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Durotrigia daveyi gen. et sp. nov., an Early Bajocian dinocyst with a variable precingular archaeopyle

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ABSTRACT–*Durotrigia daveyi* gen. et sp. nov. is described from the Inferior Oolite (Early Bajocian) of Dorset, England. It is the earliest distinctly tabulated gonyaulacacean dinocyst with a precingular archaeopyle. The archaeopyle is apparently variable, involving the loss of between 1 and 5 precingular plates. This variability poses some interesting taxonomic problems, particularly the implications to the value of the archaeopyle type as a high-level classification criterion. Some possible causes of archaeopyle variability are discussed.

INTRODUCTION

In a study of palynological assemblages from the Bajocian interval in a borehole in Lyme Bay, Davey (*in* Penn *et al.*, 1980) observed two previously undescribed gonyaulacacean dinocysts from the *laeviuscula* and *sauzei* ammonite zones. Davey (*op. cit.*) noted that one of these forms; Gonyaulacid sp. I "loses more than one precingular plate in archaeopyle formation". The other, Gonyaulacid sp. II, apparently had a single plate (3″) precingular archaeopyle.

During 1984, the author examined Early Bajocian material from the Winterborne Kingston borehole in Dorset as part of an M.Sc. research project at the University of Sheffield. Significant numbers of similar forms to those described by Davey (*op. cit.*) were recorded, and it was noted that the number of precingular opercular plates varied in otherwise identical forms. Subsequently, the original material of Davey (*op. cit.*) was re-examined and a similar variation in archaeopyle structure was observed. It is proposed that Gonyaulacid sp. I and II belong to a single species with variable detachment of precingular plates.

In this paper, these forms are formally described and named in a new genus, *Durotrigia*, which has a variable (1P–5P) precingular archaeopyle.

MATERIAL

The material described here is from the lower Inferior Oolite (Early Bajocian) of the Winterborne Kingston borehole, Dorset (SY 8470 9790), and BGS borehole 50/03 329 in Lyme Bay (location map, fig. 1).

Detailed lithostratigraphy and ammonite dating for the Middle Jurassic of the Winterborne Kingston borehole is given by Penn (1982). Ammonite control in the Lyme Bay borehole is from Penn *et al.* (1980).

All palynological slides are housed in the Palynological Collections of the British Geological Survey at Keyworth, Nottingham. All material figures are registered in the series MPK 5319 to MPK 5327, MPK 1186 and MPK 1188.

Durotrigia daveyi gen. et sp. nov. is the dominant form in a low diversity assemblage in which other marine taxa include *Nannoceratopsis gracilis* Alberti, 1961, *Gongylodinium erymnoteichos* Fenton *et al.*, 1980, *Escharisphaeridia pococki* Sarjeant, 1968, "*Tenua*" *asymmetra* Fenton *et al.*, 1980 and *Pareodinia* sp.

SYSTEMATIC PALYNOLOGY

Division PYRROPHYTA Pascher 1914
Class DINOPHYCEAE Fritsch 1929
Order PERIDINIALES Haeckel 1894
Family GONYAULACACEAE Lindemann 1928
Genus *Durotrigia* gen. nov.

Durotrigia daveyi gen. et sp. nov.
(Pl. 1, figs. 1–5, pl. 2, figs. 1–11; Fig. 2a–d)
1980 Gonyaulacid sp. I Davey: pl. 1, figs. 11, 12.
1980 Gonyaulacid sp. II Davey: pl. 1, figs. 15, 16.

Derivation of name. Named after the Durotriges, the ancient Celtic tribe who inhabited Dorset. The specific name is after Roger Davey, who first recorded this form.

Diagnosis generico-specifica (ICBN art. 42). Cyst subspherical, proximate or proximochorate. Gonyaulacacean tabulation: (1acl, 1pr, 4′, 2a, 6″, 6c, 6‴, 1p, 1⁗, 5s, flagellar pore area). The archaeopyle is formed by the loss of 1 to 5 precingular plates (1P–5P). The autophragm is well tabulated, with distinct sutural ridges surmounted by isolated projections and/or crests, which may be perforate.

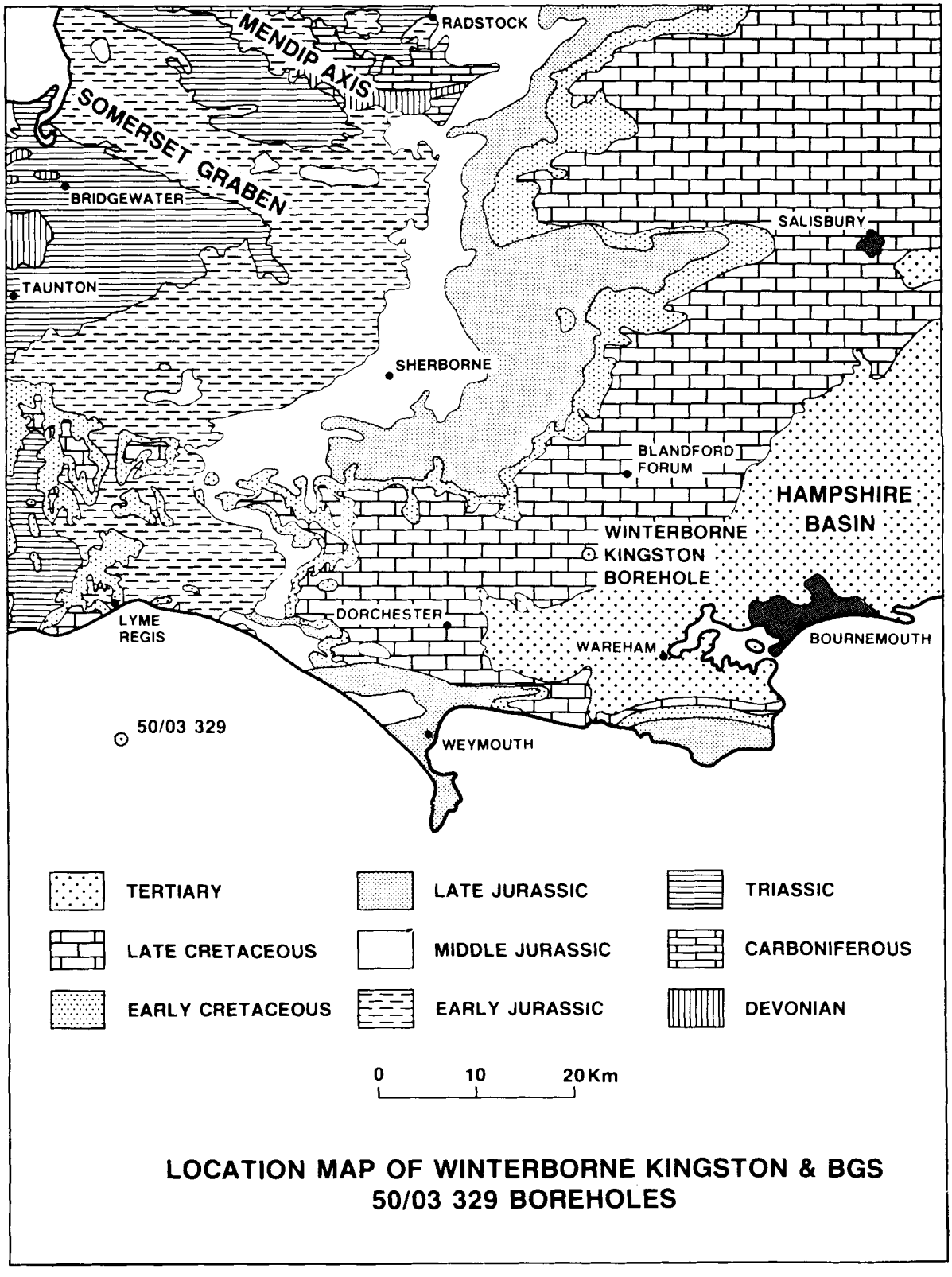


Fig. 1. Location Map of Winterborne Kingston and BGS 50/03 329 Boreholes.

Holotype. Slide CSA 1459/1. MPK 1188, EF reference H.34/2.
Paratype. Slide MPA 2212/2 EF, reference C.33 MPK 5326.
Type locality. BGS borehole 50/03 329 at 9.5–10.5m. Inferior Oolite (*sauzei* Zone).
Description
SHAPE. Cyst subspherical.
WALL RELATIONSHIPS. Autophragm only.
WALL FEATURES. Sutural features include low ridges, usually surmounted by isolated projections and/or denticulate crests which may be perforate. The spines/denticulations may be distally bifurcate, and tend to be more complex about the cingulum and antapical pole. Gonal spines are also large. The autophragm has a complex structure (see Pl. 1, fig. 5), appearing scabrate in transmitted light.
TABULATION. Indicated by variable, but distinct sutural features. Gonyaulacacean formula: 1acl, 1pr, 4′, 2a, 6″, 6c, 6‴, 1p, 1⁗, 5s, flagellar pore area.
ARCHAEOPYLE. Precingular, formed by the loss of up to five precingular plates. Cysts with varying dehiscence; 1P, 2P, 3P, 4P and 5P. The most common type is 4P, with the first and sixth precingulars remaining attached, forming a broad isthmus joining the apical series to the hypocyst. Excystment begins dorsally at the 3″ plate and progresses ventrally in both directions.
CINGULUM. Indicated by six rectangular plates. Cingular sutures often carry complex denticulate crests which may be perforate and bear bifurcate spines (Fig. 2c). Ornamentation is symmetrical about the cingulum.
SULCUS. Clearly discernible. The innermost part of the sulcus is occupied by a large flagellar pore area where no detail can be distinguished. Surrounding this area are five sulcal plates; as, ras, rs, ps, ls. (Fig. 2d).
Comparison. *Durotrigia* gen. nov. differs from all other genera in having a variable (1P–5P) archaeopyle. *Diacanthum* Habib (Habib & Drugg, 1987) has a variable (1P–3P) archaeopyle. *Dissiliodinium* Drugg, 1978 loses four or five precingulars and is non tabulate. *Occisucysta* Gitmez, 1970 and *Tehamadinium* Jan du Chene *et al.*, 1986 both have a 2P(2″ 3″) archaeopyle. *Occisucysta* differs further in being cornucavate and/or suturocavate. *Liesbergia* Berger, 1986 has a P(3″) or 2P(3″ 4″) archaeopyle and has trabeculate parasutural ornament. *Durotrigia* gen. nov. also possesses two dorsal intercalary plates which do not occur in *Dissiliodinium, Occisucysta, Diacanthum* or *Tehamadinium*. Table 1 summarises the main distinguishing morphological features of *Durotrigia* and similar genera.

Lingulodinium Wall, 1967 is a skolochorate dinocyst with a variable precingular archaeopyle, but can also develop an epicystal archaeopyle. *Ctenidodinium* Deflandre, 1938 and related cysts have epicystal archaeopyles.

Diacanthum is originally described with a 2P(3″ 4″) archaeopyle (Habib, 1972). Unfortunately, the holotype for *D. hollisteri* Habib was lost. However, examination additional material (Habib & Drugg, 1987) has resulted in an emendation of *Diacanthum* to include variability (1P–3P) in the archaeopyle. *Diacanthum filapicatum* (Gocht) Stover & Evitt (1978) is described with a 2P(3″ 4″) archaeopyle. Gocht (1970) noted that one plate often remained behind, and also, that "tears (along the cingulum) often extend up to the region of the longitudinal furrow". However, he concluded that this was due to mechanical breakage.

Dissiliodinium globulum Drugg (1978) is described with a 4P or 5P archaeopyle, though it has been recorded as varying between 3P and 6P (W. Wille, pers. comm.). *Dissiliodinium* differs further from *Durotrigia* in lacking both tabulation and dorsal intercalaries.
Discussion. *Durotrigia daveyi* gen. et sp. nov. is the earliest distinctly tabulated gonyaulacacean dinocyst with a precingular archaeopyle. The fact that archaeopyle variability is described in the generic diagnosis of *Durotrigia* is contentious. For many years the archaeopyle in both modern and fossil dinocysts has been considered a high level taxonomic character and Evitt (1967) recommended that forms with different archaeopyle structure should be assigned to separate genera. To a large extent this proposal was followed for several years, and Norris (1978) awards the same taxonomic value to the archaeopyle in his supra-generic

Table 1. Comparison of morphological features to distinguish *Durotrigia* gen, nov. from similar genera.

Genus	*Archaeopyle*	*Wall Structure*	*Clarity of Tabulation*	*Dorsal Intercalaries*
DUROTRIGIA	1P–5P	Autophragm	Distinct	Present
DIACANTHUM	1P–3P	Autophragm	Distinct	Absent
OCCISUCYSTA	2P	Autophragm	Distinct	Absent
TEHAMADINIUM	2P	Cornucavate	Distinct	Absent
DISSILIODINIUM	3–5P	Autophragm	Absent	Absent
GONGYLODINIUM	2P	Autophragm	Absent	Unknown

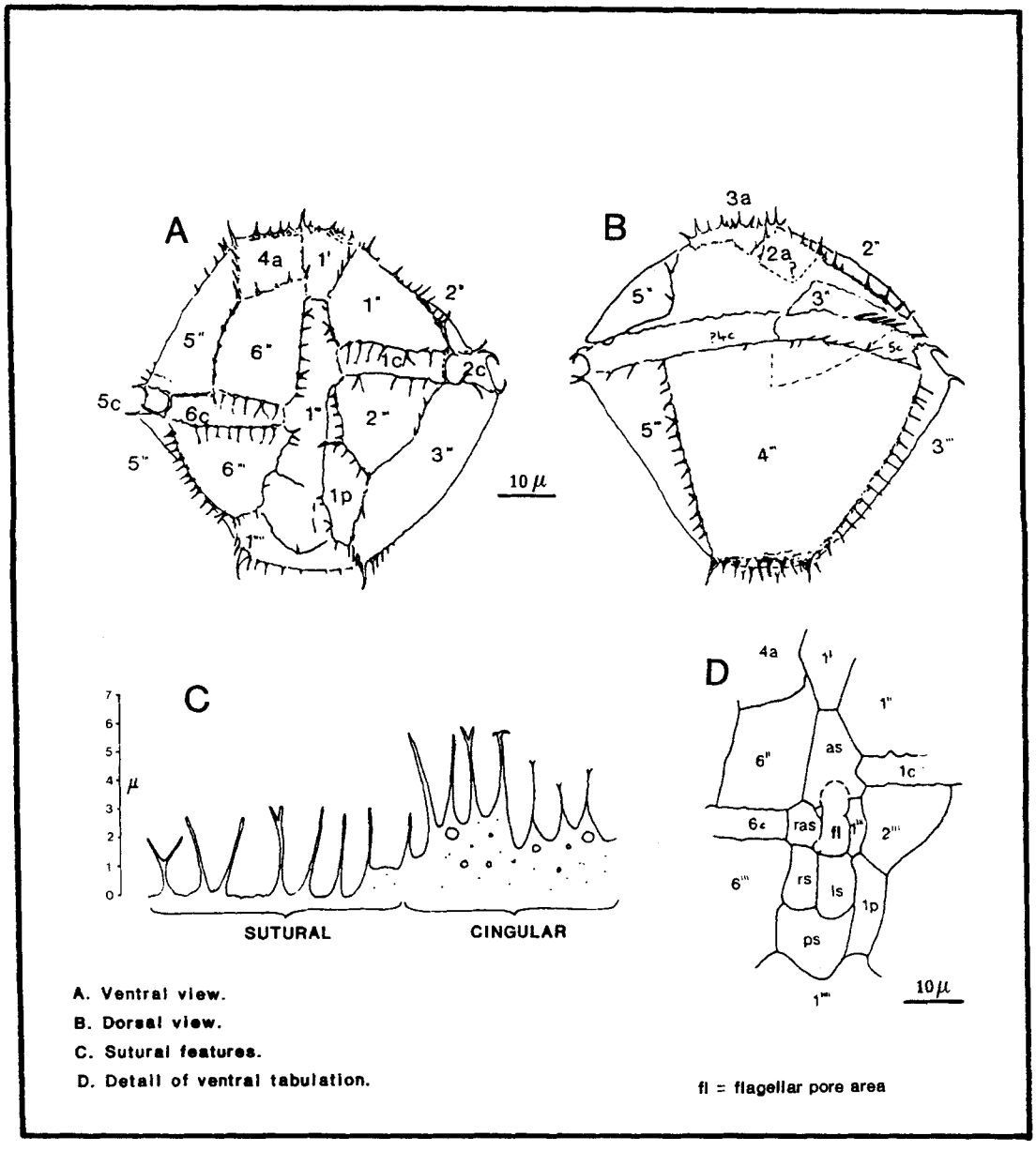


Fig. 2. *Durotrigia daveyi* gen. et sp. nov.

Explanation of Plate 1

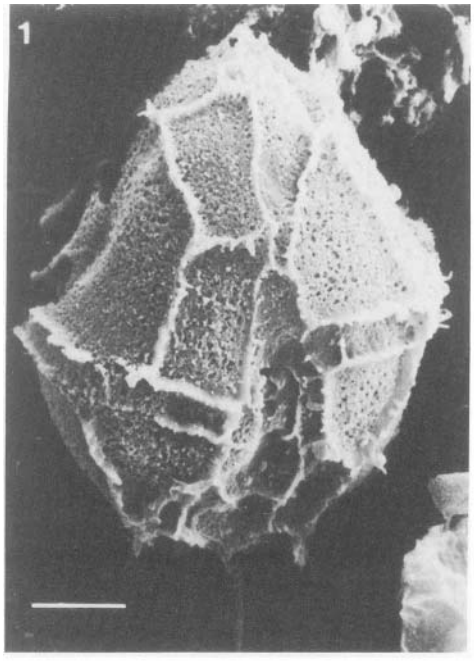
Durotrigia daveyi gen. et sp. nov.

Fig. 1. Sample WK 56, stub A, Winterborne Kingston borehole at 918.96m. Ventral View, MPK 5319.

Fig. 2. Sample WK 56, stub A, Winterborne Kingston borehole at 918.96m. Dorsal view of specimen showing loss of 2 precingular plates, MPK 5320.

Fig. 3. Sample WK 54, stub 1, Winterborne Kingston borehole at 917.56m. Antapical view, MPK 5321.

Figs. 4, 5. Sample WK 54, stub 2, Winterborne Kingston borehole at 917.56m: fig. 4, lateral view; fig. 5, close up on apical region showing detail of autophragm and sutural ornament, MPK 5322.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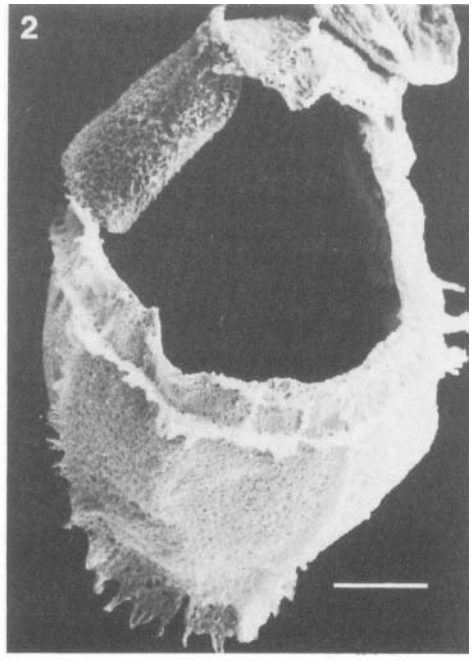
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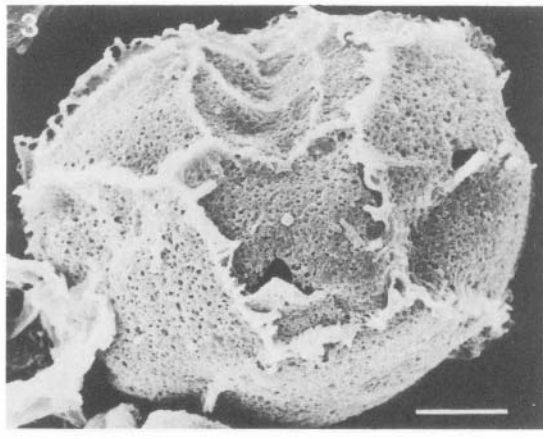
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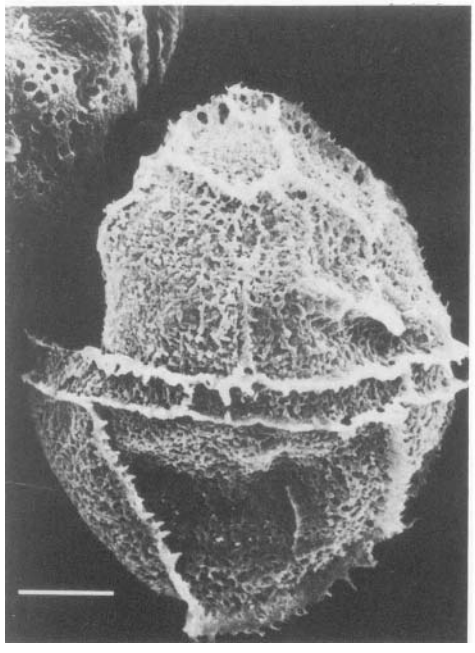

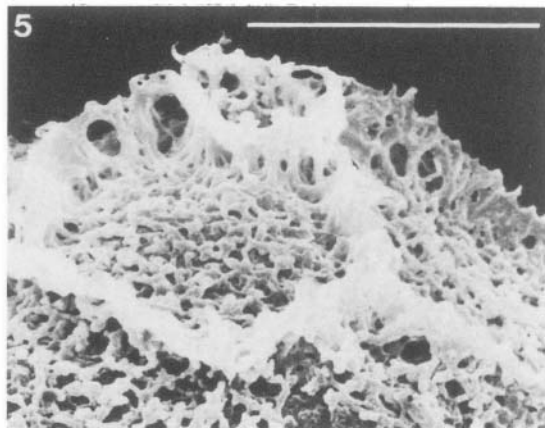
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classification scheme.

Strict adherence to this principle has led to the erection of separate genera for otherwise identical forms, e.g. *Tectatodinium* Wall (1967) (1P), and *Bitectatodinium* Wilson (1973) (2P). On the other hand, Wall (1967) in describing *Lingulodinium machaerophorum*, was probably the first to recognise archaeopyle variability within a single species. Subsequently an increasing number of genera have been identified with variable archeopyles, e.g. *Diphyes* Cookson (Goodman & Witmer, 1985), *Phthanoperidinium* Edwards & Bebout (Islam, 1983), *Spiniferites* Mantel (Dobell & Taylor, 1981).

The often customary separation of genera solely on the basis of differences in the archaeopyle is becoming far less rigid. Indeed, Evitt (1985) states that the principle is "unacceptably simplistic".

In *Durotrigia*, the archaeopyle type obviously cannot be determined from a single specimen. The different number of opercular plates observed within this species may represent biological variability. Alternatively, mechanical stresses from sedimentary processes and sample preparation may lead to the loss of additional precingular plates, but this generally occurs along incipient archaeopyle sutures. This compares with the 'disintegration archaeopyle' described by Dörhöfer & Davies (1980, p. 42) from the Late Triassic and Liassic.

Because of the archaeopyle variability, there will be a certain amount of overlap in the generic diagnosis of some forms; e.g. *Dissiliodinium* and *Durotrigia*. In this case, one can utilise other diagnostic features, for example, the presence/absence of dorsal intercalary plates.

In the early Middle Jurassic of northwest Europe there is a large group of related dinocysts, including *Durotrigia daveyi*, which show variability in the number of precingular opercular plates. Some of these forms will be described in a subsequent paper.

Stratigraphic distribution. *Durotrigia daveyi* gen. et sp. nov. has been recorded from the *laeviuscula* and *sauzei* ammonite zones (Early Bajocian) from Lyme Bay (as Gonyaulacid sp. I and II) by Davey (*in* Penn *et al.*, 1980).

In the Winterborne Kingston borehole, the occurrence of *D. daveyi* is again restricted to the *laeviuscula* and *sauzei* zones. Similar forms have been observed from the central North Sea (W. Paley, pers. comm.).

For the present, then, *D. daveyi* is thought to be restricted to the Early Bajocian, *laeviuscula* to *humphriesianum* zones, and is potentially a very useful stratigraphic marker.

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Explanation of Plate 2

Durotrigia daveyi gen. et sp. nov.

Figs. 1, 4, 9. Holotype. Slide CSA 1459/1, MPK 1188. (EF H34.2) BGS borehole 50/03 329 at 9.5–10.5m: fig. 1, ventral focus; fig. 4, mid-focus) fig. 9, dorsal focus; note loss of 3″ plate and partial detachment of adjacent plates (×1000 approx.).

Fig. 2. Slide MPA 2212/3 (EF T. 37) Winterborne Kingston borehole at 918m, lateral view. MPK 5323 (×800 approx.).

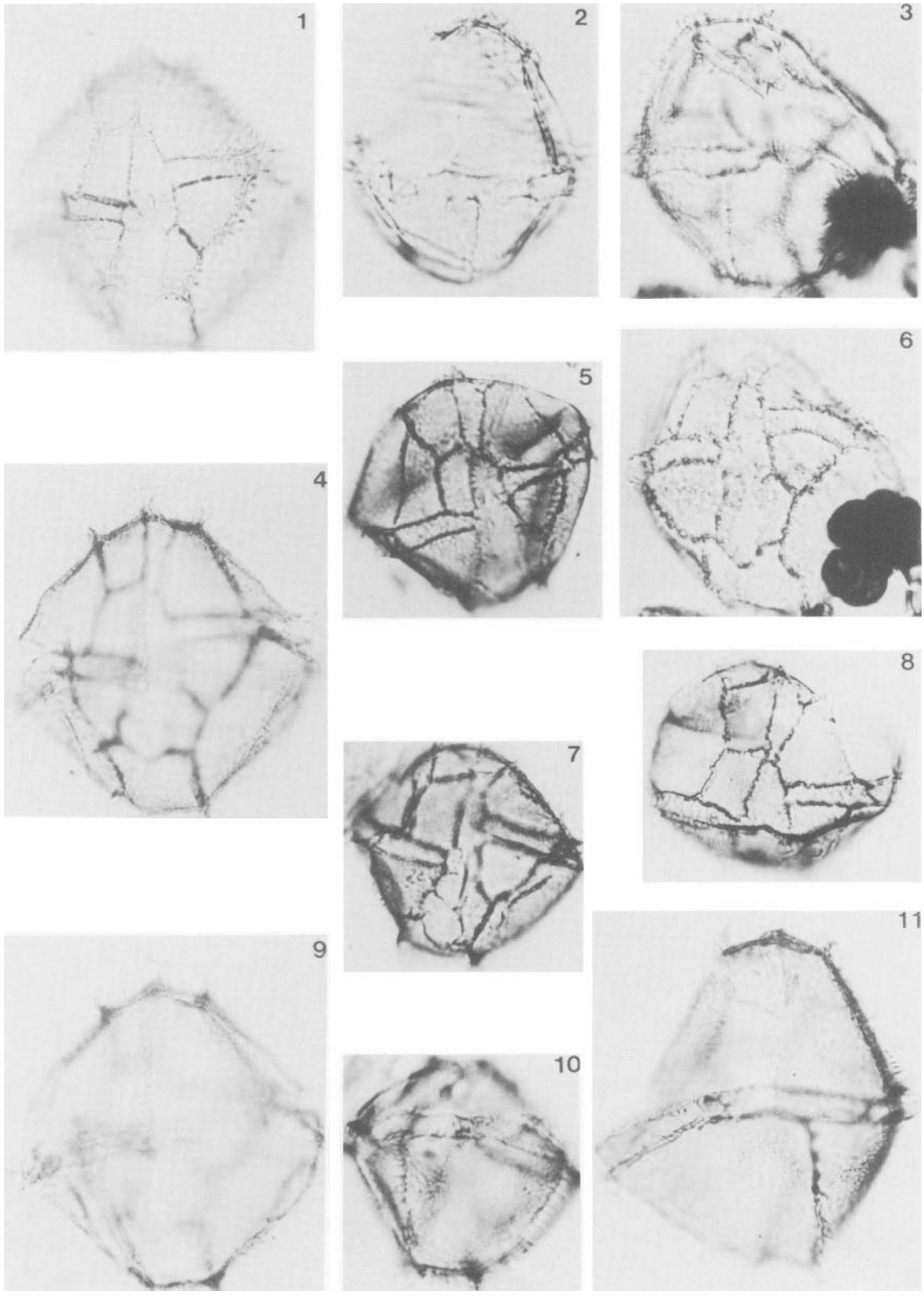
Figs. 3, 6. Slide MPA 2212/2 (EF N.53). Specimen with a 2P archaeopyle: fig. 3, dorsal focus; fig. 6, ventral focus. MPK 5324 (×1000 approx.).

Fig. 5. Slide MPA 2212/2 (EF D35.1). Ventral View. MPK 5325 (×800 approx.).

Figs. 7, 10. Paratype. Slide MPA 2212/2 (EF C.33): fig. 7, ventral focus; fig. 10, dorsal focus. MPK 5326 (×800 approx.).

Fig. 8. Slide MPA 2212/2 (EF U35). Ventral focus: note the 4P archaeopyle. MPK 5327 (×800 approx.).

Fig. 11. Slide CSA 1459/1. MPK 1186 (EF F.53). BGS borehole 50/03 329 at 9.5 – 10.5m (×1000 approx.).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