

(coherent, lava-like masses showing *fiamme*) : in the second case such incoherent masses are considered as not having had the internal energy necessary to return to a coherent state, showing *fiamme*.

I have studied some of the pumiceous upper flow-rocks from Oramutia and it is clear that Bristow is correct in saying that they are frothy, pumiceous lavas and not true tuffs, notwithstanding their superficial appearance of a tuff. It is also clear to me that these have never suffered complete disintegration to an incoherent state.

Finally, I must mention the term devitrification used by Bristow (*op. cit.*, p. 160) : is it really certain that the minute crystals referred to are due to the slow conversion of a glass to the crystalline state? These rocks are Pleistocene and not much progress in devitrification is to be expected in the short time that has elapsed since their eruption. I believe that a great deal of primary, incipient crystallization is being dismissed as due to devitrification.

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#### REFERENCES

- MCTAGGART, K. C., 1960. The mobility of *nuées ardentes*. *Amer. J. Sci.*, **258**, 269–382.  
MARSHALL, P., 1935. Acid rocks of the Taupo-Rotorua volcanic district of the North Island, New Zealand. *Trans. roy. Soc. N.Z.*, **64**, 323–366.  
ROSS, C. S., and R. L. SMITH, 1961. Ash-flow tuffs. *U.S. geol. Surv. Prof. Pap.* No. 366.

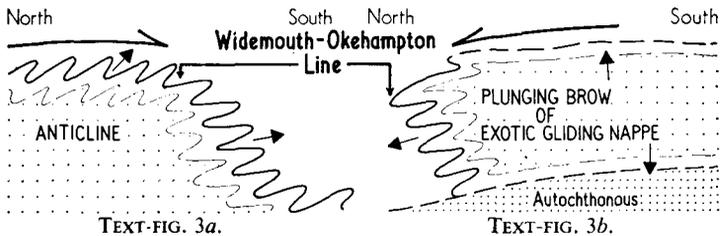
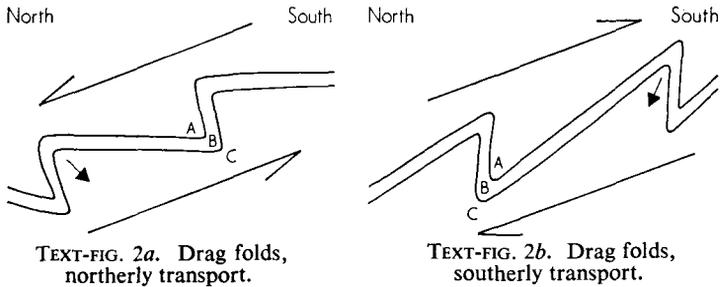
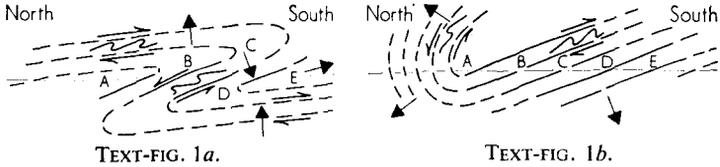
#### THE STRUCTURE OF MID-DEVON AND NORTH CORNWALL

SIR,—The letter from Professor S. Simpson published on the 4th June, 1962, in vol. xcix, part 3, of this magazine under the heading of "Structures of Devon and Cornwall" presents an alternative to my (1962) interpretation of the structure of the tract of country extending from the Cornish coast in the general neighbourhood of Boscastle to the north-western margin of the Dartmoor granite. But at the same time Professor Simpson has misconstrued, at least in part, my remarks on the probable structural implications of Dr. E. B. Selwood's (1961) discoveries. I must accept responsibility for this as I did not take the trouble to embellish my letter with illustrative text-figures. This omission has now been rectified by Professor Simpson. I find that his illustrations can be used, with slight additions, to clarify the essential differences between his interpretation (Text-figs. 1*b*, 2*b*, 3*b*) and the alternative interpretation (Text-figs. 1*a*, 2*a*, 3*a*).

Professor Simpson says that there is a line which runs continuously from the Cornish coast somewhere between Crackington Haven and Widemouth to the northern end of Dartmoor. For convenience it is proposed here that this should be referred to as the Widemouth–Okehampton line. This fundamental structural line, as he called it in 1961, separates recumbent folds on the south from overfolds on the north. I agree with this as a generalization that was already well known from the work of Owen (1937, 1950) and Ashwin (1958) on the coastal sections.

I also agree with Professor Simpson that Text-fig. 1*b* is a valid interpretation of the structural implications of northerly dipping inverted strata. Although he has not yet given a full account of his interpretation of the structure of the area, he has suggested in a brief abstract (1961) that if the recumbent folds have come into position by gravitational sliding it is possible to regard them as the original cover of the older and more deformed rocks of the south (north in the original but an obvious misprint). This statement has been freely interpreted by me in Text-fig. 3*b*.

Text-figs. 1a, 2a, and 3a, on the other hand, illustrate the structural implications of northerly dipping beds at the southern margin of the mid-Devon outcrop of the Culm Measures as set down in paragraphs (i) to (iv) in my earlier letter (Dearman, 1962). The only additional comment I would make is that if, as I believe, the minor folds are congruent with the larger folds then southerly facing folds as shown in Text-fig. 2a, indicative of local northerly transport, should occur in the inverted limbs of the southerly facing recumbent synclines (Text-fig. 1a). I agree with Professor Simpson when he says that "As far as my limited observations go the minor folds do face south"



TEXT-FIGS. 1a, 2a, 3a.—The reconciliation of local northerly transport in the inverted limbs of recumbent folds with general southerly transport of the major anticline. Structures on all scales face south. The Widemouth-Okehampton Line marks the change in attitude of folds within the major anticline having a steep southern limb. Solid-headed arrows indicate direction of facing of beds.

TEXT-FIGS. 1b, 2b, 3b.—Northerly transport of the major structure here interpreted as a gliding nappe which may be associated with an autochthonous foundation. All structures face south. The Widemouth-Okehampton Line in this reconstruction marks the junction between northerly facing recumbent folds involving mainly Devonian and Lower Carboniferous rocks and southerly facing overfolds in autochthonous Upper Carboniferous rocks. The latter are not shown on the diagram.

(Simpson, 1962), and, disregarding his earlier statement that south of the Widemouth-Okehampton line "any southward facing recumbent structures would only be local and exceptional" (Simpson, 1961, p. 21), I accept this as evidence in favour of the interpretation shown in Text-fig. 3a.

I am not impressed by the argument involving tectonic gradients because both in Text-fig. 1a and in 1b the beds, being inverted, become younger to the south. Thus more folds must be postulated in order to bring in the older Delabole slates in the same direction and in both cases these folds would be at deeper tectonic levels than those to the north. The areal distribution of the metamorphic and structural expressions of the tectonic gradient, or local tectonic gradients, would appear to have been influenced by faulting along the Widemouth-Okehampton line, by faulting within the pile of recumbent folds (Dearman and Butcher, 1959; Dearman, 1960), and by the uplift produced by the granite ridge to the south.

It is obvious that much more field work remains to be done before the opposing views discussed in this and earlier letters can be reconciled. But I would emphasize that as far as my observations go the recumbent folds face south.

#### REFERENCES

- ASHWIN, D. P., 1958. The coastal outcrop of the Culm Measures of South-West England. *Abstracts, South-West England Conference, R. geol. Soc. Cornwall*, 2-3.
- DEARMAN, W. R., 1960. The structure and stratigraphy of the Lower Culm Measures between Bridestowe and Lewtrenchard, Devon. *Ibid.*, 8-9.
- 1962. Devonian and Carboniferous stratigraphy of Cornwall. *Geol. Mag.*, **98**, 529-530.
- and N. E. BUTCHER, 1959. The geology of the Devonian and Carboniferous rocks of the north-west border of the Dartmoor granite, Devonshire. *Proc. Geol. Ass., Lond.*, **70**, 51-92.
- OWEN, D. E., 1937. The geological structure of mid-Devon and North Cornwall. *Proc. Liverpool Geol. Soc.*, **17**, 141-159.
- 1950. Carboniferous deposits in Cornubia. *Trans. R. geol. Soc. Cornwall*, **18**, 65-104.
- SELWOOD, E. B., 1961. The Upper Devonian and Lower Carboniferous stratigraphy of Boscastle and Tintagel, Cornwall. *Geol. Mag.*, **98**, 161-167.
- SIMPSON, S., 1961. The structure of Devon and North Cornwall. *Abstracts, South-West England Conference, R. geol. Soc. Cornwall*, 20-21.
- 1962. Structures of Devon and Cornwall. *Geol. Mag.*, **98**, 284-286.

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#### ? EARLY TERTIARY FOLD MOVEMENTS IN MULL

SIR,—R. F. Cheeney (1962) has remapped the Loch Don Anticline of eastern Mull. This is an arcuate fold, running more or less north and south, that strongly tilts a great covering of Tertiary basalt lavas, thus bringing to the present surface of erosion: Upper Cretaceous limestone, various Jurassic sediments (Inferior Oolite to Lower Lias), Trias conglomerate, Devonian lavas and Dalradian schists. Dips in both limbs of the anticline are steep; and in the eastern limb the Jurassic sediments are occasionally somewhat overturned. Cheeney's black and white map (1962, p. 230) is almost identical with the coloured version in the Geological Survey one-inch Sheet 44 (1923, reprinted 1959). The comparison is easy since Cheeney has adopted the same