

# DUFTONIA, A NEW TRILOBITE GENUS FROM THE ORDOVICIAN OF ENGLAND AND WALES

by W. T. DEAN

ABSTRACT. A new phacopid trilobite genus *Duftonia* is described and assigned to the subfamily Acastinae Delo. In addition to the type material from the Ordovician of the Cross Fell Inlier in northern England other specimens related to the same species are described and figured from both North and South Wales.

DURING a recent re-examination of the stratigraphy and shelly faunas of the Caradoc Series in the Cross Fell Inlier, several specimens of what proves now to be a new genus and species of phacopid trilobite, here named *Duftonia*, were collected by the writer from the Pusgillian Stage. Since then another cranidium has been collected from the same horizon at Cross Fell by Mr. M. Mitchell who has kindly made it available for examination. The writer has also traced three other specimens belonging to a closely related form of *Duftonia*, two from North Wales, in the British Museum (Natural History), and one from South Wales, in the Geological Survey and Museum, London. Mr. J. D. D. Smith has kindly facilitated the loan of the last-named specimen.

The Cross Fell material was collected during field-work carried out with the aid of a grant from the Gloyne Outdoor Geological Research Fund, for the award of which I am grateful to the Council of the Geological Society of London. Professor W. F. Whitard has kindly read the manuscript and made several useful suggestions for its improvement. This paper is published by permission of the Trustees of the British Museum (Natural History).

Family PHACOPIDAE Hawle and Corda 1847

Subfamily ACASTINAE Delo 1935

Genus DUFTONIA gen. nov.

Type species *Duftonia lacunosa* sp. nov.

*Diagnosis.* Glabella of general phacopid outline with three pairs of glabellar furrows, the first or anterior pair of which are only faintly impressed; second and third pairs deep, third pair with apodemes. Three pairs of glabellar lobes, decreasing in size from first to third. Anterior branches of facial suture meet in front of glabella where a pre-glabellar furrow is not developed. In the type species, at least, surface of the glabella is finely granular, but that of the fixed cheeks is pitted. Small fixigenal spines present at the genal angles, and pygidium is mucronate.

*Discussion.* The type species of the new genus is found in the Pusgillian Stage, comprising the topmost Dufton Shales, Caradoc Series, of the Cross Fell Inlier in Westmorland, but closely related forms occur in strata usually classified with the Ashgill Series in both [Palaeontology, Vol. 2, Part 1, 1959, pp. 143-9, pl. 19.]

North and South Wales. No other records are yet known, but this may be due to lack of detailed collecting, or to absence of the requisite strata from much of England and Wales. *Duftonia* bears some resemblance to *Phacopidina* Bancroft 1949 but is distinguished by having more divergent axial furrows, eyes set farther from the glabella, deep second glabellar furrows which cut the axial furrows, and much smaller third glabellar lobes of different shape. It is named after the village of Dufton, Westmorland.

*Duftonia lacunosa* gen. et sp. nov.

Plate 19, figs. 1-3, 5, 6, 8

1948 *Pterygometopus* sp. Bancroft in Lamont, p. 468.

*Derivation of name.* *lacunosa* (Lat.) = pitted, referring to the pitted surface of the fixed cheeks.

*Description.* Cephalon roughly semicircular in outline. Glabella expanded anteriorly and attains its maximum breadth, which is about equal to the length, excluding occipital ring, just in front of the first glabellar furrows, though this not apparent in the holotype which is incompletely preserved. Axial portion of frontal lobe occupies about two-fifths of the length of the glabella. Three pairs of glabellar lobes decrease in size from first to third. First glabellar furrows straight, shallow, each extending inwards about one-third of the glabellar width, and diverge anteriorly at an angle of about 140 degrees; first glabellar lobes subtriangular in form, expanding outwards. Second glabellar furrows straight and moderately deep, directed inwards and slightly forwards, parallel to the long axes of the subrectangular second glabellar lobes. Third glabellar furrows deep, directed straight inwards, and expand slightly at their inner ends where apodemes are present, so that in consequence the small third glabellar lobes appear to increase in size outwards. Occipital furrow shallow medially, deepening laterally into apodemal pits; occipital ring long (*sag.*) centrally, but towards the axial furrows it first contracts slightly and then expands to form small occipital lobes. Axial furrows deep, narrow (except in internal moulds), and gently sigmoidal. The externally convex palpebral lobes stand about as high as the top of the glabella; they are sigmoidal in plan, thickened, and with a smooth surface, contrasting sharply with the pitting of the adjacent fixed cheeks from which they are separated by well-defined palpebral furrows. Anteriorly the palpebral lobes meet the axial furrows almost at right angles opposite the anterior half of the first glabellar lobes, after which they first run outwards and backwards, then curve sharply inwards and, finally, turn outwards again before being truncated by the intersection of the palpebral furrows and the outer margins of the palpebral lobes opposite the third or basal glabellar lobes. The eyes themselves have not been found preserved in the specimens from Cross Fell but are discussed later in an account of related Welsh material. Anterior branches of the facial suture run forwards from the eyes towards the widest portion of the glabella, where they cut the axial furrows, and then converge anteriorly to meet medially at the bluntly pointed outline of the frontal lobe. There is no development of a preglabellar furrow. Posterior branches of the facial suture continue the line of the palpebral furrows, curving first forwards and then back to meet the lateral margin just in front of the line of the pleuroccipital furrows which are broad (*exsag.*), straight, and become shallower towards, but do not reach, the lateral margin. Posterior margin of the cephalon transversely straight, and the genal angles are produced into small fixigenal

spines, seldom preserved intact; immediately in front of these the cephalic margin is slightly indented, a feature which serves to emphasize the outwardly directed attitude of the fixigenal spines. Corresponding indentations and fixigenal spines of similar type are found in another Ordovician phacopid genus, *Phacopidina* Bancroft 1949, which is typified by the species *P. harnagensis* Bancroft and *P. apiculata* (M'Coy), both from the Caradoc Series of the Anglo-Welsh area.

Hypostoma and thorax are as yet unknown from the Cross Fell Inlier, but the thorax of a related form has been collected from Wales (see later). Several associated pygidia have been found at the type locality, of which one, a paratype, is figured (Pl. 19, figs. 1, 3). Outline is subparabolic and the border is produced posteriorly into a small, thorn-like caudal spine, directed backwards and upwards. Projected length, including spine, is about three-quarters of the maximum breadth. Axis occupies about one-third of the breadth of the pygidium anteriorly and is bounded by moderately deep axial furrows which converge rearwards at 25 to 30 degrees, becoming obsolete before reaching the base of the caudal spine; excluding the articulating half-ring there are five or six axial rings. Each side-lobe is moderately convex and bears four pleural furrows, the first three of which are deeply impressed and the fourth less so, and four faint rib furrows; all these furrows die out laterally without reaching the margin, resulting in the formation of a smooth border.

Surface of the glabella is covered with fine granules, hardly discernible on internal moulds, and the fixed cheeks are finely pitted as seen from the external mould, though appearing granulose in internal moulds owing to the state of preservation. As already stated, the palpebral lobes are quite smooth. One specimen, BM. In.49824b, shows that at least part of the outer surface of the cephalic doublure carries fine granules. Surface of pygidium is smooth.

*Measurements (in mm.).* IM. = internal mould. EM. = external mould.

	<i>In.49821</i>	<i>In.49824A</i>	<i>In.49826</i>	<i>In.49920</i>
	<i>IM.</i>	<i>EM.</i>	<i>IM.</i>	<i>IM.</i>
Length of cranium	6.2	8.0	7.8	..
.. .. glabella	5.3	6.4	6.8	..
Breadth .. ..	5.0	7.0	..	..
.. .. cranium	12 (estd.)	..	..	..
Length .. pygidium	..	..	..	6.5
Breadth .. ..	..	..	..	8.5
Max. breadth of axis	..	..	..	3.0

*Holotype.* BM. In.49824A (Pl. 19, fig. 6), an external mould of an incomplete cranium, figured here as a latex cast. *Paratypes.* BM. In.49821 (Pl. 19, fig. 2); In.49826 (Pl. 19, fig. 8); In.49830 (Pl. 19, fig. 5); In.49920 (Pl. 19, figs. 1, 3).

*Horizon and localities.* The holotype and paratypes were all obtained from a highly fossiliferous band of weathered sandy limestone, average thickness about 2 inches, at the exposure in the eastern bank of Swindale Beck immediately north of the stone bridge 70 yards north-north-east of the barn situated about 820 yards south-south-east of the

summit of Knock Pike, Westmorland (National Grid reference 36884/52758). The species occurs also in the western bank of Swindale Beck directly opposite the type locality and at the same horizon. In the section cut through by Pus Gill, about half a mile north-east of Dufton, Westmorland, *Duftonia lacunosa* has been found by Mr. M. Mitchell at the exposure in the north-western bank of the stream 680 feet north-east of Pusgill House (National Grid reference 36980/52577). Other sections from which the species has been recorded are Hurning Lane, one mile due north of Dufton, and Billy's Beck, east of the same village.

All the above occurrences of *D. lacunosa* are in the uppermost part of the Dufton Shales, strata to which Bancroft gave the name Pusgillian Stage. At the type locality the associated fauna includes the trilobites *Atractopyge*, *Cybeloides*, *Flexicalymene*, *Platylchas*, and *Tretaspis*, and the brachiopods *Onniella*, *Sampo*, and *Sowerbyella*.

*Discussion.* *Duftonia lacunosa* sp. nov. is almost certainly the trilobite recorded by Bancroft on a locality map (in Lamont 1948, p. 468) as *Pterygometopus* sp., though no specimen has been found in his collection at the British Museum (Natural History). The horizon was marked on the same map as 'Pterygometopus Beds', but this term was never described or defined by him, and the number of individuals occurring there certainly does not warrant the introduction of such a name. The type species of *Pterygometopus*, *P. sclerops* (Dalman), has been redescribed by Whittington (1950, p. 538, pl. 68, figs. 17-20; pl. 69, figs. 1-4) who has preferred to restrict the genus to those forms in which, unlike *Duftonia*, a preglabellar furrow is developed. Another trilobite from the Anglo-Welsh Caradoc Series which is customarily referred to *Pterygometopus* can now be named *Estoniops jukesi* (Salter); the genus *Estoniops* has been erected by Männil (1957, p. 385) on the basis of *Acaste exilis* Eichwald 1857 and, like *Duftonia*, lacks a preglabellar furrow, but other differences are so marked that the two genera are unlikely to be confused, and are placed in different subfamilies.

The phacopid described and figured by Linnarsson (1869, pp. 59, 86, pl. 1, figs. 1, 2) as *Phacops recurvus* from the Trinucleidskiffer of Sweden resembles *D. lacunosa* in the form of the pygidium and, to a lesser extent, of the glabella and eyes, but unfortunately no photographs of the type material have been published and a full comparison is not possible. Kielan (1956, pl. 2, figs. 2-4) has figured what she calls *Pterygometopus recurvus*, the authorship of which species she wrongly ascribes to Olin instead of Linnarsson, from the Ashgill Series of Poland, but her specimen more resembles a typical *Calliops* and is not close to Linnarsson's original figures.

The only British Caradoc phacopid with which *Duftonia lacunosa* might possibly be confused is *Phacopidina apiculata* (M'Coy), which has been redescribed by Harper (1947, p. 169, pl. 6, figs. 6, 9). The glabella of the latter species differs markedly from that of *D. lacunosa* in having eyes situated closer to the glabella, straighter, more closely parallel axial furrows, second glabellar furrows which are curved, only faintly impressed and do not reach the axial furrows, and third glabellar furrows which are less divergent forwards and border larger basal glabellar lobes of 'cat's-ear' form, subtriangular in outline and very narrow (*exsag.*) at their inner ends. Apparently the surface of the glabella and fixed cheeks is smooth. The pygidium of *P. apiculata* is proportionately much larger, has a larger number of well-defined axial rings and, when preserved, a longer, slimmer, better-differentiated caudal spine.

The species described and figured by Reed (1915, p. 53, pl. 9, figs. 1-6) as *Phacops* (*Pterygometopus*) *tagon* from the Upper Naungkangyi Beds of the northern Shan States resembles *Duftonia lacunosa* in several respects such as the plan of the glabella, the presence of granules on the glabella and pitting on the fixed cheeks, and in the possession of a mucronate pygidium. However, there are notable differences, such as the absence of fixigenal spines, the development of a preglabellar furrow and deeper first glabellar furrows; *P. (P.) tagon* may belong to a new genus.

*Duftonia* aff. *lacunosa* sp. nov.

Plate 19, figs. 4, 7, 9-11

There are in the older collections of the British Museum (Natural History) two specimens of *Duftonia*, from the Corwen district of North Wales, apparently closely related to *D. lacunosa*. One of these, Thomas Ruddy Collection In.16999 (Pl. 19, fig. 4), is a whole individual with a maximum breadth of 15 mm.; the thorax is flexed but the estimated length, excluding the caudal spine which is broken off, is about 25 mm., though this may be less than the original owing to some distortion. Thoracic axis occupies one-third of the total breadth and is separated from the side-lobes by moderately deep axial furrows. The articulating half-ring and axial ring of each segment are of about the same length medially, separated by a deep, broad (*sag.*) articulating furrow, but the axial ring expands laterally to form a pair of axial lobes directed outwards and slightly forwards. Immediately in front of the axial lobes the articulating furrow deepens to form a pair of apodemal pits situated just inwards from the axial furrows. Inner halves of the side-lobes are flat, but the outer halves then turned down through almost a right angle at the fulcrum. Each pleura carries a broad (*exsag.*), gently sigmoidal pleural furrow which commences just outside the axial furrow where it divides the pleura into a narrow (*exsag.*) posterior band and a broader (*exsag.*) ridged anterior band. Beyond the fulcrum the pleural furrow curves forwards very slightly, at the same time becoming shallower and dying out without reaching the bluntly rounded pleural point which is flexed forwards slightly. The pygidium of the same individual has been slightly distorted, and the caudal spine is missing, nevertheless it can be seen to bear a close resemblance to that of *D. lacunosa*. Axial rings number four, with a suggestion of a fifth, and there are four pleural furrows on each side-lobe.

The eyes are not preserved in the above specimen but, as far as can be ascertained from their remains, they appear to be noticeably shorter than in *D. lacunosa* itself. This conclusion is borne out by an apparently identical form in the British Museum (Natural History), J. E. Lee Collection I. 1301 (Pl. 19, figs. 7, 10), in which the palpebral lobes intersect the axial furrows apposite the anterior half of the first glabellar lobes, as in *D. lacunosa* (s.s.), but then extend rearwards only as far as the level of the second glabellar furrows. The thorax is fairly well preserved, though having undergone some lateral compression, and contains eleven segments apparently similar to those of the preceding specimen. The pygidium is poorly preserved but the axis possesses four rings and each side-lobe four pleural furrows. The eyes themselves are badly preserved but one, the right, exhibits a schizochroal surface which, it is estimated, must have contained about seventeen or eighteen vertical rows of facets, the maximum number in a row being roughly eight.

There is one specimen, JP 3696, of a whole individual of *Duftonia* from the Ordovician of South Wales in the Geological Survey and Museum. The total length, excluding caudal spine, is 21 mm. The cephalon resembles those from North Wales in nearly all respects, particularly in having shorter palpebral lobes than *D. lacunosa* (s.s.), but the first glabellar furrows are slightly different. In *Duftonia* aff. *lacunosa* from the Corwen district the first glabellar furrows are faintly impressed, as in *D. lacunosa*, but diverge anteriorly at just under 130 degrees, compared with 140 degrees in the *forma typica*. The corresponding glabellar furrows of the South Welsh form are slightly deeper than those of the other two trilobites and, forming an angle of about 150 degrees, are more divergent anteriorly. It is not yet clear how much significance should be attached to these variations.

The eyes of the same specimen are not particularly well preserved but there appear to be about sixteen vertical rows of facets, the maximum number in a row being four, and the total number of facets being of the order of fifty-four. The thorax and pygidium of JP 3696 appear to resemble those of the North Welsh specimens though the caudal spine is not preserved.

*Horizon and localities.* Specimen In.16999 is labelled as coming from 'Blaendinan, 3 miles from Llandrillo'; at the present day this locality is known as Blaen Dinam, a farm  $1\frac{1}{2}$  miles south-west of Llandrillo, Merioneth. It is thought that the trilobite may be that recorded by Ruddy (1885, p. 119) from 'Blaendinan' and described by him as 'very rare'. The label gives the horizon as 'Trilobite Zone', a stratum which Ruddy (1885, p. 118) denoted as 'Zone 4', lying above 'Zone 5' which he described as representing the 'Bala crystalline limestone'. Judging by the matrix the specimen probably came from the Ddolhŷr Limestone, the lowest member of the Ashgill Series of the district. The second specimen from North Wales, I. 1301, is labelled merely 'Cynwyd, Merionethshire', and the matrix suggests that it, too, derives from the Ddolhŷr Limestone, outcrops of which are abundant in the Cynwyd District, particularly between the village and Moel Ferna to the east. JP 3696 was collected from the disused quarry by the west side of the Llandilo-Carmarthen road, 1,030 yards almost due north of Dynevor Castle, one mile west of Llandilo, Carmarthenshire (National Grid reference 26152/22350). In recent years the district has been examined by Williams (1953, pp. 195-6, pl. 9) whose

---

EXPLANATION OF PLATE 19

Figs. 1-3, 5, 6, 8. *Duftonia lacunosa* sp. nov. Dufton Shales, Pugsillian Stage, Swindale Beck, near Knock, Westmorland. 1, 3. BM. In.49920,  $\times 4.5$ . Pygidium, internal mould, showing caudal spine. 2. BM. In.49821,  $\times 3.5$ . Incomplete cranidium, internal mould. 5. BM. In.49830,  $\times 3$ . Internal mould of cephalon showing posterior branch of facial suture and fixigenal spine. 6. BM. In.49824A,  $\times 3.25$ . Latex cast of the holotype, an external mould. 8. BM. In.49826,  $\times 3.25$ . Incomplete cranidium, internal mould.

Figs. 4, 7, 9, 10, 11. *Duftonia* aff. *lacunosa* sp. nov. 4. BM. In.16999,  $\times 2.5$ . Internal mould of whole individual from Ddolhŷr Limestone (?), Blaen Dinam, near Llandrillo, Merioneth. 7, 10. BM. In.1301. 7,  $\times 2.8$ . 10,  $\times 2.4$ . Plan and side views of whole individual, internal mould, from Ddolhŷr Limestone (?), Cynwyd, Merioneth. 9, 11. GSM. JP 3696. 9,  $\times 2.5$ . Plan and side views of whole individual preserved as internal mould, Ashgill Series, north of Dynevor Castle, near Llandilo, Carmarthenshire.

---



map shows that the locality occurs in the lower part of the strata which he considers to be of Upper Bala age; Williams has equated at least some of these beds with the *Diacalymene* Beds of Cautley, Yorkshire.

The stratigraphical position of that portion of the Dufton Shales comprising the Pusgillian Stage has been doubtful for some time. The term was introduced by Bancroft (1945, pp. 182, 186) who claimed that it was equivalent to the *Dicellograptus complanatus* zone of the Ashgill, a course which has been followed by other writers, for example King and Williams 1948. It is not proposed to discuss this claim or the position of the Pusgillian in detail here, a topic to be dealt with in a later paper, but in view of a re-evaluation of the correlation between the shelly and graptolitic zones of the Caradoc Series in the Shropshire type area (Dean 1958, pp. 226–30), in which it was shown that the Onnian Stage is no later than the upper part of the *Dicranograptus clingani* zone, it can be argued that the Pusgillian is at least partly equivalent to the *Pleurograptus linearis* zone. The presence of the trilobite *Duftonia* in strata of both the Pusgillian Stage and the lower Ashgill Series should not be taken as conclusive proof of their equivalence. One could equally well argue that the genus may range through a succession of strata at and near the Caradoc/Ashgill junction, and the present lack of material makes it uncertain whether the morphological differences between the English and Welsh specimens are to be attributed to the effects of geographical distribution or of time.

## REFERENCES

- BANCROFT, B. B. 1945. The brachiopod zonal indices of the Stages Costonian to Onnian in Britain. *J. Paleont.* **19**, 181–252, pl. 22–38.
- 1949. Upper Ordovician trilobites of zonal value in south-east Shropshire. *Proc. Roy. Soc. Lond.*, **B**, **136**, 291–315, pl. 9–11.
- DEAN, W. T. 1958. The faunal succession in the Caradoc Series of south Shropshire. *Bull. Brit. Mus. (Nat. Hist.)*, *Geol.* **3** (6), 191–231, pl. 24–26.
- DELO, D. M. 1935. A revision of the Phacopid trilobites. *J. Paleont.* **9**, 402–20.
- HARPER, J. C. 1947. The Caradoc fauna of Ynys Galed, Caernarvonshire. *Ann. Mag. Nat. Hist.* (11), **14**, 153–75, pl. 6, 7.
- KIELAN, Z. 1956. On the stratigraphy of the Upper Ordovician in the Holy Cross Mountains. *Acta Geol. Polonica*, **6**, 253–71, pl. 1–4. [In Polish with English and Russian summaries.]
- KING, W. B. R. and WILLIAMS, A. 1948. On the lower part of the Ashgillian Series in the north of England. *Geol. Mag.* **85**, 205–12, pl. 16.
- LAMONT, A. 1948. B. B. Bancroft's geological work. 2. Upper Ordovician of the Cross Fell Inlier. *Quarry Man. J.* **31**, 416–18, 466–9, 1 pl.
- LINNARSSON, J. G. O. 1869. Om Vestergötlands Cambriska och Siluriska aflagringar. *Kongl. Sven. Vet.-Akad. Handl.* **8** (2), 1–89, 2 pl.
- MÄNNIL, R. 1957. *Estoniops*—a new genus of Phacopidae (Trilobita). *Eesti Nsv Teaduste Akad. Toimetised, Tallin*, **4**, 385–8, 1 pl. [In Russian, with summaries in Estonian and English.]
- REED, F. R. C. 1915. Supplementary Memoir on new Ordovician and Silurian fossils from the Northern Shan States. *Pal. Indica*, n.s., **6** (1), 1–98, pl. 1–12.
- RUDDY, T. 1885. List of Caradoc or Bala fossils found in the neighbourhood of Bala, Corwen, and Glyn Ceiriog. *Proc. Chester Soc. Nat. Sci.* **3**, 113–24.
- WHITTINGTON, H. B. 1950. Sixteen Ordovician genotype trilobites. *J. Paleont.* **24**, 531–65, pl. 68–75.
- WILLIAMS, A. 1953. The geology of the Llandeilo district, Carmarthenshire. *Quart. J. Geol. Soc. London*, **108**, 177–208, pl. 9.

W. T. DEAN  
British Museum (Natural History),  
London, S.W. 7.

Manuscript received 1 December 1958



1 x 4.5



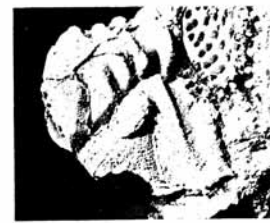
4 x 2.5



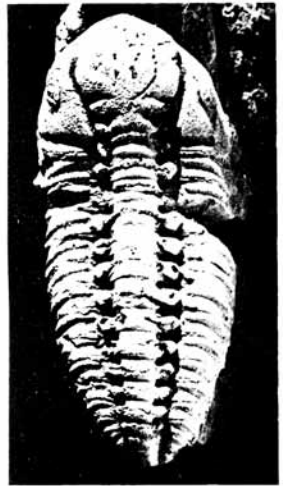
2 x 3.5



3 x 4.5



5 x 3



7 x 2.8



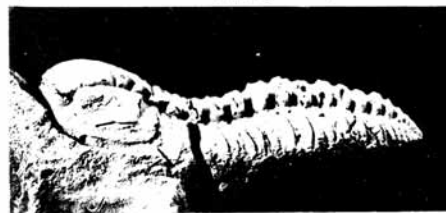
6 x 3.25



9 x 2.8



8 x 3.25



10 x 2.4



11 x 2.5

DEAN, *Duftonia* gen. nov.