

## CORRESPONDENCE AND NOTES

## The Iapetus suture in the British Isles – comment on its position in eastern Ireland

**SIRS** – McKerrow & Soper (1989) have presented, in detail, a clear discussion of some of the existing faunal and other related geological and geophysical evidence used to constrain the position of the Iapetus suture in Britain and Ireland. Palaeontological control, based on the manifest biogeography of Ordovician marine animals, provides a critical database for the definition of, in simple terms, North American and European zones within the system. In Britain the precise location of the suture is hidden beneath post-Lower Palaeozoic cover but is conventionally considered coincident with the Solway Line. However, in eastern Ireland a greater diversity of Ordovician rocks crops out, permitting a more critical analysis of the suture.

In this part of eastern Ireland there are three discrete terranes (Murphy, 1987; Murphy *et al.* unpub. data). The Grangegeeth, Bellewstown and Leinster terranes are recognized on the basis of contrasting Ordovician faunas, lithostratigraphies and volcanicity. The Silurian evolution of eastern Ireland places little direct constraint on the trace of a suture as here the Wenlock oversteps older successions.

The proposed suture, along the Navan Fault (Phillips, Stillman & Murphy, 1976; McKerrow & Soper, 1989, fig. 1), separates the rocks of the Longford–Down massif, whose equivalents in the Scottish Southern Uplands contain, in its Ordovician northern belt, a Scoto-Appalachian fauna, from the Ordovician Collon–Grangegeeth inlier with faunas of putative European affinities. Current revision of the Caradoc brachiopods from the Grangegeeth Group (Harper, unpublished data) suggests a domination by members of the Scoto-Appalachian fauna; the European influence is slight (Harper & Parkes, 1989). Moreover J. C. Harper (1952) and subsequently Romano (1980) compared many of the Grangegeeth species with congeners in the Balclatchie and Ardwell groups of the Girvan district, southwest Scotland (north of the Solway Line). Although the record of *Productorthis* from Grangegeeth (Williams, 1956) was used to confirm the Baltic affinities of the fauna, that genus is known to occur within Scoto-Appalachian faunas during Caradoc time (Cooper, 1956).

The Caradoc fauna described from the Clashford House Formation in the Balbriggan inlier (Harper *et al.* 1985; not the Collon–Grangegeeth inlier, cf. McKerrow & Soper, 1989, p. 4), has strong Baltic affinities and occurs within the northern part of the Leinster terrane. The intervening Bellewstown terrane bounded to the north by the Slane Fault and to the south by the Lowther Lodge Fault (Murphy, 1985), and characterized by Anglo-Welsh faunas during Caradoc time, thus provides a significant contrast with the adjacent terranes to the north and south.

Harper & Parkes (1989) have emphasized that many of the Irish Ordovician assemblages are external or marginal. Such faunas often have mixed provincial affinities which vary with time; consequently diagnosis of faunal sutures, in marginal regimes, may be much less clear-cut than McKerrow & Soper (1989) have suggested. This problem is not unique to the British and Irish Caledonides; the Lower Ordovician Celtic type fauna in the Otta Conglomerate, located near the base of the Upper Allochthon in Scandin-

avia, has mixed faunal affinities suggestive of an oceanic setting (Bruton & Harper, 1981, 1985) whilst Boyce *et al.* (1988) have discussed the problems of drawing a single suture through a mosaic of oceanic terranes in Newfoundland. The diversity of exposed Ordovician strata in eastern Ireland suggests that a single suture may be inadequate to describe the complex assembly of parts of a fossil ocean system. However, if an unique suture is considered more appropriate it should be drawn between the Collon–Grangegeeth inlier and Bellewstown.

## References

- BOYCE, W. D., ASH, J. S., O'NEILL, P. & KNIGHT, I. 1988. Ordovician biostratigraphic studies in the central mobile belt and their implications for Newfoundland tectonics. *Current Research Newfoundland Department of Mines, Mineral Development Division Report* 88–1, 177–82.
- BRUTON, D. L. & HARPER, D. A. T. 1981. Brachiopods and trilobites of the early Ordovician Otta Conglomerate, south central Norway. *Norsk Geologisk Tidsskrift* 61, 153–81.
- BRUTON, D. L. & HARPER, D. A. T. 1985. Early Ordovician (Arenig–Llanvirn) faunas from oceanic islands in the Appalachian–Caledonide orogen. In *The Caledonide Orogen – Scandinavia and Related Areas* (eds D. G. Gee & B. A. Sturt), pp. 359–68. John Wiley & Sons.
- COOPER, G. A. 1956. Chazyan and related brachiopods. *Smithsonian Miscellaneous Collections* 127, 1–1245.
- HARPER, D. A. T., MITCHELL, W. I., OWEN, A. W. & ROMANO, M. 1985. Caradoc brachiopods and trilobites from the Clashford House Formation, Herbertstown, eastern Ireland. *Bulletin of the British Museum (Natural History), Geology* 38, 287–308.
- HARPER, D. A. T. & PARKES, M. A. 1989. Palaeontological constraints on the definition and development of Irish Caledonide terranes. *Journal of the Geological Society of London* 146, 413–5.
- HARPER, J. C. 1952. The Ordovician rocks between Collon (Co. Louth) and Grangegeeth (Co. Meath). *Scientific Proceedings of the Royal Dublin Society* 26, 85–112.
- MCKERROW, W. S. & SOPER, N. J. 1989. The Iapetus suture in the British Isles. *Geological Magazine* 126, 1–8.
- MURPHY, F. C. 1985. Non-axial planar cleavage and Caledonian sinistral transpression in Eastern Ireland. *Geological Journal* 20, 257–79.
- MURPHY, F. C. 1987. Evidence for late Ordovician amalgamation of volcanogenic terranes in the Iapetus suture zone of eastern Ireland. *Transactions of the Royal Society of Edinburgh, Earth Sciences* 78, 153–67.
- PHILLIPS, W. E. A., STILLMAN, C. J. & MURPHY, T. 1976. A Caledonian plate tectonic model. *Journal of the Geological Society of London* 132, 579–609.
- ROMANO, M. 1980. The stratigraphy of the Ordovician rocks between Slane (Co. Meath) and Collon (Co. Louth), Ireland. *Journal of Earth Sciences, Royal Dublin Society* 3, 53–79.

WILLIAMS, A. 1956. *Productorthis* in Ireland. *Proceedings of the Royal Irish Academy* **57B**, 179–83.

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### The Iapetus suture in the British Isles – reply

SIRS – Harper & Murphy refer to the thematic set on Displaced Terranes in Britain and Ireland (Soper, Gibbons & McKerrow, 1989) which has been written and published since we wrote our paper (McKerrow & Soper, 1989), and which includes a clear definition of the three terranes in northeast Ireland to the south of the Southern Uplands (Harper & Parkes, 1989). The Balbriggan inlier of the Leinster terrane, with its strong Baltic affinities, is clearly part of Avalonia. The Bellewstown terrane has some formations containing ubiquitous Celtic Province genera which occur on both sides of the Iapetus Ocean (McKerrow & Cocks, 1986), but it also contains some other formations containing characteristic Anglo-Welsh genera (Harper & Parkes, 1989); so it, too, lies in Avalonia to the south of the Iapetus suture. Our present uncertainty is in the biogeographical affinities of the faunas (and thus the tectonic setting) of the Grangegeeth terrane, which lies to the south of the Navan Fault. This fault marks the southern boundary of the Longford–Down continuation of the Southern Uplands, which we consider to have been an accretionary complex developed in a trench along the southeastern margin of Laurentia (McKerrow & Soper, 1989, and references therein).

The previous literature on the affinities of the Ordovician faunas of the Grangegeeth terrane is ambiguous. Harper (1952) and Brenchley *et al.* (1967) describe faunas, occurring in different formations of the same sequence, which have Balclatchie (i.e. Laurentian) and Baltic (or Esthonian) affinities respectively. Clearly, some of the taxa present were capable of crossing Iapetus during Ordovician time. The

question is: which forms migrated across the ocean prior to the general Late Ordovician mixing?

The position of a part of Laurentia to the south of the Southern Uplands trench deposits, while not impossible, would imply even greater tectonic complexity along the Laurentian continental margin than is at present envisaged. Unusually large Late Silurian/Early Devonian strike-slip movements would have to be inferred to explain the emplacement of the Grangegeeth terrane to the south of the Southern Uplands. We look forward to the publication of a careful analysis of the biogeography of all the Grangegeeth faunas; only then will a decision on the palaeogeographical setting of this suspect terrane be possible. In the meantime, on purely tectonic considerations, we would still surmise that the surface expression of the suture is most likely to lie along the Navan Fault, to the north of Grangegeeth.

### Further references

- BRENCHLEY, P. J., HARPER, J. C., ROMANO, M. & SKEVINGTON, D. 1967. New Ordovician faunas from Grangegeeth, Co. Meath. *Proceedings of the Royal Irish Academy* **B65**, 297–304.
- HARPER, J. C. 1952. The Ordovician rocks between Collon (Co. Louth) and Grangegeeth (Co. Meath). *Scientific Proceedings of the Royal Dublin Society* **26**, 85–112, pls 5–7.
- MCKERROW, W. S. & COCKS, L. R. M. 1986. Oceans, island arcs and olistostromes: the use of fossils in distinguishing sutures, terranes and environments around the Iapetus Ocean. *Journal of the Geological Society of London* **143**, 185–91.
- SOPER, N. J., GIBBONS, W. & MCKERROW, W. S. 1989. Introduction: Displaced terranes in Britain and Ireland. *Journal of the Geological Society of London* **146**, 365–7.

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