. [2] Zeitschr. d. D. Geol. Ges. p. 460.

[3] See Beyrich, "Ueber die Zusammensetzung der Norddeutschen Tertiaerbildungen." Abhandl. der Koenigl. Acad. zu Berlin, 1856.

some other species, peculiar to the Vienna basin and to the Faluns, such as *Murex aquitanicus*, Grat., *M. Partschi*, Hœrnes, etc. About 20 German miles to the east from this place, there are, in numerous places, near Berssenbrück, north of Osnabrück, black sandy and marly clay-deposits of about 160 feet in thickness, with the same fossils repeated. About 30 German miles further to the east-north-east, the black clay once more appears, near Lüneburg, with a similar fauna, and again, about 15 miles from this, a yellow marl, with nearly the same fossils, is met with also near Gühlitz, near Terleberg or Wittenberge (on the railway, mid-way between Berlin and Hamburg). This is the farthest known point of this Miocene basin to the south-east. From thence the Miocene beds spread over the western part of Mecklenburg, where they sometimes occur as hard sandstones, with casts of marine shells (Bokup Reinbeck).[1] In the western part of Holstein, Schleswig, and on the Isle of Sylt, black micaceous clay-deposits appear frequently, with a similar but rather poorer fauna, somewhat more approaching that of the Coralline Crag. In the eastern part of Holstein and Mecklenburg, erratic blocks are frequently met with, containing a richer and older fauna, that is to say of Lower Miocene age.

There has been apparently no direct communication with the Miocene sea in Bohemia and Galicia, the extension of which into Upper Silesia has been explained and illustrated by Professor Beyrich, in his most important work already referred to.

So far for the distribution of the Miocene beds in the North of Germany. As to the fauna, there is yet little known; it is described by Professor Beyrich in his still unfinished work, and in some lists by Mr. Semper. I can only assure English geologists that the fauna much more resembles that of the Vienna basin, and of the Subapennine formation, than that of the English Crag, and of the Système Scaldisien, near Antwerp. It seems quite natural that the Miocene of the North of Germany should contain more Subapennine forms than the Vienna basin, because there has clearly been a migration of many species from the North to the South, as is now generally accepted by most geologists.

Another paper, "On the Kainozoic Formations of Belgium,"[2] has been published last year by Mr. Godwin-Austen, against which Mr. Lankester, Mr. Searles Wood, and others have more or less energetically remonstrated in different papers, especially with regard to some points advanced as to the formation of the English Crag. Mr. Searles Wood, with his long years of experience of the Crag-beds, did not think it possible to admit the theories and many of the observations as to the state and condition of the Crag-sea, as explained by Mr. Godwin-Austen. There cannot be any very strong opposition offered to such a high authority; but as I find that Mr. Godwin-Austen has published a number of observations, made at Antwerp, during his short stay, which have not yet been disputed,

[1] See Koch in Zeitschr. d. D. Geol. Ges. vi. pp 22 and 269; viii. p. 249. Meyr in Zeitschr. d. Deutsch. Geol. Ges. iii. p. 411.

[2] Quart. Journ. Geol. Soc., London, vol. xxii. p. 228. 1866.

I venture to offer a few remarks thereon. I have visited Antwerp upon five separate occasions, in three different years, and have always seen new cuttings in the main ditch at the forts, and in the excavations for a new harbour between the town and the Fort d'Austruweel. I have stayed there altogether above two months collecting a large quantity of fossils, mostly from the untouched beds, and as my observations differ in so many parts from those of Mr. Godwin-Austen, I think it necessary to call attention to, at least, the more important ones, on which he bases his theories. It is most unfortunate that he does not follow in his paper the divisions of the Tertiaries of any of the authors who had already described these beds; and that he does not himself explain where he intends to make these divisions, nor the names by which they shall be called. It is impossible, therefore, to say much about this point; but there are certainly more than two Tertiary horizons. The Barton clay does not correspond in age with the "Rupel clay" (which Mr. Godwin-Austen calls Rupellien clay), as stated by him (p. 234, *op. cit.*). The Tertiary beds of Cassel, Luithorst, Freden, and Diekholz, which he puts into the Upper Kainozoic (p. 241), are older than the Faluns de la Touraine, and coëval with the Grafenberg, near Düsseldorf, and the Sternberg sandstones which he puts (p. 237) into the Tongrien; but the Tongrien of d'Orbigny is not well defined. That of Dumont and that of Ch. Mayer is older than all these. The Faluns of Touraine and most of those of Bordeaux are older than the Crag and the Cotentin according to the opinion of all other geologists, whereas Mr. Godwin-Austen says they were synchronous (p. 239), but without giving any reason for this opinion.

This classification, then, of Mr. Godwin-Austen's, invalidates his otherwise valuable map, because so many different periods are confounded together. As to his theories about the condition of the Crag-sea area, and the origin of its deposits, I cannot agree with him at all, because I have observed many important facts differing very much from those stated by him.

For example, he considers the "Sable noir" as coëval with the Coralline Crag, but thinks it impossible to separate these from the Red Crag and from the Scaldisien (called in Mr. Godwin-Austen's paper "Scaldésien"), because this should "contain only dead and drifted shells," (p. 233), "wholly extraneous to it, belonging to all regions of depth, and all periods of the Crag formation" (p. 238),

The difference of the fauna of the "Sable noir" and of the Coralline Crag is explained by him (p. 238) "by the differences which result from depth and condition of sea-bed," and (p. 241) "taken together both form a complete marine fauna, representing a greater range of sea-zones." The Système Diestien was deposited in thirty to forty fathoms (p. 233), in a maximum thickness of four metres (p. 233). The Système Scaldisien was (p. 232) "heaped up under inconsiderable depths of water," and formed about six feet, but at no place exceeded probably eight feet;" it was a dead shell gravel; "not one of the shells had lived where it is now found."

Now I can assure Mr. Godwin-Austen that the thickness of the

different beds is much more considerable. The "Sable jaune" attains, near Deurne, a thickness above fifteen feet; the "Sable gris," in the new harbour (or dock?) between the town and the Fort d'Austruweel, as far as I remember, about twice as much; the "Sable noir; attains six metres near the fort (according to the section of Captain Dèjardin).

I have collected in the Scaldisien beds between Deurne and the Fort d'Austruweel the following species of bivalve shells, in a splendid state of preservation, partly even with the ligament preserved:—*Lingula Dumortieri*, Nyst., *Terebratula grandis*, Blum., *Ostrea edulis*,* *Pecten tigrinus*, Müll., *Pecten opercularis*, L., *Modiola sericea*, Goldf.,* *Pinna* sp., *Leda* sp.,* *Nucula* sp., *Astarte Basteroti*, La Jonk.,* *Astarte Omalii*, La Jonk.,* *Astarte Burtini*, N., *Cyprina islandica*, L., *C. rustica*, Wood,* *Isocardia cor*, L.,* *Artemis exoleta*, *Lucina borealis*, L.,* *Axinus sinuosus*, Sow.,* *Tellina Benedenii*, Nyst.,* *Solen*, two sp., *Mya truncata?* L., *Panopœa Menardii? Glycimeris angusta*, L., and many others. My collection and my books being packed up, on account of leaving Berlin in order to settle at Marburg, I am obliged to write down from memory only those species about which I am quite sure. I mark by asterisks the species which were rather common bivalves.

I think there can be no doubt, *first*, that these species *have* lived where I found them; *secondly*, that some of them indicate a much greater depth of water than Mr. Godwin-Austen gives credit for in the Système Scaldisien; and, *thirdly*, that they are not washed out from the Système Diestien, in which, with few exceptions, they do not occur at all.

I have indeed seen, near Deurne, some Scaldisien beds, with numerous broken shells, which undoubtedly were "terrains remanies," *but only by former fortification-works.* A dead-shell gravel might also be seen in a few places, but I have never found any shell in it which was not common in the finer sandy beds in the neighbourhood. Some beds near Deurne, several feet thick, consisted only of fragments of *Pecten grandis*, *P. striatus*, *P. opercularis*, etc.; but the shells had been crushed at that very place, the pieces of every shell lying flat together; there was no clay or sand there to protect them against the pressure of the overlying beds. The deepest cutting I have seen was in the before-mentioned harbour (or dock) near the Guano-magazine, north of the town. There was at the bottom, still, fine grey sand with numerous specimens of *Axinus sinuosus*, and *Modiola sericea*, and other shells, always having both valves. Somewhat higher I have found several *Panopœa*, also, with both valves, and still higher the *Mya*, oysters, *Isocardia*, etc., mostly with both valves.

It is very probable that some Scaldisien beds, particularly of the Sable jaune, in the main ditch, indicate shallow water; but others, particularly of the Sable gris, undoubtedly have been deposited in a similar depth as the Sable noir, so that the difference of fauna between the Scaldisien and the Diestien cannot be explained by difference of depth. I do not think that I have collected a single

species in the Système Scaldisien, near Antwerp, that does not occur in the English Crag. There is, therefore, no reason to disbelieve the geological and palæontological evidences, that the Système Diestien is older than the Crag, and that the Système Scaldisien is the exact equivalent of the Crag.

If the Sable jaune (or Sable rouge) resembles more in its fauna the Coralline Crag than the Red Crag, to which it is referable, by reason of its being the upper member of the Scaldisien, that may be explained by the different condition and structure of the Red Crag, which was deposited, apparently, in a more agitated or shallower sea.

As to the Système Diestien I have explained my views before. The scheme, therefore, is this:—

		England.	Belgium.	Germany.
Pliocene		Red Crag. Coralline Crag.	Système Scaldisien. { Sable jaune. Sable gris.	
Miocene			Système Diestien and Boldérien { Sable noir and Iron-sands.	Schleswig. Dingden, Berssenbrück, Lüneburg, Gühlitz, etc.
Oligocene.	Upper.		Elsloo, near Maestricht.	Cassel, Freden, Bünde, Crefeld. Sternberg, Wiepke.
	Middle.	Hempstead series Bembridge series.	Système Rupélien. Systéme Tongrien, super.	Hermsdorf, Söllingen. Stettin, Cassel, Bünde.
	Lower.	Headon series. Brockenhurst.	Système Tongrien, inf.	Lattorf, Westeregeln, Ursberg, Helmstädt, Bünde.

In conclusion, I may say it was most instructive to me to see the different species distributed in the different places, and how each had its peculiar locality. Thus, I remember a place where, in the Sable noir, below the *Pectunculus* bed, there were large numbers of bivalve *Panopæa* to be seen, though very difficult to be got out entire. In another place, near the railway, I collected, at least, fifty examples of *Pecten Brummelii*, Nyst., having a diameter of about four inches, a species reputed very rare by Belgian geologists. It is very unfortunate that the fortification-works are now finished. Last year I could not find a single specimen worth picking up. Let us hope that the fortress of Antwerp may soon become too small for the requirements of Belgium, and that there will be new ditches made around the city to yield future collectors additional examples of these beautiful fossil shells and corals.