

of the terrace is above the summit level of the pass, it will be difficult to avoid the conclusion that it is an old sea-margin. At the time I first saw the water-mark and terrace, I had no hesitation about ascribing them to the sea; but on returning to England, I found that the Norwegian geologists do not admit so great a depression. I cannot see that the mere absence of shells is an insuperable objection to the beds in question being marine; for surely the climate might have been unfavourable to the existence of shell-fish.

If, on the other hand, the said terrace is on a level with the watershed (and there is certainly no great difference between them), one is irresistibly led to think of the similar case of the parallel roads of Glenroy, and to speculate on this terrace too having been due to the waters of a gigantic Marjelen See, dammed back by ice till it overflowed the summit of the pass at Molmen; and it is significant that I could see no trace of terrace or water-mark on the Romsdal side of the pass.

But the above is not all. There is in the same district a second horizontal mark on the solid rock, several hundred feet higher than the 2000 one. This, too, appears to correspond with sand-terraces in the recesses of the high glens; but I was not able to visit it, and can form no more than a guess as to its height; it probably is as high as the plateau of the Dovre Fell,—that is, more than 3100 feet above the sea. This plateau I know to be covered with large gravel mounds between Dombaas and Folkstuen. Here, again, it is striking, that the water-mark should seem to correspond with the level of a watershed. But it is useless to speculate, and would be absurd to offer an opinion on the subject without examining the ground. I will merely say, that only one of two conclusions seems open to us; either the terraces and water-marks are old sea-margins, or else they are the margins of huge ice-dammed lakes.

The fells rising above the high-level terraces and water-marks are rounded, and of a general moutonné look. This general glaciation of the high fells must have taken place either before or simultaneously with the deposition of the terraces, as any subsequent ice-sheet would inevitably have swept them clean way.

The Norwegian Geological Map represents the valley, above and below Dovre, for the distance of forty-one kilometres, as occupied by alluvial and post-glacial sand; but whether this is intended to include the high-level terraces as well as the sand-heaps in the valley bottom I do not know, but presumably it is.

NOTICES OF MEMOIRS.

I.—ONDULATIONS DE LA CRAIE DANS LE NORD DE LA FRANCE—
DEUX SYSTÈMES DE PLIS,—ÂGE DE CES PLIS. Par M. HÉBERT.
(Annales des Science Géologiques, tom. vii. No. 2, Paris, 1876.)

IN a paper read before the Société Géologique de la France, in June, 1875, M. Hébert described a series of nearly parallel

folds in the Chalk of Northern France, running in a general direction from S.E. to N.W. These folds, five in number, he distinguished as the axes of Perche, the Seine, Bray, Bresle, and Artois.¹ These are crossed almost at right angles by a second set, also nearly parallel, whose general direction is consequently about S.W.—N.E. To describe this second series, and to advance some general views on the probable age of the folds in both, is M. Hébert's object in the paper under consideration.

The first fold of this second series starts at Rouen, and runs in a straight line through Aumale to Pecquigny, whence it is prolonged in a N.E. direction, passing a little to the south of Arras towards Douai and Tournay.

The second brings the Glauconitic Chalk to the surface at Presagny l'Orgueilleux and La Madeleine, near Vernon, and passes in its north-east extension close to Breteuil (Oise), cutting the axis of Bray a little to the south of Ville-en-Bray. If prolonged in a south-west direction, it would pass between Evreux and Conches by the important fault which has determined the outcrop of the Glauconitic Chalk in the valley of the Iton.

The third fold runs along near the shores of the Channel. Starting from Pétreval, near Fécamp, it extends with a curve, or bend, to Dieppe, where it is probably represented by the fault described in a previous paper.² At both Fécamp and Dieppe the beds dip at a higher angle on the N.W. than on the S.E. side. Supposing it to continue in the same direction on leaving Dieppe, it would then pass through Beaurainville, north-west of Hesdin, intersect the axis of Artois at Fruges, and terminate at Dennebrœucq, where the Devonian beds crop up.

The presence of these several folds leads the author to conclude, in opposition to several eminent English geologists, that one, if not more such folds exist in the bed of the Channel, which will offer serious obstacles to the construction of a tunnel in the Chalk as proposed. That such undulations do exist there, he considers to have been conclusively proved by the soundings conducted by MM. Potier and De Lapparent. One of these (the fourth of this series) would be nearer to the English than the French shore, but parallel to the Sandgatte coast, and consequently to the other three.

The fifth and last of the series is also the southernmost. Commencing at Ferté-Bernard, it stretches in a N.E. direction, past Beynes to Compiègne, and is exactly parallel to that between Vernon and Breteuil.

Respecting the ages of the folds of both the S.E.-N.W. and S.W.-N.E. series, M. Hébert comes to the following conclusions:—

1. The first, or oldest, is the synclinal fold, in which the Wealden

¹ The correspondence of some of these axes with others on this side of the Channel had already been pointed out by M. Ch. Barrois in a communication read before the same Society in March, 1875. Thus the axis of Artois is probably represented by that of Kingsclere; the axis of Bresle by that of Winchester; and the axis of Bray by that of the Isles of Wight and Purbeck.

² Bull. Soc. Géol. de France, 2^e série, tom. xxix. p. 586, and *ibid.* 3^e série, tom. iii. p. 526.

beds were deposited; in age between the Jurassic and Cretaceous periods; and belonging to the S.W.-N.E. series.

2. The second, also synclinal, is the depression of the Somme; in age, between the Wealden and Neocomian; belonging to the S.E.-N.W. series.

3. The third, also S.E.-N.W., is the first indication of the elevation of the Boulonnais and the Weald, and took place between the Gault and Glauconitic Chalk periods.

4. The fourth is the S.W.-N.E. anticlinal ridge from Ferté-Bernard to Brunelles.

5. The three S.E.-N.W. folds of the Perche hills follow next, posterior to the Chalk with *Inoceramus labiatus*, anterior probably to that with *Terebratella Bourgeoisii*, but at all events of Turonian age.

6. The above-named crumplings doubtless acted on other parts of the basin besides those named, but it was especially after the deposition of the Chalk with *Micraster cor-anguinum* and before that of the Chalk with *Belemnitella*, that the S.E.-N.W. elevations of the Seine, of Bray, Bresle, and Artois were clearly defined.

7. The S.W.-N.E. fold of Pressagny-l'Orgueilleux to Breteuil, also anterior to the Chalk with *Belemnitella*, was coincident with an upheaval of N.W. France, and the formation in the north-east, in Flanders, of a channel, apparently the only one, connecting the Paris Basin with the North Sea.

8. Finally, between the periods of the Chalk with *Belemnitella mucronata*, and the Pisolitic Chalk, an increase of elevation took place in the S.W.-N.E. axes of Bray and the Seine.

The lateral pressures which have caused these two systems of folds seem generally to have acted alternately, and so far from having formed them at once, appear to have acted through successive epochs. The S.W.-N.E. system showed itself first; but as far as the actual configuration of the ground is concerned, the S.E.-N.W. series exercised the more considerable influence, inasmuch as its action was prolonged to the close of the Tertiary deposits of the Paris Basin, destroying or at least obliterating the effects of the perpendicular folding.

II.—ON A RECENT DISCOVERY OF CARBONIFEROUS BATRACHIANS IN NOVA SCOTIA. By J. W. DAWSON, LL.D., F.R.S. (American Journal of Science and Arts, vol. xii., Dec. 1876.)

THE erect Sigillariæ inclosed in the sandstone overlying coal-group 15 of Section XV. Division 4, of the South Joggins section, have already furnished Principal Dawson with numerous remains of the reptilia of the Coal Period. The contents of another of these hollow stems have recently been investigated by him with great success.

Thirteen skeletons, representing six species, were brought to light, besides several Millipedes and shells of *Pupa vetusta*. These remains enable Prof. Dawson to give fuller descriptions than hitherto of the genera *Hylerpeton*, *Dendrerpeton*, and *Hylonomus*, and to add two new species to the first-named genus, viz.—*Hylerpeton longidentatus*, and *H. curtidentatus*.