

CORRESPONDENCE

A note on the occurrence of marine animal remains in a Lancashire coal ball (Westphalian A)

(Plate 1)

SIR – Ever since Hooker & Binney (1854) described structurally preserved plants in coal balls from the Lower Coal Measures of Lancashire these permineralized peats have aroused the interest of both geologists and botanists, as a source of structural and ecological data on British Coal Measure plants (e.g. Williamson, 1872–93). The origin and formation of coal balls was the subject of a major contribution by Stopes & Watson (1908) that has remained substantially unchallenged to the present day. New discoveries in North America (Mamay & Yochelson, 1962) of marine animals in coal balls supported the conclusion that the formation of coal balls may be directly related to overlying marine waters supplying the calcium and magnesium carbonate of the coal-ball matrix. Recent interest in coal balls in the U.S.A. has concerned palaeoecological as well as botanical and geological studies (Perkins, 1976; Phillips, 1979; Eggert & Phillips, 1979). In their paper Mamay & Yochelson stated (p. 194) that ‘it may be that animal remains simply do not occur in coal balls in Europe or England’.

We should like to draw attention to the discovery by one of us (J.H.) of a coal ball (U.S.T.M.B 139) containing marine animal remains found at Rowley tip, Burnley, Lancashire, associated with otherwise ‘normal’ coal balls. The coal ball, measuring 15 cm across (Pl. 1a) is generally of the ‘heterogeneous’ type of Mamay & Yochelson (i.e. with patches of purely plant or purely marine sediment) but a true mixing of plant and animal material occurs in part. The animals consist mainly of goniatites (Pl. 1b) but we have seen other as yet unidentified fauna including bone fragments. The coal ball is composed mainly of plant fragments only some of which are identifiable. Lycopods, both stems and stigmarian rootlets, are the most abundant plants in the coal ball but the flora also includes *Calamites* (Pl. 1b), *Botryopteris*, *Achlamydocarpon*, fern sporangia and megaspores including *Cystosporites*. Coprolites containing plant material also occur. The outer zone is pyritic and pyrite has permineralized some of the plant fragments as well as being incorporated into goniatite shells (Fig. 1b). The coal ball is surrounded by a coaly matrix showing that it truly occurred within the seam and was not a roof nodule. Details of the preservation awaits further study but this discovery further illustrates the probable common process of formation of American and British coal balls.

Of the 2000 or so coal balls from Burnley investigated during the present study only one such marine coal ball has been found. Roof nodules containing abundant goniatites with isolated fragments of plant material are well known, however (Stopes & Watson, 1908). Coal balls are known in Britain only from the Westphalian A and their absence from higher Coal Measure horizons has not been fully explained but it may be due to the lack of marine influence following peat formation. This alone, however, may not be the full explanation.

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References

- Eggert, D. L. & Phillips, T. L. 1979. Guide Book to Environments of Plant Deposition in Coal Balls, Paper Coals and Grey Shale Floras. *9th Int. Congr. Carb. Strat. Geol.* Illinois, 1–74.
- Hooker, J. D. & Binney, E. W. 1854. On the structure of certain limestone nodules enclosed in seams of bituminous coal with a description of some Trigonocarpons contained in them. *Phil. Trans. R. Soc. Lond.* B, **145**, 149–56.
- Mamay, S. H. & Yochelson, E. L. 1962. Occurrence and significance of Marine Animal Remains in American Coal Balls. *Prof. Pap. U.S. geol. Surv.* **354** I, 193–224.
- Perkins, T. W. 1976. Textures and conditions of formation of Middle Pennsylvanian Coal Balls, Central United States. *Kansas Univer. Pal. Contr. Pap.* **82**, 1–13.
- Phillips, T. L. 1979. Paleobotanical Studies in the Pennsylvanian System of the Illinois Basin. In *Depositional and Structural History of the Pennsylvanian System of the Illinois Basin*, vol. 2 (ed. J. E. Palmer and R. R. Dutcher), pp. 4–7. Field Trip 9. *9th Int. Cong. Carb. Strat. Geol. Illinois. Geol. Mag.* **118** (3), 1981, pp. 307–308. Printed in Great Britain.

- Stopes, M. C. & Watson, D. M. S. 1908. On the present distribution and origin of the calcareous concretions in coal seams known as 'coal balls'. *Phil. Trans. R. Soc. Lond. B* **200**, 167–218.
- Williamson, W. C. 1872–93. On the organization of fossil plants of the Coal Measures. 19 Parts. *Phil. Trans. R. Soc. Lond. B*, 161–84.

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EXPLANATION OF PLATE

Plate 1. (a) Etched surface of sliced coal ball. Surrounded by coal (arrowed) and containing goniatites as well as abundant plant fragments. About natural size.

Plate 1. (b) Detail of Plate 1(a) showing association of goniatites (G), *Calamites* stem (C), *Stigmaria* (S) and a lycopod stele (L); In addition there is unidentified animal remains, possibly bone (B). $\times 3$.

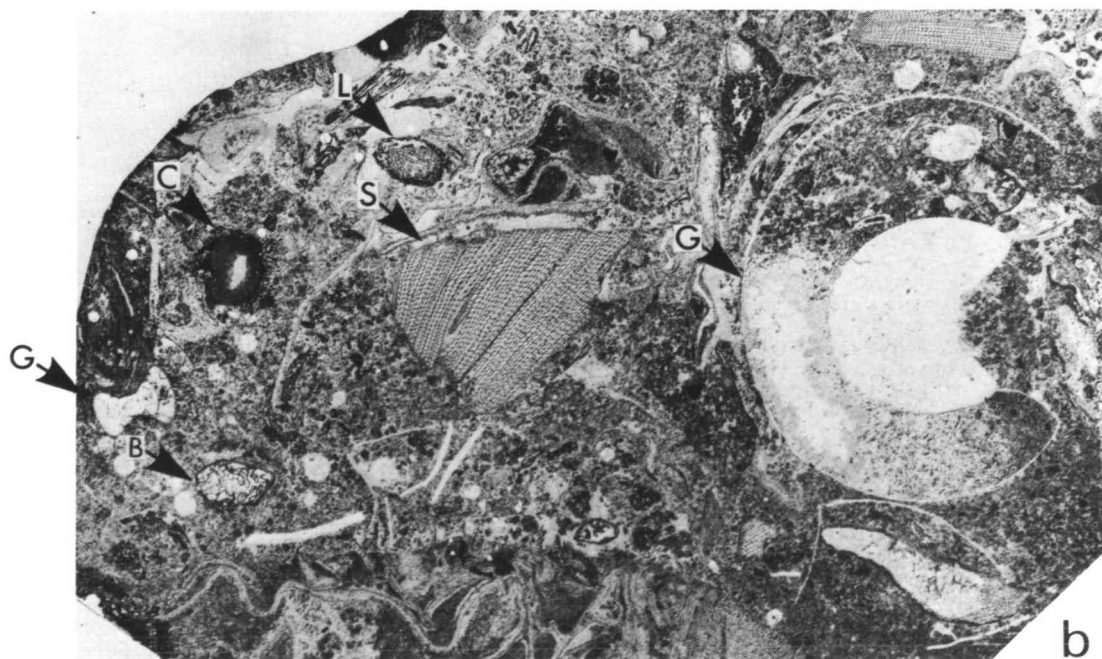


Plate 1. Marine remains in a Lancashire coal ball.