longitudinal nerves being prominent, one might even be tempted, in determining this fossil, to consider the Gramineæ also. But the firm texture and the quality of the epidermis of the leaf do not admit of such a view.

I have named the species *Ceratozamia Hoffmanni*. The fossil leaf above described will be figured in my Memoir on the Tertiary Flora of Leoben.

IV.—CORRELATION OF THE LINCOLNSHIRE PLEISTOCENE DEPOSITS WITH THOSE OF THE MIDLAND COUNTIES.

By R. M. DEELEY, Esq.

THE Memoir of the Geological Survey on "The Geology of Part of East Lincolnshire," by A. J. Jukes-Browne, lately reviewed in the GEOLOGICAL MAGAZINE, proves so interesting that I am tempted to compare the classification of the Glacial deposits which he has adopted with that I have proposed for the Midland Counties. There are also some features in the distribution and lithological characters of the Boulder Clays to which I should like to draw attention.

At the outset Mr. Jukes-Browne shows that there are in Lincolnshire two types of Boulder Clay occupying areas separated from each other by the Chalk Wolds. These two deposits, which he regards as having been formed at different stages of the Pleistocene period, are described as the "Older" and the "Newer Boulder Clay." The Older Boulder Clay, the Chalky Boulder Clay of Mr. Searles Wood, an intensely chalky deposit, is only found on the west side of Sheet 84 of the Ordnance Survey. The Newer deposits are brown or purple clays, which rise up from beneath the alluvium stretching along the coast. Both these deposits contain intercalated beds of sand or gravel. In a paper printed in the Quart. Journ. Geological Soc. vol. xli. p. 114, Mr. Jukes-Browne shows that the brown or purple clays, generally known as the Hesse and Purple Clays, frequently occupy interglacial valleys cut through the older Chalky Boulder Clay. In my own paper I found it most convenient to divide the Pleistocene period into three epochs, namely, Older, Middle, and Newer Pleistocene, the Great Chalky Boulder Clay and associated chalky gravels being relegated to the Middle Pleistocene division, an arrangement which might also be adopted for the similar deposits of Lincolnshire. As far as I am aware the only Older Pleistocene deposit in this county is the mass of Quartzose Sand on the hill near Gelston, north of Grantham. A careful search would doubtless reveal many other sections both of Boulder Clay and gravel. Too much reliance must not be placed on the colour of a deposit. Similarity of colour no doubt indicates that the materials forming the different deposits have been derived from similar rocks, but we must not be too ready to assume that it also indicates similarity of age. In the Midland Counties the adoption of such a test would lead to great confusion, for in this area the Older and Newer Pleistocene clays, having been generally formed by the breaking up of similar rocks, are somewhat similar in colour,

and yet they are separated from each other by the whole of the Middle Pleistocene series.

I do not mean to affirm that on this account the classification adopted by Mr. Jukes-Browne is incorrect, but it is possible that some of the brown and purple clays he describes belong to the Older and not to the Newer Pleistocene series. Such deposits would be difficult to recognize on the east side of the Chalk Wolds, as they would contain chalk and flint; but on the west the comparative scarcity or even total absence of these rocks should render their detection tolerably easy. In the Trent Basin, south and west of Newark, there are no signs of a submergence having occurred in Newer Pleistocene times. With the close of the Middle Pleistocene epoch marine conditions came to an end, and rivers commenced to re-excavate their valleys through the masses of Boulder Clay and sand which had been formed in them. Subaerial erosion also seems to have been active in Lincolnshire at the same time, for there the Newer Pleistocene Hesse and Purple Boulder Clays are found at low levels in valleys excavated subsequently to the formation of the Chalky Boulder Clay. This would make the Later Pennine Boulder Clay of the Midland Counties the equivalent of the Hesse and Purple Clays. In the Trent Basin, as I have remarked, the Later Pennine Boulder Clay shows no signs of aqueous action, whereas the equivalent low-level deposits in Lincolnshire seem to be of marine origin. If we admit the possibility of a Newer Pleistocene submergence of about 400 feet, such as Mr. Jukes-Browne requires, great difficulties present themselves; indeed, it would be necessary to assume great but local earth-movements without we imagine the whole of Central England to have been occupied by an ice-sheet, which displaced the water. The severity of the glacial conditions which really obtained in Newer Pleistocene times is as yet scarcely realized, yet at this age the cold was sufficiently severe to permanently freeze the ground in the South of England, and bring down great glaciers from the Cambrian and Cumbrian Mountains, which, spreading over Lancashire and Cheshire, eventually passed over the watershed into the Trent Basin. I am aware that this is disputed, many geologists regarding the striæ as being due to large icebergs grating along the bottom of a sea about 1200 feet deep; glaciers being with them at a discount. Now an iceberg is merely a fragment of a glacier, and therefore the larger the iceberg the larger the glacier. Consequently I prefer to make my glaciers larger than my icebergs, not *vice versa*.

During the Middle Pleistocene epoch the ice-flow seems to have passed from the north-east over the submerged Chalk Wolds, giving rise to the intensely Chalky Boulder-clay. At a still later stage, in Newer Pleistocene times, the ice came from the Pennine Hills or further west, and passing down the Trent Valley, pressed against the escarpment of the Middle Oolite. Through the gaps of the Humber and Witham Valleys the subglacial streams poured their sediment into the sea forming the Purple Clays. At one time it is probable that the ice actually passed out through the Witham and

Humber Valleys, or even over the Wolds as well, giving rise to the more chalky Hesse Clay. Before accepting a submergence of 400 feet, very strong proofs will have to be furnished, not only of the marine aspect of the high-level brown Boulder Clays, but also of their Newer Pleistocene age.

V.—AVALANCHES AND AVALANCHE BLASTS.—“WINTER IN THE HIGH ALPS.”

By JOHN ADDINGTON SYMONDS, Esq.

THE following important and interesting notes on avalanches and the dangerous wind-blasts they cause, appeared in the *Pall Mall Gazette* for February 28th, 1888. As we do not remember to have seen the geological effects of these phenomena described in any detail in our numerous geological text-books, we believe Mr. Symonds' notes on the subject will be of much interest to readers of the *GEOLOGICAL MAGAZINE*.

“Feb. 6.—We reckoned another foot of snow this morning. The Fluela Pass, which connects us with the Lower Engadine, was closed to traffic. Just before noon a man called Anton Broher, known among his comrades as “the Knave of Spades,” because he had a bushy black beard, was swept away by an avalanche below Tschuggen, on the Fluela road, about three miles from Davos Platz. Eye-witnesses saw him carried by the blast of the avalanche, together with his horse and sledge, three hundred yards in the air across the mountain stream. The snow which followed buried him. He was subsequently dug out dead, with his horse dead, and the sledge beside him. The harness had been blown to ribbons in the air; for nothing could be found of it, except the head-piece on the horse's neck.

This violence of the wind which precedes an avalanche is well authenticated. A carter, whom I know, once told me that he was driving his sledge with two horses on the Albula Pass, when an avalanche fell upon the opposite side of the gorge. It did not catch him. But the blast carried him and his horses and the sledge at one swoop over into deep snow, whence they emerged with difficulty. Another man, who is well known to me, showed me a spot in the Schaufigg Valley (between Chur and the Streda Pass) where one of his female relatives had been caught by the wind of an avalanche. She was walking to church when this happened. The blast lifted her into the air, swept her from the road, and landed her at the top of a lofty pine, to which she clung with all the energy of desperation. The snow rushed under her, and left the pine standing. It must have been a trifling avalanche. Her friends, returning from church, saw her clutching for bare life upon the tree, and rescued her. Many such cases could be mentioned. A road-maker named Schorta this winter was blown in like manner into the air below Zernetz, and saved himself by grappling to a fir tree. I have been shown a place near Ems, in the Rhine Valley, not far from Chur, where a miller's house was carried some distance through the air by an