contained little sediment. As sea levels rose during the Rhaetian, these fissures filled with contemporaneous sediment, with additional solution occurring during intermittent periods of local Rhaetian subaerial exposure[4].

When Robinson[2] dated the Emborough fissure as Norian she was influenced by the absence of mammals, so that their discovery removes this age connotation. Fraser *et al.*[1] distinguish a discrete Norian fauna, in spite of the lack of an independent Norian date for this supposed pre-Rhaetic reptile assemblage, and in disregard of the evidence from the Tytherington fissure[5] which is dated as Rhaetian using diverse microfloras. Fraser *et al.*[1] dismiss this date, indicating incorrectly that these particular deposits were tectonically disturbed and mixed. Microfloras of Rhaetian age have now been recovered[6] from six separate fissure fills in Tytherington Quarry and except for one minor slump sequence none of these palynomorph-bearing intervals shows any evidence of tectonic mixing. Whilst some of the Tytherington fissures were tectonicaly initiated[6], most show a pre-infill solutional influence or are entirely solutional in origin. In addition to microfloras, five of these fissures also contain fish (including *Pholidophorus, Gyrolepis Hybodus, Saurichthys*) and crustacea (*Euestheria minuta*) characteristic of the Rhaetian[6]. The microflora and fauna both occur in the same matrix as the supposed pre-Rhaetic Norian reptile assemblage.

Because the Tytherington 'Norian' reptile fauna has been shown to be Rhaetian and because the nature of Robinson's evidence for a pre-Rhaetic age at Emborough is highly equivocal, we suggest that the presence of *Kuehneotherium* could more reasonably indicate the date of the Emborough deposit than vice versa. It is generally accepted that the abundant mammal fossils (including *Kuehneotherium*) from other British fissure fills are of Rhaeto-Liassic age[7]. We therefore place the Emborough deposit in the Upper Rhaetian and see no justification for the date proposed by Fraser *et al.*[1].

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FRASER, WALKDEN AND STEWART REPLY—We are most interested to learn that on the basis of detailed comparisons with well-dated German faunas[1], Buffetaut and Martin would now revise downwards the age of the Saint-Nicholas-de-Port vertebrate assemblage. Although there is as yet no other firm evidence to confirm a Norian rather than Rhaetian age for these late Triassic deposits, the presence of Kuehneotheriids amongst otherwise acceptable Norian forms does suggest a mammalian occurrence as old as the Emborough *Kuehneotherium* specimens.

As stressed by Warrington *et al.*[2], the term 'Rhaetic' in Britain is a lithostratigraphic one, not to be confused with the chronostratigraphic stage name 'Rhaetian' which generally extends a little lower. The marine incursion which established characteristic Rhaetic deposits in Britain was a rapid event affecting wide areas almost simultaneously[3]. It thus provides a useful stratigraphical marker, and it would be difficult to persuade geologists not to use it. Hitherto, all records of late Triassic mammals have post-dated this transgression, but at Emborough, where we have found mammal remains for the first time, the isolated Triassic pocket containing them lies beneath a planation surface associated with Rhaetic (Westbury Formation) sediments. The pocket sediments themselves are completely distinct, and have continental characteristics identical with Norian deposits nearby. We fully agree that in many other places, including parts of mainland Europe, such a distinction could not so clearly be made.

Meanwhile, Whiteside and Marshall claim, on the basis of their own interpretation, that the Emborough deposit in which we have found mammalian teeth is probably of Rhaetian rather than Norian age. Our dating of the deposit followed careful re-assessment in the field as part of a wider study of the fissure deposit phenomenon, and our acceptance of Robinson was arrived at because we found no cause to criticize Robinson's evidence. Certainly, if palynological evidence came to light, the deposit could prove to be Rhaetic, but equally it might be pre-Norian or mid-Jurassic.

The evidence for a pre-Rhaetic age is based on classical stratigraphical argument, reviewed by Whiteside and Marshall, and no evidence to the contrary has emerged. The deposit is in fact closely similar to local Keuper Marl facies and is comparable to pre-Rhaetic boulder and conglomerate deposits elsewhere in the Mendips. It contains no evidence of derived Rhaetic or post-Rhaetic sediments (including the ubiquitous phosphatic basal bone-bed formerly exposed nearby within Emborough Quarry) and is unlike any of the known post-Norian lithologies in the area. If Whiteside and Marshall believe that the deposit belongs to the Upper Rhaetian, then the onus of proof lies with them and we will welcome any new information they can provide.

As regards the dating of the Tytherington deposits, we merely wish to sound a strong note of caution at a locality where the fissures owe their origin to tensional stresses which continued into the Rhaetic. Whether directly attributable to tectonic dilation, or resulting from meteroic reworking or marine flooding of open systems (for example, ref. 4) the effects of remobilization, mixing and contamination can be very subtle. We would not dispute that the fish faunas may be of Rhaetian age, but it would be helpul if the full sedimentological and faunal details of Tytherington were published in order to provide a firmer basis for discussion. However, the age of the Tytherington assemblages has no direct bearing on the age of the Emborough mammal find, and we raised the matter originally because if it does prove to be Rhaetic it further supports our contention (misunderstood by Whiteside and Marshall and by the author of ref. 5) that there is no longer any case for a fundamental distinction between the terrestrial faunas before and after the Rhaetic transgression based on the presence or absence of mammals.

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Flow law for ice in polar ice sheets

DOAKE and Wolff[1] have argued that a relationship between strain rate $\dot{\epsilon}$ and stress τ of the form $\dot{\epsilon} = A\tau^n$ with $n = 1$, rather than the commonly used value of 3 (and where A is the flow law constant), provides a better fit to data from polar ice masses. Weertman[2] has discussed the implications. I remain unconvinced for the following reasons.

(1) The Devon Ice Cap borehole is within a distance of 3 ice thicknesses from the ice divide. Modelling of flow near divides, with $n = 3$, shows that the shape of the velocity-depth profile changes with distance; tilting data, if analysed by Doake and Wolff's method, would give a value of n increasing from zero near the divide to 3 at about 10 ice thicknesses from it[3]. Doake and Wolff's analysis is therefore invalid.

(2) At Camp Century, the strain rate measured for $\tau_{xz} = 10$ kPa, where x_L^Y and 3 define a rectangular coordinate system, is less than the observational error[4]. The same is almost certainly true at Law Dome.

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