layer of white, false-bedded sand, of varying thickness. The Upper Crag usually lies among a shingle composed of well-rounded flint pebbles. The widely distinct character between the fine sand which forms the matrix of the Lower Crag, and the general pebbly or rubbly nature of the upper deposit, shows that the two strata were deposited under different circumstances. The currents bringing the material must have come from different directions.

It is probable that the Crag at Mundesley and elsewhere in the north-east of Norfolk, may belong to the period of the Upper Crag rather than to the Lower. The fact that several feet of sand intervenes between the Crag and the Chalk, is confirmatory of this idea.

[The Report on the Rev. J. Gunn's paper is postponed till our next Number.]

CORRESPONDENCE.

FISH IN THE OLD RED SANDSTONE.

To the Editor of the GEOLOGICAL MAGAZINE.

DEAR SIR,—Precluded, from want of local knowledge, from taking any prominent part in the controversy at present pending as to the relative positions of the Devonian and Old Red Sandstone formations, yet my geological associations are, to so large an extent, connected with the latter formation, that I cannot be otherwise than highly interested in the discussion.

I have now for some years been employing a considerable portion of my leisure hours in collecting and examining our Old Red Sandstone fishes, and, perhaps, on this account feel not a little curious as to the character and state of preservation, etc., of Mr. Pengelly's specimens mentioned in Mr. Salter's communication in your Number of this month (May). I have never seen and it may be long before, if ever, I have an opportunity of examining these; I, therefore, may be allowed, through the medium of your pages, to put a few queries as to their bearing on the subject in dispute.

Then, First: Are these specimens sufficiently distinct to be *undoubtedly* referred to any well-ascertained genus of Old Red Sandstone fishes?

The scales of these fishes are often not a little puzzling; for the same scale may present very different aspects from different surfaces being exposed, while quite distinct scales, belonging to very different fishes, occasionally present surfaces so similar to each other as to be all but undistinguishable. I have now before me a fragment of limestone from Burdiehouse, showing some moderately well preserved *Rhizodus* scales, also a very fine specimen of *Glyptolepis elegans* from Gamrie.—These genera are very distinct, the former belonging to the Lower Carboniferous, the latter to the middle and upper Old Red Sandstone, yet on each of the specimens I can point to a scale which, if detached, and these laid side by side would, by any one, be pronounced specifically identical, so nearly do they resemble each other.

Now, if the *Phyllolepis* from Meadsfoot be only, as stated by Mr.

Salter, "like that genus," *is it of any value whatever in determining the horizon of the Rock in which it was found?*

If difficulty and doubt must exist in determining the affinities of detached scales, much more is this the case with spines. On the fragment of Limestone already referred to, are one or two imperfectly preserved spines which, if found by themselves, would have been thought to belong to a *Diplacanthus*, nearly allied to *D. longispinus*; they undoubtedly differ in form from all the spines of that fish, but not more so than these differ from each other: in short, the spines of Carboniferous Fishes occasionally so nearly resemble those from the Old Red Sandstone that, unless they possess some very marked features, I should think it far from safe to rely on such fragments as good evidence. But supposing the specimens do possess peculiarities, sufficiently marked, for referring them, with certainty, to known genera, is this enough?

Some genera are confined to a comparatively narrow horizon, while others range widely in this respect. The genus *Acanthodes* is found in the lowest beds of the Old Red Sandstone; in its middle division, in the Carboniferous, and in the Permian formations. Even that very peculiar genus *Pterichthys* is found in the middle and upper Old Red Sandstone, and in all probability only terminates its existence in the Lower Carboniferous, and so with many others.

Oddly enough this appears to be the case with the genera to which Mr. Pengelly's specimens are somewhat doubtfully assigned.

Of *Phyllolepis*, Agassiz, the founder of that genus says (V. G. R. p. 67) "Je connais maintenant deux espèces de ce genre, dont l'une provient du vieux grès rouge, *l'anter de la houille*," while *Ctenacanthus* is as much, if not more, a Carboniferous than an Old Red Sandstone genus.

If this genus will not determine the horizon, can these specimens be with certainty assigned to any known species?

In our lowest Forfarshire beds we have *Acanthodes Mitchelli*; in the Murrayshire nodules, and Caithness Flags, *Ac. pusillus*; and in the Caithness Flags also *Ac. Peachi* and *Ac. coriaceus*, all well ascertained species, these formations representing an immensely extended period in time: yet remove their spines from these Fishes, mingle the spines together, and no one could tell the species to which any one of them belonged. The scales, indeed, do vary, but this to so small an extent that it is only in the best preserved specimens, and with the use of highly magnifying powers, that the difference can be detected. The same might be said of the *Acanthodes* from the Coal formation as compared with those of the Old Red Sandstone, only the former being larger fishes have larger scales and spines. This is no doubt an extreme case, but similar, if less striking examples are to be met with in other genera.

Is it, therefore, safe to put any, or at least implicit, reliance on such fragmentary evidence?

I fear with most the verdict would be our Scotch one "Not Proven."—I am, dear sir, very truly yours, JAS. POWRIE.

RESWALLIE, FORFAR, *May 11th*, 1867.