CORRESPONDENCE

Comments on the paper 'The Portland–Purbeck junction (Portlandian–Berriasian) in the Weald, and the correlation of latest Jurassic–early Cretaceous rocks in southern England' by W. A. Wimbledon & C. O. Hunt

SIR – In the introduction to their recent paper, Wimbledon and Hunt (1983) referred to the palynological studies of Norris (G. Norris, unpublished Ph.D. thesis, Univ. Cambridge, 1963; 1969), and followed this by stating that 'Norris's tentative and somewhat broad correlations have been ignored by most, and even distorted by some subsequent authors (Anderson & Bazley, 1971; Worssam & Ivimey-Cook, 1971)'. The first of the papers thus quoted includes no mention of Norris; Wimbledon and Hunt (1983), however, made no further reference to the Warlingham Borehole, the subject of study by Worssam & Ivimey-Cook 1971). Only by turning to the paper itself, therefore, can one make an assessment of the extent of alleged distortion, as well as of the real difficulty in reconciling the evidence of the Warlingham Borehole with Norris's and Wimbledon & Hunt's (1983) views on the relations between the Purbeck Beds of the Weald and those of Dorset.

The reference to Norris (1969) in the Warlingham Borehole paper (his thesis was not consulted) was an attempt to summarize Norris's published work in the context of the detailed stratigraphy of the borehole. Much of the account of the Purbeck Beds on pp. 32–35 of the borehole paper is devoted to comparing the lithostratigraphy at Warlingham with that of the Sussex outcrop. The localities are only 48 km apart, and have comparable positions on the flanks of the Wealden basin of subsidence (Howitt, 1964, figure 7). Some correspondence was therefore to be expected, but the actual matching of individual members throughout the formation seemed then, and still seems, remarkably close, with the total thinning from 120 m or so at the outcrop to 80 m in the borehole being evenly distributed throughout the formation. Moreover, the presence of one well-defined Cinder Bed in the borehole, recognizable by its marine macrofauna independently of its position in the ostracod zonal scheme, goes some way towards allaying misgivings that Anderson & Bazley (1971, p. 20) felt about identification of the Cinder Bed horizon at the Sussex outcrop. The lithostratigraphical correlation is further confirmed by the results of the Fairlight (Institute of Geological Sciences, 1971) and Broadoak (Lake & Holliday, 1978) boreholes, and by the biostratigraphical work of Morter (in press).

In view of the match between the borehole and outcrop successions no great diachroneity of any of the successive facies of the Purbeck Beds seemed likely. Norris's (1969) finding that the one palynological boundary detectable in the Weald, between his suites B and C, occurred near the top of the Gypsiferous Beds at Mountfield but at a distinctly higher level, just below the Cinder Bed, in the Warlingham Borehole, therefore seemed anomalous, particularly since he reported the same boundary to be near the Cinder Bed in Dorset. In view of the opinion, then as now widely held, that there is a single widespread Cinder Bed horizon we favoured Norris's correlation between Warlingham and Dorset and suggested that the palynology of the central Weald be looked at more closely. Now that this has been done by Wimbledon & Hunt (1983), with results similar to those of Norris, the position of the Warlingham Borehole succession is still left unresolved.

Wimbledon & Hunt (1983), referring to ammonite faunas in the Weald, report that the highest Portland Beds at the Brightling mine have a *glaucolithus* Zone fauna, and that in the Fairlight Borehole 'at least one other ammonite fauna occurs above that of the *glaucolithus* Zone', while Cope *et al.* (1980, pp. 91–2, figure 15) have reported that ammonites of the Portland Beds of the Warlingham Borehole prove the presence of the *albani*, *glaucolithus*, *okusensis* and *kerberus* zones, but that in the Portsdown and Henfield boreholes *Glaucolithites* occurs close below the Purbeck Beds. This evidence provided by Portland Beds ammonites, as well, apparently, as that of dinoflagellates and acritarchs (Wimbledon & Hunt, 1983, pp. 269–71), still does not date the onset of the Purbeck facies in the Weald. On the evidence of ammonites alone there seems no reason why there should not have been a non-sequence in the southern part of the present-day Weald caused by intra-Portlandian movement of the Portsdown – Paris Plage Swell, with the onset of the Purbeck facies taking place at a Portlandian (post-*kerberus* Zone) date both at Warlingham and in the Mountfield area as well as in Dorset.

Even in the absence of firm palaeontological evidence for dating the Portland–Purbeck junction, however, it should be possible to secure agreement on the correlation between the Purbeck Beds in the Weald and those in Dorset. In this connection a feature of the Purbeck Beds not mentioned by Norris (1969) or Wimbledon & Hunt (1983) should be considered, namely, the sabkha environment, and semi-arid climatic conditions, indicated by sedimentological features of the Purbeck Beds gypsum (Shearman, 1966; Holliday & Shephard-Thorn, 1974; Holliday & Lake, 1978; West, 1975, 1979). Most workers have taken the view that a single episode of rather exceptional climatic conditions was required for the development of this facies, which was in consequence near-contemporaneous throughout Dorset and the Weald. The palynomorph assemblages of the gypsiferous beds indicate a flora predominantly of conifers, with subordinate filicales and cycadophytes, and West (1975) has suggested that the boundary between warm-temperate and dry zones that is found in the modern southern Mediterranean–North African area provides a present-day environmental analogue. Sladen & Batten (1984) attribute the change from the semi-arid conditions that favoured deposition of gypsum to the more humid climate that prevailed in post-Cinder Bed times to uplift of the Anglo-Brabant massif rather than to a global shift of climatic zones; a broad contemporaneity of the gypsiferous beds of the central Weald, of Warlingham and of Dorset is implicit in their reconstruction.

If the evidence of plant spores is at variance both with that for a climatic change and with the detailed lithostratigraphical and biostratigraphical match between the Warlingham and central Weald successions, then provided sampling has been adequate it is hard to resist the conclusion that the palynomorph assemblages are subject to local environmental factors, for instance to conditions on the contemporary land-surfaces bordering the Purbeck Beds basin of deposition.

Geol. Mag. **121** (6), *1984, pp. 651–652. Printed in Great Britain*

Norris's (1969) samples proving his suite B at Warlingham came only from a 5-ft interval between 2022 and 2027 ft, about midway in the Purbeck Beds succession in the borehole (top at 1889 ft, base at 2150 ft depth). We are not aware of the loan of any Warlingham Borehole material from the depth range 2027 to 2150 ft since Norris's study, and so far as we are aware the palynology of the Warlingham Purbeck Beds below 2027 ft remains unexamined. Its examination now might bear usefully on this problem.

Acknowledgement. This communication is published by permission of the Director, British Geological Survey (N.E.R.C.).

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27 April 1984