	Upper Chalk with flints.	Lower Chalk without flints.	Chalk Marl & Totternhoe Stone.
CONCHIFERA MONOMYARIA (continued).			
<i>Gryphea globosa</i>	*		*
<i>Ostrea</i> , various sp.	*	*	*
<i>Dentalium difforme</i>	*		
<i>Hipponyx</i>	*		
<i>Scalaria compacta</i>			*
<i>Pleurotomaria perspectiva</i> .	*		*
<i>Turbo</i>		* "Chalk- Rock." ¹	*
<i>Aporrhais stenopteris</i>			*
<i>Belemnites</i>	*		*
<i>Nautilus</i>			*
<i>Ammonites varians</i>			*
<i>Ammonites</i>	*		
<i>Turritites triplicatus</i>			*
PISCES.			
<i>Ptychodus mammillaris</i> ...	*		
" <i>decurrens</i>	*		
" <i>latissimus</i>	*	*	*
" <i>polygyrus</i>	*		
<i>Corax falcatus</i>	*		
<i>Saurodon</i>	*		
<i>Enchodus</i>	*		
<i>Otodus appendiculatus</i>	*		
<i>Lamna acuminata</i>	*	*	*
<i>Notidanus microdon</i>			*
<i>Coprolites</i> of <i>Macropoma</i> ...			*
REPTILIA.			
<i>Ichthyosaurus</i>			*

VI.—THE ANGLO-BELGIAN BASIN.

By the Rev. JOHN GUNN, M.A., F.G.S.

THE principal object of a paper which I read at the British Association was to point out the connection between an ancient river running on the Continent, in the direction of the Rhine, and the estuarine deposit of the Forest bed, on the eastern coast of this country. Many geologists have maintained that such a river ran from south to north, which would be in the direction of the Straits of Dover. In proof of the correctness of this supposition, I mentioned that numerous vertebræ of whales had been found in the estuary, which indicated an opening to the sea, and also arctic shells, which indicated a northerly direction; at the same time that the immigration of elephants and other animals proved the junction of this country with the Continent.

The way over, then, for such animals was on the south side, by the ridge of chalk hills, now severed, between Dover and Calais; and I mentioned that this ridge of hills formed a barrier to the influx of boulders and Boulder-clay in France and the South of England. Professor Ramsay (the President of the Geological Section), while admitting the absence of the Boulder-clay from France, expressed his opinion that it would be found to the south of the Thames. This, probably, is correct, as the chalk hills of the Downs may have served as a barrier to the south of the Thames; and ice-action and striated

¹ See Mr. Whitaker's Paper, Quart. Journ. Geol. Soc., vol. xvii. p. 166.

boulders are to be found to the extreme south-west of Devonshire and elsewhere. I had found a boulder myself near Bovey Tracey, and regarded it as a proof of the extension of northerly drift; but Prof. John Phillips informed me that it came from the neighbourhood of Hay-Tor, and he expressed his opinion that during the Glacial period such ice-action might have been propagated from the heights of Hay-Tor, to which the rounded eminence of that rock bears evidence.

I do not think, therefore, that the discovery of striated boulders and Boulder-clay to the south of the Dover chalk hills at all militates against my theory, namely, that such a ridge of chalk formed a barrier to the spread of Boulder-clay over France, and a way for the elephant, etc., to have migrated into this country.

Such was the main object of my paper. I propose in this, as a sequel, to assign the probable boundaries of land on the north side. Mr. Godwin-Austen, in his valuable article on the "Belgian Tertiaries" (*Quart. Journ. Geol. Soc.* August, 1866, p. 240), represents the opening between the Atlantic and Arctic Sea, and also Baffin's Bay, to have been closed, while he leaves open the Straits of Dover. I beg most respectfully to differ from him, both with respect to his arrangement and distribution of land and sea on the north and on the south: on the south for reasons already given; and on the north because it is scarcely possible, that with due regard to centrifugal tendency, and the accumulation of ice and sea near the North Pole, the waters could be so permanently and extensively hemmed in. The reflux of accumulated ice and snow seems a necessary consequence of the form and motion of the earth, and therefore I cannot admit the probability of the exclusion of the Arctic Sea from the Atlantic. But it appears to me that there was a considerable extension of land from the coast of Norway to the west, so as to mask this country on the north, and serve as a defence against the flowing of icebergs from the Polar regions; and this extension of land appears to account for the phenomena which present themselves to the geologist from the Triassic to the Glacial epoch.

I cannot resist the conclusion that icebergs charged with boulders would have been borne from arctic to southerly regions; and yet not one instance of a scratched boulder during that enormous period of time has, I believe, been found. This, I humbly submit, must be due to such masking of this country between the North and the Arctic Sea. No such boulders appear to have been imported into Great Britain, and none appear during the level and warm condition of this country, and of Europe generally, to have been propagated within such territories. As the elevation of mountain ranges is seen to be the cause of depression of temperature, so must the normal, or level, state of the earth's surface be of a warmer and more genial temperature; and before we invoke extraordinary causes for the rise of temperature, it would be well if attention were turned to what would be the result of the absence of mountains or of hills, at least above the permanent snow-line, and what would be the accumulating effect of warmth, just as of cold.

The great discovery by Professor Ramsay of signs of glaciation in

the highly disturbed Permian epoch, the succession of a warmer period, and then the return to cold in the Glacial epoch, when we know that mountains were elevated to an extraordinary height and extent, appear to me to tell a very consistent story of this part of the history of our earth.

No sooner was the north of Europe, and the land which masked this country, depressed and submerged, than icebergs and field-ice were borne down, and covered parts of this country, of which we see such interesting evidences in the Eastern Counties.

In conclusion, I will add a few remarks on the distribution of Proboscideans, which bear upon the subject. It has been a question whether the *Elephas primigenius* has ever been obtained from the forest bed. Certainly its constant companion, the *Rhinoceros tichorhinus*, has not. The result of my own observation is that an elephant resembling the *Elephas primigenius*, in point of number of the laminae of the teeth, is found not only in the forest bed, but in the Norwich crag. This has been regarded by Dr. Falconer as a type of *Elephas primigenius*, the true *Elephas primigenius* having been a Post-glacial importation, together with the *Rhinoceros tichorhinus* and the reindeer. They could pass into France and this country, and live there long after some of their race had been entombed in the ice of Siberia. That they migrated from the north of Europe, driven by the cold, which their hairy and woolly coats could not enable them to bear, is, I think, correct. That the *Mastodon Arvernensis*, *Elephas meridionalis*, *E. antiquus*, *E. priacus*, and others, migrated from the south-west with the *Rhinoceros Etruscus*, and that their remains were also carried into the estuarine deposit of the Forest bed by a river flowing in the direction of the Rhine from the south-west, are statements which are based upon long observation and experience.

NOTICES OF MEMOIRS.

I.—ON BITUMINOUS STRATA OF GNEISS AND MICA SCHIST IN THE PROVINCE OF WERMLAND (in the West of Sweden). By L. J. IGELSTRÖM.

IN the north-western district of Wermland, M. Igelström has discovered a hill consisting, in its central part, of hyperite, the rest chiefly of common reddish granitoid gneiss. Beneath the central hyperite and above the fundamental gneiss, there is a mass, twenty Swedish fathoms in thickness, consisting of bituminous strata of gneiss and mica schist. The bituminous matter is distributed everywhere throughout the whole mass of these strata, so as to be present even in the smallest fragment and thence giving them a black colour closely resembling gunpowder. When M. Igelström heated some fragments in a retort of iron, there were formed combustible hydro-carbons as gases, to the amount of nine per cent., and a combustible oil, as well as a non-combustible, colourless oil were collected in the receiver of the heating-apparatus. This interesting