

No. XV.—**The Basal Fauna of the Zone of *Anthracomya modiolaris* in the Coal Measures of South Ayrshire.** By D. Leitch, B.Sc., R. G. Absalom, M.Sc., Ph.D. and S. M. K. Henderson, B.Sc., Ph.D.

(Read 9th April, 1936. Issued separately 5th April, 1937).

In a recent paper on 'The Zonal Distribution of the Non-marine Lamellibranchs in the Coal Measures of Scotland,' Weir and Leitch (1936, pp. 725-726) were unable to record in South Ayrshire the musselband fauna which marks the base of the *modiolaris* zone in North Ayrshire and the Central Coalfield. The base of the zone was therefore taken provisionally at the Low Camlarg Coal (Fig. 1), following the final occurrence of *Carbonicola pseudorobusta* in the Beoch Musselband. The lowest *modiolaris*-fauna studied by these authors in South Ayrshire was obtained from the roof of the Pennyvenie Two Foot Three Inch Coal which lies 170 ft. above the Beoch Musselband. The dominance of *C. aquilina* in this fauna suggests a fairly high horizon in the zone.

Since the publication of the above paper two significant mussel horizons have been discovered in Auldnav Glen, 4 miles N.E. of Dalmellington, South Ayrshire (six-inch Sheet 47 N.W.). The lower occurs between the Low Camlarg Coal and the Beoch Musselband and has already been recorded in a bore by the Geological Survey (*see* Vertical Sections of the Scottish Coalfields, Sheet 20, 1932, Section 12). The upper horizon is a new record and occurs 24 ft. above the Low Camlarg Coal. These two faunas mark the sudden termination of the *Carbonicola pseudorobusta* sub-zone and the incoming of *Anthracomyae* related to *A. modiolaris*, *C. os-lancis* and *Naiadites* of the *producta-triangularis* group. We may therefore definitely place the lower boundary of the *modiolaris* zone just below the lower of these musselbands (Fig. 1), i.e. virtually in the position assigned to it by Weir and Leitch.

In the lower horizon the shells occur 20 ft. below the Low Camlarg Coal, in a shaly ironstone immediately on top of one of the numerous ironstone ribs which outcrop through a debris slope on the right bank of the stream. Only a few shells occur and they

are usually in the solid state. The fauna includes *C.os-lancis* Wright (Fig. 2, a; and cf. Weir and Leitch, Fig. 9, b), *C. cf. subconstricta* (J. Sow.) (Fig. 2, b and c; and cf. Weir and Leitch, Fig. 3, d and e), and *C. bipennis* (Brown), which in Scotland are typical of the basal fauna of the *modiolaris* zone. No *Anthracomya* was found and only a small fragment of *Naiadites*.

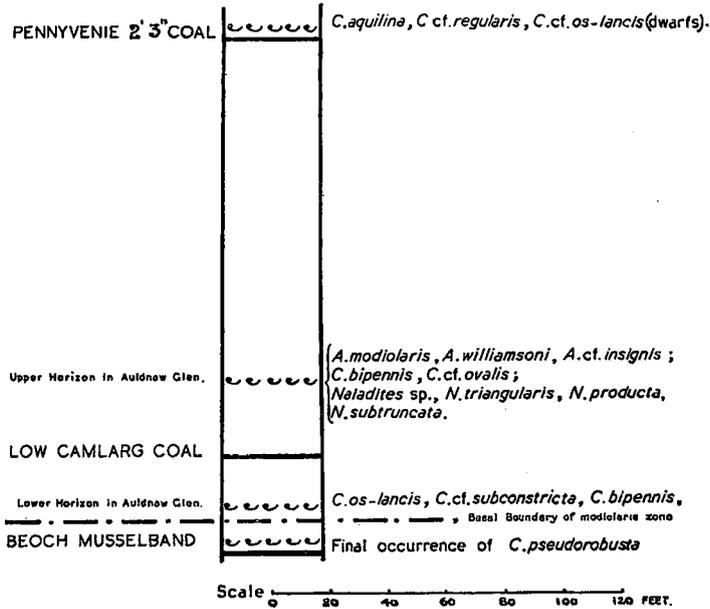


Fig. 1.—Section of part of Productive Coal Measures in Auldnaw Glen, near Dalmellington.

The upper horizon occurs in the bed of the stream in a thin parrotty shale 24 ft. above the Low Camlarg Coal which is here overlain by a 3-ft. sill. The assemblage consists mainly of *Anthracomya* and *Naiadites*; of the sixty specimens collected only four are *Carbonicola*. The fauna (Fig. 2, d to l) includes *C. bipennis* (Brown), *C. cf. bipennis* (tending to *C. ovalis*), *C. cf. ovalis* (Martin), *Anthracomya modiolaris* (J. de C. Sow.), *A. williamsoni* (Brown), *A. cf. insignis* Trueman. The *Naiadites* are a variable group including *N. triangularis* (J. de C. Sow.), *N. producta* (Brown), *N. subtruncata* (Brown), and *Naiadites* sp., a variant of this group resembling *N. triangularis* (cf. Dix and

Trueman, 1932, Fig. 5, a) but with a more central carina, larger angle β and greater elongation along the axis of obliquity; in the crushed state this variant shows a certain misleading resemblance to *Anthraconauta phillipsi* (Williamson). In the discussion in Dix and Trueman (1931, p. 21) Mr. J. T. Stobbs remarks on the presence in the *modiolaris* zone of North Staffordshire of a group of small *Naiadites* resembling *A. phillipsi*. A more extreme form of this variant, showing a tendency towards *N. quadrata*, was obtained from the Kiltongue Musselband in waste from a disused colliery at Slamannan, Stirlingshire, and is figured for comparison (Fig. 2, m).

The occurrence of *A. cf. insignis* in the upper horizon is the first Scottish record of a shell comparable with this species; in England it is usually found at or near the base of the *modiolaris* zone.

Although these two faunas indicate a low position in the *modiolaris* zone, neither can be correlated with any particular horizon in North Ayrshire or in the Central Coalfield. The lower horizon, occurring as it does only 10 ft. above the *C. pseudorobusta* sub-zone is undoubtedly the basal fauna of the *modiolaris* zone in this locality but it may not be the precise stratigraphical equivalent of the Kiltongue Musselband. They differ in certain respects. The Kiltongue Musselband consists of hundreds of crushed shells closely crowded together in shale and ironstone whereas in the lower musselband in Auldnaw Glen only solid specimens occur sparsely distributed through the ironstone. At this horizon, in contrast to the Kiltongue Musselband, there is no record of *Anthracomya* and *Naiadites flexuosa*. It is interesting to note, however, that the combined faunas of the upper and lower horizons in Auldnaw Glen show a close resemblance to the Kiltongue fauna; the upper horizon contains typical *Anthracomya* but no representatives of the *C. os-lancis* group, and the lower horizon contains *C. os-lancis* but no *Anthracomya*. It seems therefore that in South Ayrshire the Kiltongue fauna has been separated into two horizons and that instead of the usual 'burst' of *modiolaris* zone forms in the basal fauna we have in South Ayrshire first a modification of the *ovalis* zone *Carbonicola*-fauna in the lower horizon, followed by the entry of the Kiltongue *Anthracomya* in the upper horizon. This appears to be somewhat similar to the faunal sequence at the base of the *modiolaris* zone in Lancashire (Wright, 1931, p. 140).

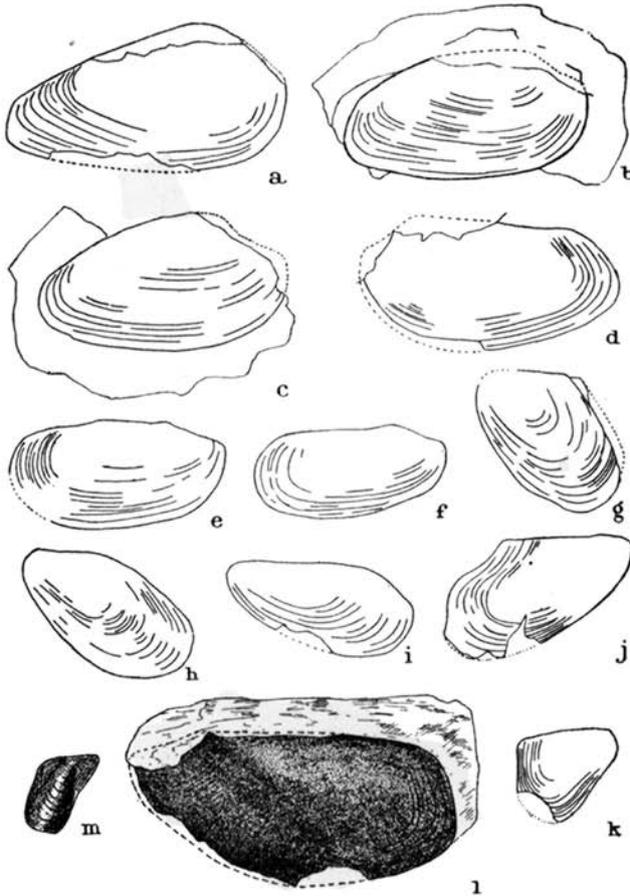


Fig. 2.—All specimens natural size:

- a. *Carbonicola os-lancis* Wright, S 6360.
- b, c. *C. cf. subconstricta* (J. Sow.) S 6361-2.
- d. *C. bipennis* (Brown). S 6363.
- e. *C. cf. ovalis* (Martin). S 6364.
- f. *Anthracomya* sp. between *A. modiolaris* and *A. williamsoni* S 6365.
- g, h. *Naidites* sp. 6366-7.
- i. *N. subtruncata* (Brown). S 6368.
- j. *N. producta* (Brown). S 6369.
- k. *N. triangularis* (J. de C. Sow.). S 6370.
- l. *Anthracomya cf. insignis* Trueman. S 6371.
- m. *Naidites* sp. S 6372.

a-c from musselband 20 ft. below Low Camlarg Coal; d-l from musselband 24 ft. above Low Camlarg Coal, in Auldnav Glen, 4 miles N.E. of Dalmellington, Ayrshire; m from Kiltongue Musselband, disused colliery at Slamannan, Stirlingshire.

The registered numbers are those of the Hunterian Museum Collection, Glasgow University.

Ten plant specimens were obtained from the upper horizon. The species are *Lepidodendron lycopodoides* Kidston (? Sternberg), *L. cf. lycopodoides*, *Calamites cisti* Brongniart, *Calamites* sp., *Cordaites principalis* (Germar). These are consistent with the zonal position suggested by the lamellibranchs but none is a critical species.

The authors wish to thank Professor A. E. Trueman who kindly furnished a report on certain doubtful specimens. Thanks are also due to Dr. J. Weir for helpful advice and criticism.

REFERENCES TO LITERATURE.

- WRIGHT, W. B., 1931. 'The Geology of Manchester and the South-East Lancashire Coalfield.' *Mem. Geol. Surv.*, pp. 132-158.
- DIX, E. and TRUEMAN A. E., 1931. 'Some Non-marine Lamellibranchs from the Upper Part of the Coal Measures,' *Quart. Journ. Geol. Soc.*, vol. lxxxvii, pp. 180-211.
- DIX, E. and TRUEMAN, A. E., 1932. 'Some Observations on the Genus *Naiadites*,' *Annals and Mag. of Natural History*, Series 10, vol. ix, pp. 1-20 (reprint).
- WEIR, J. and LEITCH, D., 1936. 'The Zonal Distribution of the Non-marine Lamellibranchs in the Coal Measures of Scotland.' *Trans. Roy. Soc. Edin.*, vol. lviii, part iii, pp. 697-751.