Sirs,—Dr Leeder (1973, 1974) has recently suggested on the basis of inferred palaeocurrent directions that the Upper Devonian (Upper Old Red Sandstone) of the Scottish Borders region accumulated in an interior drainage basin centred on Teviotdale where argillaceous deposits, possibly of lacustrine origin, occur within the sequence. This concept is open to criticism on the following grounds.

1. There is no evidence in the Upper Old Red Sandstone of the Borders of evaporites or sabkha-type deposits such as might be expected in an interior drainage basin.

2. The presence in the Upper Old Red Sandstone of abundant fish remains cannot be explained if there was no access from the contemporary sea by way of a river system.

3. The ultimate escape of the Teviotdale drainage around the northern edge of the Cheviot Uplands is not excluded by the southsouthwesterly palaeocurrent trends shown by Leeder (1973, Fig. 13), even if these were correct. Measurements of cross-bedding at Pease Bay, Kelso and Greenlaw (Table 1, localities 1–7), however, clearly suggest transport towards the east or southeast, contradicting some of the current directions derived by Smith (1967).

<table>
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<th>National Grid Reference</th>
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Published palaeocurrent measurements (see Leeder 1973, Fig. 13; Chisholm and Dean, 1974), for areas within the Midland Valley of Scotland are not inconsistent with the view that the Upper Old Red Sandstone was deposited on a wide alluvial plain by a generally eastward flowing river system with which the Scottish Border drainage may have been confluent.

I. B. Paterson
M. A. E. Browne
M. Armstrong
Sirs,—The attempted refutation by Paterson et al., of my interior drainage basin hypothesis for the Upper O.R.S. of the Scottish Borders is welcome. I would reply to each of their points as follows:

1. The proposed basin centre facies around Jedburgh is most distinctive, comprising over 100 m of thinly bedded, sharp-based sandstones (10-50 mm) with subordinate silty mudstones. These are similar to Type A-D beds of facies association 4 described previously (Leeder 1973 pp. 127-33). Work is continuing in this area but results to date indicate that the facies is dominantly of flood origin, possibly accumulating in the basin centre from the most distal parts of low gradient alluvial cones originating to the southwest and northeast. Deposition rates were obviously too high to allow significant cornstone development. The absence of evaporites is ascribed to permanently low water tables, allowing rapid draining of flood water, and in no way refutes the interior drainage basin hypothesis. I stated previously that the area may have been lacustrine at times (1973, p. 140), not that the whole sequence may have been lacustrine as Paterson et al. infer. There now seems to be little evidence of true lacustrine facies within the sequence.

2. The origin of the fish faunas in the Border rivers is indeed a problem. If they evolved in Upper O.R.S. times from a fauna of marine origins then obviously a marine connection to the rivers at some time must be postulated. If, however, they were already a fully fledged freshwater fauna by the Upper Devonian then the marine connection hypothesis must be regarded as irrelevant.

3. The palaeocurrent evidence that I quoted from the supposed northeastern entrant to the Border basin (1973, p. 139) was taken from the published work of Smith (1967). The Paterson et al., vector means for Greenlaw and Kelso differ from the Smith results by about 15° and 55° respectively. The Pease Bay data of Paterson et al., is new and most welcome, but represents 81 out of 107 readings reported in their Table 1. Before acceptance of their palaeocurrent data, Paterson et al. must state (a) the variance about their vector means or show rose diagrams, (b) the vertical interval over which their readings were taken to ensure adequate formational coverage and lack of horizontal duplication (at Pease Bay especially), (c) whether large or small scale structures were involved, the latter providing unsatisfactory indicators of regional palaeoslope. Assuming that the vector means are significant and that they sample the whole formation using large scale cross stratification, then the data, taken together with the Smith results (1967, Fig. 1) from Preston and Burnmouth, still indicates a variation of palaeocurrents between east and southwest. This might well arise simply through a natural variance of channel trends with time over the area superimposed on a general southerly palaeoslope, particularly in the Merse of Berwick. It is obvious that further statistical sampling of Old Red palaeocurrents from several more sites in the area is necessary before the rival easterly and southerly palaeoslope hypotheses can be evaluated critically.

In conclusion, I remain unconvinced at present of Paterson et al.'s conjecture that the whole lowland Scottish Upper Old Red Sandstone 'was deposited on a wide alluvial plain by a generally eastward flowing river system'. The conjecture, leading as it
does to important palaeogeographic conclusions for the North Sea area in Upper Devonian times, does not explain the distinctive Jedburgh facies and is only directly supported in the Border area by the Pease Bay palaeocurrents. I prefer to interpret the available facies and palaeocurrent evidence as favouring an interior basin origin.

References


M. R. Leeder

*Department of Earth Sciences,*

*Leeds, LS2 9JT*

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