

In a more complex case, the style observed may point to a sequence of events and so to a sequence of fields. Each field will belong to a particular regime, so that a sequence of regimes is also implied. With regard to facies, it is held that only one facies can now be observed; it may be "isoclinal 1,000' × 100' refolded open 200' × 1,000' × 100' on perpendicular axes, schist" and it might be inferred that the facies of the rock at some earlier time was simply "isoclinal 1,000' × 100' shale"; but it is held that in tectonics a rock *is* of only one facies at the present time.

Turner's review of the facies classification makes an opportunity to distinguish observation from conjecture. It has been the purpose of these remarks to seize upon the opportunity and to note how a close correspondence in meaning can be preserved between metamorphic and tectonic terms.

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#### CULM STRATIGRAPHY

SIR,—Professor Scott Simpson has recently presented (*Geol. Mag.*, xciv, 201-8) a review of Culm stratigraphy which I can in general accept without reservation. An aspect which needs clarification, however, is the stratigraphic succession in the Greywacke Group and the Central Devon Group. Greywackes undoubtedly succeed the Limestone and Chert group both in North-West and in North-East Devon, but with the intervention of a thin shaly and silty series of Namurian age. Greywacke deposition begins, however, at different times; in the north-west later than  $R_2$  (my own observation) in the north-east before  $R_2$  (J. M. Thomas, unpubl.), in the south-west before  $H$  (Owen, D. E., 1950). Provided that the Greywacke Group is taken to include all beds above the top of the Cherts, which seems a reasonably homochronous line, there seems no objection to the use of the classification here.

I have, however, grave doubts as to the value of the Central Devon Group as a stratigraphic term. It is an indication of our lack of knowledge of these beds that Scott Simpson can describe them as consisting of "facies similar to the Millstone Grit" whilst Ashwin (unpubl. thesis, Univ. of London) refers to the same rocks as exclusively greywackes. In the north-west I can demonstrate that the strata of Coal Measure type in which the early Westphalian flora and fauna are found (i.e. the Morchard type of Ussher) pass upwards into more greywackes, these higher greywackes being Ussher's Eggesford Grits. There is no doubt that these two facies recur in various parts of Central Devon, but whether the repetition is structural or stratigraphical is a problem which only careful mapping can solve. In the north-east the Coal Measure type is apparently absent, and greywacke deposition is continuous. Thus until further evidence is available, I feel it would be unwise to suggest that the succession is simply greywacke followed by non-greywacke deposition.

I find it particularly pleasing that Scott Simpson finds much to approve in

the work of Ussher ; my own work in Devon leads me continually to increased respect for his authority and judgment. To my mind it is particularly unfortunate that his classification, based on a unique knowledge of the Culm, should so long have been ignored.

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28th October, 1959.

SIR,—The publication in your last issue of Mr. Butcher's letter has anticipated a spontaneous retraction of my heresy (which was also that of A. Somervail) and also a letter from Dr. Dearman, along the same lines as Mr. Butcher's which he had courteously discussed with me in correspondence.

There is no doubt that Mr. Butcher is right in concluding that I was mistaken in supposing that the Ugbrooke Group is post-orogenic. I had come to this conclusion myself as Mr. S. C. Matthews has found that in the area south of Callington the members of this Group are undoubtedly inverted in some places. It follows that there is now no conclusive evidence that the Ugbrooke Group is younger than either the Central Devon or Greywacke Groups.

Mr. Butcher's discovery of *Homoceras* near the River Inny is obviously of great interest. I note, though, that he forbears from saying that his fossils are actually out of the Ugbrooke Group rocks. Dr. Selwood allows me to say that he has also found goniatites in this area which are, however, undoubtedly derived, though occurring in the Ugbrooke Group. I think the possibility still remains that the Ugbrooke Group are the youngest sediments of the region.

I do not accept that my error could have been avoided by careful reading of the Survey Memoirs. I am well aware of the passages to which Mr. Butcher refers. The evidence is conflicting and the Survey Officers themselves did not know how to interpret it.

The cleavage problem remains a very interesting one. It is a fact that the Ugbrooke Group rocks do not show the kind of slaty fissility seen in other formations (even when the rocks are highly argillaceous) and this is true of the area south of Callington where they are certainly involved in recumbent structures. The presence or absence of slaty fissility must reflect different styles of tectonic deformation, and the problems presented by the juxtaposition of such differing styles, particularly in South Devon, remains to be investigated.

I do not think the situation at Altarnun is so simple as Mr. Butcher suggests, but I will not comment on this as Dr. Dearman is now working on the area and will no doubt be able to describe the true facts in due course. Moreover I do not question that the Ugbrooke Group enters the Dartmoor aureole as Mr. Butcher has demonstrated.

I welcome Dr. Prentice's communication and need only say that I have no doubt that when his researches are completed he will be able to suggest a better way of dealing with the formations I have lumped together as the Central Devon Group. Until these formations are delimited stratigraphically and on the map the term may be of some use.

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11th November, 1959.

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