

Red Sea as being due to the intrusion along a crack in the earth's crust of a large basic mass 40 miles wide. It is conceivable that this basic mass may be represented in Cyprus by the Diabase and was intruded, during a period of regional crustal tension, by successive injection of magma along a gradually widening crack.

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TOURNAISIAN BEDS IN RAVENSTONEDALE AND DUBLIN

SIR,—In a recent memoir on Lower Carboniferous palaeogeography, Professor T. N. George (1958) claims that no rocks older than Viséan are present in Northern England and Scotland nor in County Dublin. For his argument the Ravenstonedale area of the North-West Province is critical, since as he states (1958, p. 241), “the occurrence of Tournaisian rocks elsewhere in the north of England and in Scotland has rested on correlation with the Ravenstonedale sequence.”

The beds which have been attributed at Ravenstonedale to the Tournaisian belong to the *Solenopora*- (recte *Pseudochaetetes*) and *gregaria*-subzones above the Shap Conglomerate horizon and the Pinsky Gill Beds below it.

In Garwood's vertical section (1913, fig. 2, p. 452) the base of C_2 is drawn at the *Thysanophyllum pseudovermiculare*-band in the *gregaria*-subzone. Professor George appears to have been unaware that I have already (1950, pp. 125, 128–9) advocated lowering this boundary broadly to the base of the algal phase at that of the *gregaria*-subzone, which latter I regard as wholly Viséan. I welcome Professor George's additional arguments (1958, pp. 240–1) for this. (Whether Tournaisian Lower C_2 is present or recognizable in Ravenstonedale is an interesting but, for present purposes, unessential question.)

For the underlying *Solenopora*-subzone the sole positive evidence adduced for a Viséan age is the presence of *Composita* aff. *ficoides* and *Pustula pyxidiformis*. Vaughan (1905, p. 245 and pl. xxix) shows the species-group of “*Seminula*” *ficoides* already appearing at the top of Z_6 in the Bristol area. As for *Pustula pyxidiformis*, Demanet (1958, pp. 123, 126, 130) reports it from $Tn_{28, b, \text{ and } c}$ of Tournai. Garwood (1913, p. 460) records *Spirifer tornacensis* (as *Spirifer clathratus*) from Ravenstonedale and this is one of Professor George's definitive Tournaisian species, but to which he makes no reference in connection with this area. Dr. W. H. C. Ramsbottom kindly informs me that one at least of Garwood's Ravenstonedale *Schellwienella crenistria* is close to, and may well be *Schellwienella aspis*, which is Vaughan's *Orthotetes crenistria* mut Z ; and that another is, or is close to, *Schuchertella wexfordensis* (“*Orthotetes crenistria* mut C ”). Both species are common together in the Tournaisian of South-East Ireland.

The *Solenopora*-subzone thus being Tournaisian, still more must be the Pinsky Gill Beds with their strangely Devonian faunal aspect, disproved only by the presence of a Carboniferous fish, and separated from the *Solenopora*-subzone by at least 50 feet and very probably at least as much more, of green and red sandstones with conglomerate. Professor George's only attempt at justification of his Viséan dating is an analogy with deltaic intercalations in North-West Ireland. The arenaceous beds below the *Solenopora*-subzone are not deltaic deposits and the Pinsky Beds themselves are dolomites and shaly mudstones resting directly on the Lower Palaeozoic floor. Professor George refers to Dr. E. E. L. Dixon's non-palaeontological argument (1913, p. 585) for Viséan dating of the whole *glabristria*-zone. But he was referring to the break between *Solenopora*- and Pinsky Beds, not to the sub-Pinsky unconformity which, of course, proves nothing beyond the Pinsky Gill Beds being later than the Caledonian folding.

From County Dublin Professor George (1958, fig. 15, p. 276 and p. 242) similarly banishes all Tournaisian rocks, basing his action on Smyth's discovery of early Viséan goniatites towards the top of the very thick Rush Slates. There are at least 600 feet of beds below the goniatite level, and inland is the long section at Swords, much of which is probably lower than anything seen on the coast. From the middle of it I have recorded *Avonia bassa* (1938, p. 26), another of Professor George's definitive Tournaisian species. Moreover, he omits all mention of Smyth's (1920) exhaustive account of highly fossiliferous Tournaisian (both Z and C₁) at Malahide. Here the lateral equivalents of the sub-Viséan part of the Rush Slates yield *Avonia* aff. *bassa* and *Dictyoclostus vaughani* ("*Productus burlingtonensis*") (both definitive Tournaisian species) and also *Schellwienella aspis* ("*Orthotetes crenistria* mut Z") and *Vaughania cleistoporoides*, this last indicating connection with Ravenstonedale in C₁. From the south-westerly extension of the Swords Anticline into Kildare I have recorded (1938, p. 28) the definitive *Dictyo. vaughani* and *Spirifer tornacensis*. The evidence for Tournaisian in the Dublin region is overwhelming by Professor George's self-chosen criteria and reinforces that from Ravenstonedale.

Tournaisian rocks are therefore present in both County Dublin and Ravenstonedale, and so in those other areas of Britain in which rocks of the same age as the *Solenopora*- and Pinsky Beds can be identified.

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