Fig. 1 Sketch map of the Skiddaw Group graptolite localities showing suggested zonal boundaries.

faunas²⁻⁷ (Fig. 1) appears to indicate an ENE-WSW trending anticline, with a marked easterly plunge with respect to the overlying Borrowdale Volcanic Group. It seems likely that older Arenig rocks, yielding *Didymograptus extensus* and *D. hirundo* Zone graptolites, lie in the core of this structure and are flanked by younger Llanvirn beds containing *D. bifidus* and *D. murchisoni* Zone faunas. This broad picture remains valid, even though the polyphase deformation of the group^{5,8} doubtless gives a complex local pattern of outcrops.

Considered in isolation, this distribution of Skiddaw faunas adjacent to the Borrowdales could be produced by widespread faulting or thrusting between the two groups. Equally, it could result from a rapid change in facies, with the lower part of the Borrowdales in the west passing laterally into the upper Skiddaws farther east. Both these views are rejected, however, as a result of recent field-work⁹ in eastern Lakeland which demonstrates a regional unconformity between the two groups. It is concluded therefore that the pre-Borrowdale fold shown above best accounts for the faunal distribution known at present.

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⁹ Wadge, A. J. (in the press).

Relationship between the Skiddaw Slates and the Borrowdale Volcanics

THE communication by Helm and Roberts¹ conveys a misleading picture of the geological situation at Scarbrow Wood and Hollows Farm and, as this is vitally important to interpretation of the junction between the Skiddaw Slates and Borrowdale Volcanics, I should like to place their observations in perspective. Two years ago I mapped this small area in detail and have revisited it several times since then; it is clear to me that there is no evidence for an unconformity of the scale they suggest anywhere in the area.

As they state, the existence of local unconformities is not

now doubted (Crookley Beck², Newlands Valley³). Furthermore, the evidence from Brampton and the West Lake District cited by Wadge and Burgess (both in ref. 1) suggests the presence of a regional break between the Skiddaw Slates and Borrowdale Volcanics, but this break will manifest itself in several ways depending on the local geographical conditions and the structural response to deformation of the rocks in the area concerned.

In each of the three examples from Scarbrow-Hollows figured by Helm and Roberts, their major unconformity is made to pass through areas of no exposure. Their backing-up evidence, though correct, is insufficient and misleadingly represented, and their conclusions would be impossible to sustain in the field. The critical evidence necessary to decide the nature of these junctions is lacking.

For example, exposure (1) in Scarbrow Wood is situated some thirty feet below, and sixty yards distant from the junction, which in Skiddaw Slates is ample room for disharmony of considerable magnitude to develop, sufficient to account for a single, poorly-exposed, inverted fold-pair. There is no structural evidence for a major unconformity, for both the Skiddaw Slates and the Borrowdale Volcanics show *S*₁ and *S*₂ cleavages (end-Silurian), and at exposure 3 (wrongly marked on their map) they admit that the *S*₁ cleavage passes from slates to volcanics without deviation. They explain this by representing the slates at this locality not as Skiddaw Slates but as the lowest beds of the Borrowdale Volcanics, hence leaving room below these slates for their unconformity. They present no evidence for this assertion.

The way for a major unconformity to be proved in this area is to find some break in the slates at or below the junction, either by structural or possibly geochemical means, but until this is done the possibility of the unconformity should not be represented as fact, as Helm and Roberts claim it to be.

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Reply on Skiddaw Slates and Borrowdale Volcanics

WADGE states that the map¹ illustrating our interpretation of the *D*₁ structure of the Skiddaw Group is wrong. It must be emphasized that the map is in no way central to our argument