

Postscript. Since compiling this letter we have been fortunate to hear both the excellent review lecture by Prof. G. M. Brown on Hebridean vulcanism, and the paper by J. G. Holland and Professor Brown, on the geochemistry and petrogenesis of the Ardnamurchan cone sheets, both presented at the IAVCEI Symposium sessions at Oxford.

The paper by Holland and Brown was of particular interest to us, in relation to this enquiry. Their work shows that the cone sheets of Richey & Thomas' Centre 1, plus those of Centre 2 near Mingary, are the most silicic. That is to say, according to classic differentiation theory, the latest differentiates are all in the region which we suggest may include the youngest members of the Ardnamurchan complex.

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11th September, 1969

THE BASEMENT BEDS IN THE BOBBING BOREHOLE, KENT

SIR,—No Ordovician rocks have hitherto been recorded from south-east England.

Working independently on the macrofaunas and palynology of the concealed Lower Palaeozoic rocks beneath the Kent coalfield, we have examined material from the Bobbing Borehole. This borehole, drilled in 1911 two and a half miles (4 km) west-north-west of Sittingbourne, Kent, [NGR TQ/874 652] encountered (unconformably beneath the Great Oolite) steeply dipping basement rocks at a depth of 1,192 feet (363 m), about—1,070 O.D., and was stopped at a depth of 1,250 feet (381 m). These basement beds are grey micaceous siltstones and sandstones, of an estimated true thickness of 20 feet (6 m), and were considered to be of Silurian age by Lamplugh, Kitchin & Pringle (1923, p. 158) and Dines, Holmes & Robbie (1954, p. 11).

The macrofauna from the Lower Palaeozoic rocks in the collection of the Geological Survey (registered numbers JM 1635–52) comprises the following:—

bryozoa
strophomenide brachiopod [two pedicle valves]
strophomenoid brachiopod [fragment]
orthocone nautiloid
homalonotid trilobite [fragment]
trinucleid? trilobite [fragment]
Plumulites sp. (see Withers 1926, p. 70)
Mastigograptus ? sp. [two specimens]
crinoids, bivalves and ?gastropod [assorted fragments]
worm burrows

We (L. R. M. C., A. W. A. R.) have assessed the age of this assemblage to be upper Ordovician for the following reasons. The doubtful trinucleid fragment suggests an Ordovician rather than a Silurian age, and the strophomenoid fragment suggests the upper rather than the lower part of the Ordovician. One trepostomatous bryozoan was originally examined by Dr. K. P. Oakley, who compared it with the Ordovician genus *Batostoma* Ulrich. The graptoloid (the "plant remains" of Dines *et al.* 1954) was kindly looked at by Professor O. M. B. Bulman, who tentatively referred it to the predominantly Ordovician "dendroid" genus *Mastigograptus* Ruedemann, a record which, if confirmed, would be the first for Britain; but the total age range of the genus is not yet definitively known.

The strophomenide brachiopod is of particular interest. There are two small convex pedicle valves, one with its counterpart, both about 4 mm. wide. The ornament is typical of many strophomenaceans, more or less equally parvicostellate with a conspicuous median rib, and this, taken together with a triangular, open-ended muscle field and perhaps vestigial dental plates, suggests attribution to *Rafinesquina* sp. On the other hand, on the hinge lines of both specimens there are what have been described as

small spines, which led to the previous determination of *Chonetes* cf. *novascoticus* Hall (Stubblefield in Dines *et al.* 1954). The present authors, and several other people to whom the specimens have been shown, are still in doubt as to the true identity of these spinelike objects, and we prefer to leave the question open. If these specimens are really chonetids, then they would be amongst the earliest known. No true chonetids have been found in the Ordovician of Europe, and indeed the only records from the high Ordovician are those from the Ellis Bay Formation of Anticosti Island, Canada (Twenhofel 1928, p. 199). Whether the specimens from Bobbing are rafinesquinids or chonetids, however, they indicate an upper (i.e. Caradoc or Ashgill), rather than a lower, Ordovician age.

Examination (by T. R. L.) of the palynological evidence from chitinozoa and acritarchs wholly confirms the new macrofaunal interpretation and supports a Caradoc age. The examination was based on a single composite sample (registered SAL1029) from depths 1,192–1,250 feet (approx. 363–381 m), consisting of approximately 50 gms of silty grey mudstone. Processing yielded a coarse residue comprising twenty-three chitinozoans, some scolecodonts, a few large acritarchs and organic debris. The fine residue consisted of a large quantity of indeterminate organic debris probably of algal origin and some of it certainly degraded acritarch tests; acritarchs were quite common but often very tattered and corroded, although not blackened. The following species have been determined:

CHITINOZOA

Ancyrochitina bulmani (Jansonius) Jenkins (11 specimens), *A.* cf. *bulmani* (Jansonius) Jenkins, *Conochitina lepida* Jenkins, *C. primitiva* Eisenack, ?*Conochitina elegans* Eisenack [damaged], *Cyathochitina campanulaeformis* Eisenack, ?*C. kuckersiana* Eisenack, *Spinachitina cervicornis* (Eisenack) Laufeld, indeterminate specimens.

ACRITARCHS

Baltisphaeridium eisenackianum (Deunff), *B. eisenackianum* var. *crozonensis* (Deunff), *B. cf. granulatispinosum* (Downie), *B. hirsutoides* (Eisenack), ?*B. hirsutoides* (Eisenack), *B. longispinosum* (Eisenack), *B. lucidum* (Deunff), *B. cf. lucidum* (Deunff), *B. multipilosum* (Eisenack), *B. sp.* (the *Hystrichosphaeridium* cf. *multipilosum* Eisenack of Deunff, 1958), *P. polygonale* (Eisenack), *B. spinescens* (Timofeyev), *B. trifurcatum nudum* (Eisenack), *B. sp.*, *Micrhystridium* sp. (the *Hystrichosphaeridium* cf. *alloyteum* Deunff of Deunff 1958) *Multiplicisphaeridium bifurcatum* Staplin, Jansonius & Pocock, *M. digitatum* Eisenack, *M. irregulare* Staplin, Jansonius & Pocock, *M. sp.* (the *Hystrichosphaeridium* cf. *ramusculosum* Deflandre of Deunff 1958), *Veryhachium macroceras* Deunff, *V. piliferum* Martin, *V. tetraedron* Deunff, *Leiosphaeridia* sp., *Acanthodiacrodium* sp., *Tectitheca* cf. *additionalis* Burman, *T. aff. valida* Burman.

Three of the seven chitinozoan species identified are diagnostic as to age. *Ancyrochitina bulmani* and *Conochitina lepida* are known only from the basal Caradoc in Britain (Jansonius 1964; Jenkins 1967). *Spinachitina cervicornis* was first recorded by Eisenack (1931) from Baltic drift pebbles and its stratigraphic range was unknown; recently however it has been described from the Caradoc of Sweden (Laufeld 1967). The other four species are long ranging but are consistent with an Ordovician age.

The acritarch assemblage confirms a Caradoc age. It shows many similarities to Caradoc assemblages described from Brittany (Deunff 1958; Henry 1959) in terms of acanthomorph and polygonomorph representatives (*B. eisenackianum*, *B. eisenackianum* var. *crozonensis*, *B. longispinosum*, *B. lucidum*, *B. cf. multipilosum*, *M. cf. alloyteum*, *M. cf. ramusculosum*, *V. macroceras*, *V. tetraedron*). *Multiplicisphaeridium bifurcatum* and *M. irregulare* have been recorded from the Trenton of Anticosti Island (Staplin, Jansonius & Pocock, 1965) but not so far from any other horizon.

V. piliferum has previously been found in the Upper Caradoc of Bohemia (Vavrdova 1965). However Martin's record (1968) of *V. piliferum* from the Wenlock Assise de Jonquois of Belgium is here interpreted as being derived (together with other characteristic forms) from the Arenig or Llanvirn, although Martin did not find the species in the higher Ordovician. One other species *V. macroceras* is so far known only from the Caradoc (Deunff, 1958; Henry, 1959).

Notable is the occurrence of rare diacromorph acritarchs (*Acanthodiacrodium* and *Tectitheca*). This substantiates existing records of their rare occurrence as high as the

Caradoc (Martin 1968; Vavrdova 1965). Another feature is the occurrence of a specimen compared with *B. granulatispinosum*; this is essentially a Silurian form, although Vavrdova (1965) has a record of it from the Ashgill of Bohemia.

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10th November, 1969.

LONGVILLIAN SHELLY FAUNAS FROM THE DOLWYDDELAN AREA,
NORTH WALES

SIR,—We would like to present results of recent work on the shelly faunas from sediments immediately underlying the Snowdon Volcanic Series in the Dolwyddelan area. The detailed stratigraphy of the Dolwyddelan area was first investigated by Williams & Bulman (1931). They suggested that the Snowdon Volcanic Series in the Dolwyddelan syncline consisted of the Lower Rhyolite Tuffs at the base succeeded by the Bedded Pyroclastic Series and the Upper Rhyolite Tuffs. Black slates assigned to the