

MATTERS ARISING

A new tectonic model for the central Norwegian Caledonides

HORNE'S¹ recent model for the evolution of the central Norwegian Caledonides requires that the Storen, Hovin and Horg Groups originated as an intra-oceanic arc complex above a westerly dipping subduction zone. It is difficult to reconcile present knowledge of the volcanic and sedimentary rocks of these groups with this hypothesis. The Storen Group metavolcanics are well established as being ocean floor basalts² obducted onto the Baltic Shield in pre-Arenig times³. In the Løkken-Meldal region a younger complex of basic volcanics of late-Arenig age occurs within the Lower Hovin Group⁴. These are considered to have originated in a back-arc marginal basin situation⁵. Calc-alkali volcanics of similar age occur some 100 km further west³. The Lower Hovin Group locally contains meta-andesites, but these are volumetrically less important than the rhyolitic volcanics which predominate in the upper Lower Hovin, Upper Hovin and Horg Groups^{4,6,7} (mid-Ordovician to early Silurian). In the Løkken-Meldal region the volcanoclastic sandstones of the Lower Hovin Group have a quartz content that is considerably higher⁴ than that considered typical of an island arc environment⁸. The sandstones and shales of the Upper Hovin Group have a chemistry and mineralogy consistent with a rhyolitic/granitic (continental?) provenance (unpublished data). The Horg Group contains quartzites and vein quartz pebble conglomerates^{6,7}. Thus neither the volcanic nor the sedimentary rocks of the Storen, Hovin and Horg Groups are typical of those expected in an ensimatic arc complex. Indeed the presence of considerable rhyolitic volcanic products is

often considered to imply an Andean type margin^{9,10}. Also the distribution of late-Arenig volcanism suggests an arc to the west with a marginal basin opening to the east—this requires subduction of the opposite polarity to that proposed by Horne¹.

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HORNE REPLIES—Ryan has raised some important and difficult problems of provenance and petrogenesis that persist in other parts of the Appalachian-Caledonian orogen as well as in the Trondheim region. I look forward to evaluating the unpublished papers he cites as evidence, particularly those pertaining to the age of obduction and the polarity of subduction.

Many of Ryan's arguments are based on the composition of extrusive and detrital rocks in the Løkken-Meldal area some 60 km west of Selbusjøen. Although I have not studied these rocks I am reluctant to accept generalisations based on petrotectonic pigeonholing when it is well established that volcanics in modern arcs and even some spreading ridges are so variable in composition^{1,2}. The compositions of the volcanic and sedimentary strata that Ryan describes from the Løkken-Meldal area are similar to those of strata of comparable age exposed in the

Bronson Hill anticlinorium of New England^{3,4}. Rhyolites are common in the Ordovician volcanic succession, and they are thought to have been the original core rocks of the Oliverian mantled gneiss domes⁵. Many of the Ordovician and Silurian psammitic strata along the anticlinorium are quartzose, and the early Silurian Clough quartzite that rests unconformably on the volcanics and gneiss domes is conglomeratic with very common pebbles of vein quartz within orthoquartzite matrix⁶. Although there is no easy solution to the provenance problem here or in the Trondheim region, most workers regard the rocks in the Bronson Hill anticlinorium as originating on an ensimatic arc complex within a closing Iapetus Ocean^{7,8}.

The calc-alkaline volcanics in western Norway possibly do represent an arc complex further west than the Trondheim arc. However, the presence of neither a western arc nor ophiolites in the Bergen area⁹ helps resolve the ambiguity of subduction polarity in the Trondheim region. Was there a western Iapetus seaway that closed into a second arc?

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Corrigendum

In the letter '(ADP-ribose)_n participates in DNA excision repair' by B. W. Durkacz *et al.*, *Nature* **283**, 593–596, in Fig. 2 the symbols are incorrectly defined. It should read '△, 0 min; ▲, 40 min; ●, 80 min; and ○, 300 min'. Lines 16–17 of Fig. 2 legend should read 'a, b. The cells were exposed to DMS for 20 min, which was washed out, but 3 mM 3-aminobenzamide was added to the medium for the 300 min recovery period. c, d. The cells were exposed only to DMS'.

Errata

In the letter 'Plasmid-mediated tissue invasiveness in *Yersinia enterocolitica*' by D. L. Zink *et al.*, *Nature* **283**, 224–226, a line was omitted from paragraph 4. Line 4 should read '... Serotype 0:8 strains contained either a plasmid of molecular weight (MW) 35 × 10⁶, a plasmid of MW 41 × 10⁶ or both (whereas...)'.

In the letter 'Do genealogical patterns in purple photosynthetic bacteria reflect interspecific gene transfer?' by C. R.

Woese *et al.*, *Nature* **283**, 212–214, the *x* axis in the upper part of Fig. 1 should be labelled S_{AB} and the *x* axis in the lower part should be labelled % Sequence homology.

In the letter 'The relationship between coding sequences and function in haemoglobin', by W. A. Eaton, *Nature* **284**, 183–185, on p. 184 second paragraph line 11 should read '...(2) Residues in the α₁β₂ contact'.