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Middle – Late Jurassic (Late Bathonian – Tithonian) Palynomorphs

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INTRODUCTION

Jurassic palynomorph assemblages have been recovered in numerous wells in northeast Libya. Jurassic rocks reflect changing sedimentary environments which have greatly influenced the composition of the palynological assemblages.

In the northernmost area, Jurassic sediments unconformably overlie the Palaeozoic or Triassic and show a mixed marine and continental influence. In the northeastern part of the area thicker and deeper water marine sediments are known, while shallow marine sediments overlie the platform facies immediately to the south. Pollen and miospores are fairly well preserved and are dominant in most samples. Dinoflagellate cysts are richly represented especially in the deposits of the north and northeast. Most samples contain abundant variably sorted cuticular debris and structured wood fragments. This significant influx of terrestrial debris together with the associated palynomorph assemblages indicate deposition in a shallow marine environment in close proximity to the shoreline for most of the Jurassic deposits in the northern area.

In the central and southern region, sandstone, silt stone and red shale deposited in non-marine fluvial to lacustrine or lagoonal environment, unconformably overlie the metamorphic or igneous Precambrian Basement. These sediments show a general lack of well preserved palynomorphs. Miospores, though present are generally long ranging and terrestially derived detrital kerogen dominate the assemblages.

MICROFLORAL SUCCESSION

Miospore assemblages present in most of the samples investigated are dominated by small gymnosperm pollen. *Classopollis* spp., *Exesipollenites* spp., *Sphaeripollenites* spp., and nonaperturate pollen assigned to *Araucariacites* spp. Saccate pollen assigned to *Concentrisporites* spp., *Perinopollenites* spp., *Callialasporites* spp., and *Inaperturopollenites* spp., are often common components of the assemblages. Spores are mainly represented by smooth, trilete forms. Sculptured forms are rare but in cutting samples they may be present as a result of contamination by caving.

The miospores present in this interval are long ranging and extend throughout the Jurassic sequence. The variable distribution observed within the sequence has been attributed to sedimentary control, mainly arising from the effect of transport and sorting of palynomorphs from the land vegetation area to the site of deposition.

The illustrated assemblages are similar to those reported by Reyre (1973) from Sahara who found that bisaccate pollen were common only up to zone 12B, and are replaced in Liassic and younger Mesozoic by the group of "large pollen". This group is again reduced during the later part of the Callovian and Late Jurassic. Our observations indicate a similar development in Northeast Libya. Based on assemblage characters and individual spore and pollen taxa, correlation of the Libyan assemblages can be confidently established with palynozones 5a and b of Reyre (1973). Thus, a Middle to Late Jurassic age is suggested for the Libyan miospore assemblages. No diagnostic miospores of Early Jurassic age were found in the samples examined. *Classopollis* is represented by sculptured and "smooth" forms that require study by the scanning electron microscope in order to ascertain their stratigraphical significance.

The Libyan assemblages show significant differences from those of European Jurassic deposits. Bisaccates are absent to rare in the Libyan assemblages, but are generally very common in Middle and Late Jurassic assemblages from Northern latitudes. Similarly, *Araucariacites, Classopollis* and *Sphaeripollenites* together with *Callialasporites* and *Inaperturopollenites* generally abundant in the Libyan assemblage, are relatively less abundant in the northern assemblages. There are thus strong similarities between the miospore assemblages of the Sahara and northeast Libya and marked differences from the European and Arctic microfloral assemblages as reported by Norris (1970), Herngreen & De Boer (1975), Vigran & Thusu (1975) and Pocock, (1970).

Dinoflagellate cysts, mainly restricted to the north and northeast, are present in low numbers and show low diversity. Nevertheless, unlike the miospores, they offer stage level age determinations. No dinoflagellate cysts of Early Jurassic age were found in the borehole material examined. The oldest Jurassic assemblage is of Late Bathonian-Early Callovian age. *Systematophora penicillata, Adnatosphaeridium caulleryi, Sentusidinium echinatum, Escharisphaeridia* *pocockii, Pareodinia ceratophora, Ellipsoidictyum gochtii, Ellipsoidictyum* sp. A, *Dimidiadinium dangeardii,, Korystocysta* cf. *kettonensis/gochtii, Ctenidodinium* cf. *tenellum* and *Bradleyella (Dichadogonyaulax)* sp., *Gonyaulacysta filapicata* are some of the most frequently encountered species. *Ellipsoidictyum gochtii, Ellipsoidictyum* sp. A, *Bradleyella* sp., *Gonyaulacysta filapicata, Ctenododinium* cf. *tenellum, Korystocysta* cf. *kettonensis/gochtii* group, *Adnatosphaeridium caulleryi,* and *Systematophora penicillata (orbifera)* are considered stratigraphically diagnostic species for the oldest Jurassic assemblage recorded in the area.

Dinoflagellate cyst assemblages of Late Callovian-Early Oxfordian age are characterised by the appearance of *Wanea digitata, Energlynia acollaris, Cribroperidinium granulatum, Korystocysta pachyderma* and *Gonyaulacysta scarburghensis*. *Energlynia acollaris* is common in some samples and also occurs rarely in the older assemblage. *Ellipsoidictyum* spp., *Gonyaulacysta filapicata,* and several morphotypes of *Sentusidinium* disappear in this assemblage.

The youngest assemblage is characterised by the appearance of palynomorphs of Late Kimmeridgian to Tithonian age, and is dominated by *Millioudodinium globatum,* and a few typical Late Jurassic species, such as *Muderongia* sp. A Davey, *Ctenidodinium panneum, Leptodinium* cf. *aceras* (Eisenack, 1958) Sensu Gitmez & Sarjeant 1972 and *Lithodinia* cf. *jurassica* Eisenack, 1935 Sensu Ioannides *et. al.,* 1976. *Korystocysta kettonensis* which is present in this assemblage may be reworked from the older assemblage.

In summary, the majority of the samples analysed in the northern and northeastern region contain Bathonian to Early Oxfordian dinoflagellate cysts. A limited number of wells (Al-36, Al-NC92, Cl-2 and El-2) contain a sparse Late Jurassic microflora. Many typical Oxfordian and Early Kimmeridgian dinoflagellate cyst species known in the boreal areas were not encountered. This might suggest a possible microfloral provincialism but this suggestion must await the results of further studies, currently in progress.

In the south central and southern area, where deposition of sandstone, siltstone and red shale took place in a fluvial, lacustrine or lagoonal environment, probably under dry climatic conditions, a general lack of well preserved palynomorphs is evident. The most commonly encountered species include *Cerebropollenites mesozoicus, Concavisporites* sp., *Classopollis* spp., *Araucariacites* sp. and *Deltoidospora* sp.

Many of the forms encountered also occur in the overlying sandstone of Early Cretaceous age (see later contribution). Sediments of Jurassic age are frequently difficult to distinguish from those of Early Cretaceous

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Explanation of Plate 45
All figures are × 500

Fig. 1. *Exesipollenites scabratus* (Couper) Pocock, 1970. C 1–2, 7200–7250 ft., Slide 3, E32/4, AGC 486.

Fig. 2. *Spheripollenites* sp. C 1–2, 7200–7250 ft., Slide 3, E33/1, AGC 487.

Fig. 3. *Classopollis torosus* (Reissinger) Balme, 1957. C 1–2, 8350–8390 ft., Slide 2, P31/1, AGC 488.

Fig. 4. *Classopollis* sp. C 1–2, 7100–7150 ft., Slide 1, M32/3, AGC 489.

Fig. 5. *Classopollis* sp. cf. *C. vignollensis* Reyre, Kieser & Pujol, 1970. C 1–2, 7000–7050 ft., Slide 1, O31, AGC 490.

Fig. 6. *Classopollis* sp. cf. *C. vignollensis* Reyre, Kieser & Pujol, 1970. C 1–2, 7200–7250 ft., Slide 3, H29/2, AGC 491.

Fig. 7. *Classopollis* sp. cf. *C. torosus* (Reissinger) Balme, 1957. C 1–2, 6940–7000 ft., Slide 2, K30/2, AGC 492.

Fig. 8. Fungal fruiting body. C 1–2, 7350–7400 ft., Slide 2, R29/4, AGC 493.

Fig. 9. *Scolecospore* Fungal multicellate spore Pl. 1, fig. 16, Elsik, 1983. C 1–2, 7300–7350 ft., Slide 2, Q34, AGC 494.

Fig. 10. *Classopollis* sp. cf. *C. noeli* Reyre, 1970. C 1–2, 7050–7100 ft., Slide 1, M27/4 – M28/3, AGC 495.

Fig. 11. *Cycadopitys nitidus* (Balme) Norris, 1969. C 1–2, 8450–8500 ft., Slide 4, F38/1, AGC 496.

Fig. 12. cf. *Eucommiidites* sp. C 1–2, 8250–8300 ft., Slide 2, J35/4, AGC 497.

Fig. 13. *Eucommiidites* sp. C 1–2, 8380–8390 ft., Slide 1, J37/3, AGC 498.

Fig. 14. *Eucommiidites* sp. cf. *E. troedsonii* Erdtmann, 1948. Al-NC 92, 6650–6660 ft., Slide 6, K39/2, AGC 499.

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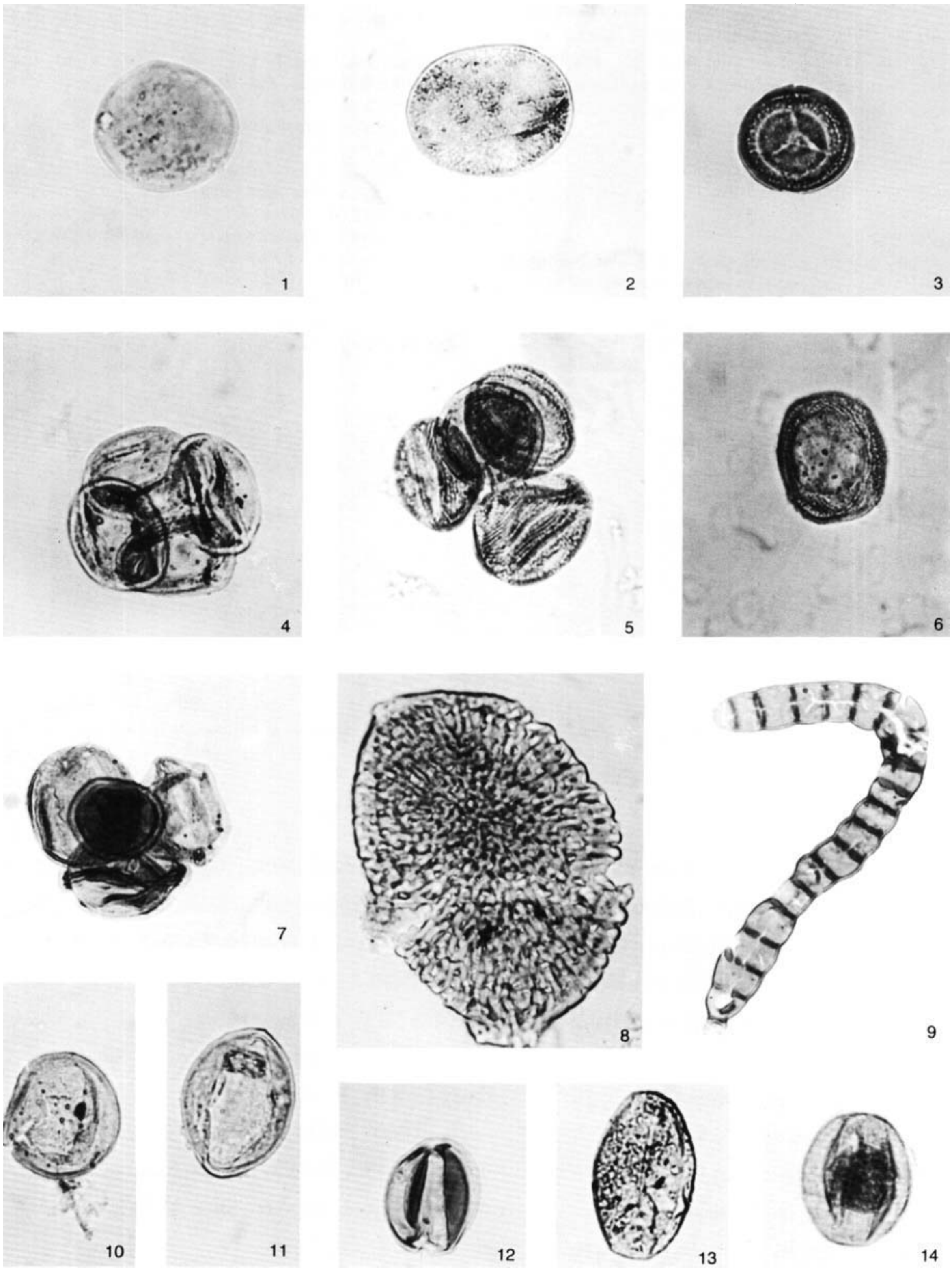
Late Bathonian – Tithonian Miospores

Plate 45



age, and are therefore collectively referred to as the Sarir or Nubian Sandstone of Late Jurassic/Early Cretaceous age in the study area. With the exception of a very few wells, where definite Neocomian-Barremian palynomorphs have been encountered, there is at present no palynological evidence to allow the separation of Jurassic and Early Cretaceous sequences in the south-central and southern areas.

REFERENCES

Herngreen, G.F.W. & De Boer, K.F. 1974. Palynology of Rhaetian, Liassic and Dogger strata in the eastern Netherlands.. *Geologie Mijnbouw,* **53**, (6), 343–368.

Horowitz, A. 1970. Jurassic microflora from the northern Negev, Israel. *Israel J. Earth Sci.,* **19**, 153–182.

Lentin, J.K. & Williams, G.L. 1981. Fossil dinoflagellates: Index to genera and species, 1981 edition, Bedford Institute of Oceanography, *Report Series BI–R–81–12,* 1–345.

Norris, G. 1970. Palynology of the Jurassic Cretaceous boundary in southern England. *Geoscience and Man*, **1**, 57–65.

Pocock, S.A.J. 1967. The Jurassic-Cretaceous boundary in northern Canada, *Rev. Palaobotan. Palynol.*, **5**, 129–136.

Pocock, S.A.J. 1970. Palynology of Jurassic sediments of Western Canada. *Palaeontographica* B, **130**, (1–2), 12–72 & **130** (3–6), 73–136.

Reyre, Y. 1973. Palynologie du Mésozoique Saharien. *Mem. Mus. Nat. d'Hist. Nat., nouv. Ser.*, C, **27**, 1–284.

Vigran, J.O. & Thusu, B. 1975. Illustrations of Norwegian microfossils. Illustrations and distribution of the Jurassic palynomorphs of Norway. *Roy. Norw. Counc. Sci.* and *Industr. Res. (NTNF), Cont. Shelf Div.*, Publ. 65, 1–55.

Woolam, R., 1983. A review of the Jurassic dinocyst genera *Ctenidodinium*, Deflandre 1938 and *Dichadogonyaulax*, Sarjeant 1966. *Palynology,* **7**, 183–196.

Explanation of Plate 46

All figures are × 500

Fig. 1. *Callialasporites dampieri* (Balme) Sukh Dev, 1961. C 1–2, 7200–7250 ft., Slide 3, N36/3, AGC 500.

Fig. 2. *Callialasporites trilobatus* (Balme) Sukh Dev, 1961. C 1–2, 8250–8300 ft., Slide 2, T31/4, AGC 501.

Fig. 3. *Callialasporites* sp. cf. *C. trilobatus* (Balme) Sukh Dev, 1961. C 1–2, 8380–8390 ft., Slide 1, R–S/35, AGC 502.

Fig. 4. *Callialasporites* sp. cf. *C. obrutus* Norris, 1969. C 1–2, 7250–7300 ft., Slide 1, T36/2, AGC 503.

Fig. 5. *Callialasporites* sp. cf. *C. trilobatus* (Balme) Sukh Dev, 1961. C 1–2, 8250–8300 ft., Slide 2, T42/4, AGC 504.

Fig. 6. *Inaperturopollenites* sp. cf. *I. turbatus* Balme, 1957. C 1–2, 8250–8300 ft., Slide 2, R36/1, AGC 505.

Fig. 7. *Inaperturopollenites turbatus* Balme, 1957. C 1–2, 8200–8250 ft., Slide 4, T42/4, AGC 506.

Fig. 8. *Araucariacites australis* Cookson, 1947. C 1–2, 6940–7000 ft., Slide 2, T36/2, AGC 507.

Fig. 9. *Perinopollenites elatoides* Couper, 1958. C 1–2, 8350–8390 ft., Slide 2, R26/2, AGC 508.

Fig. 10. *Araucariacites* sp. cf. *A. australis* Cookson, 1947. C 1–2, 6940–7000 ft., Slide 2, T37, AGC 509.

Fig. 11. *Perotrilites* sp. A. J1-81 A., 6740–6780 ft., Slide 3, C44/3, AGC 510.

Fig. 12. *Concentrisporites pseudosulcatus* (Briche, Danzé–Corsin & Laveine) Pocock, 1970. C 1–2, 8380–8390 ft., Slide 1, N42/2–N42, AGC 511.

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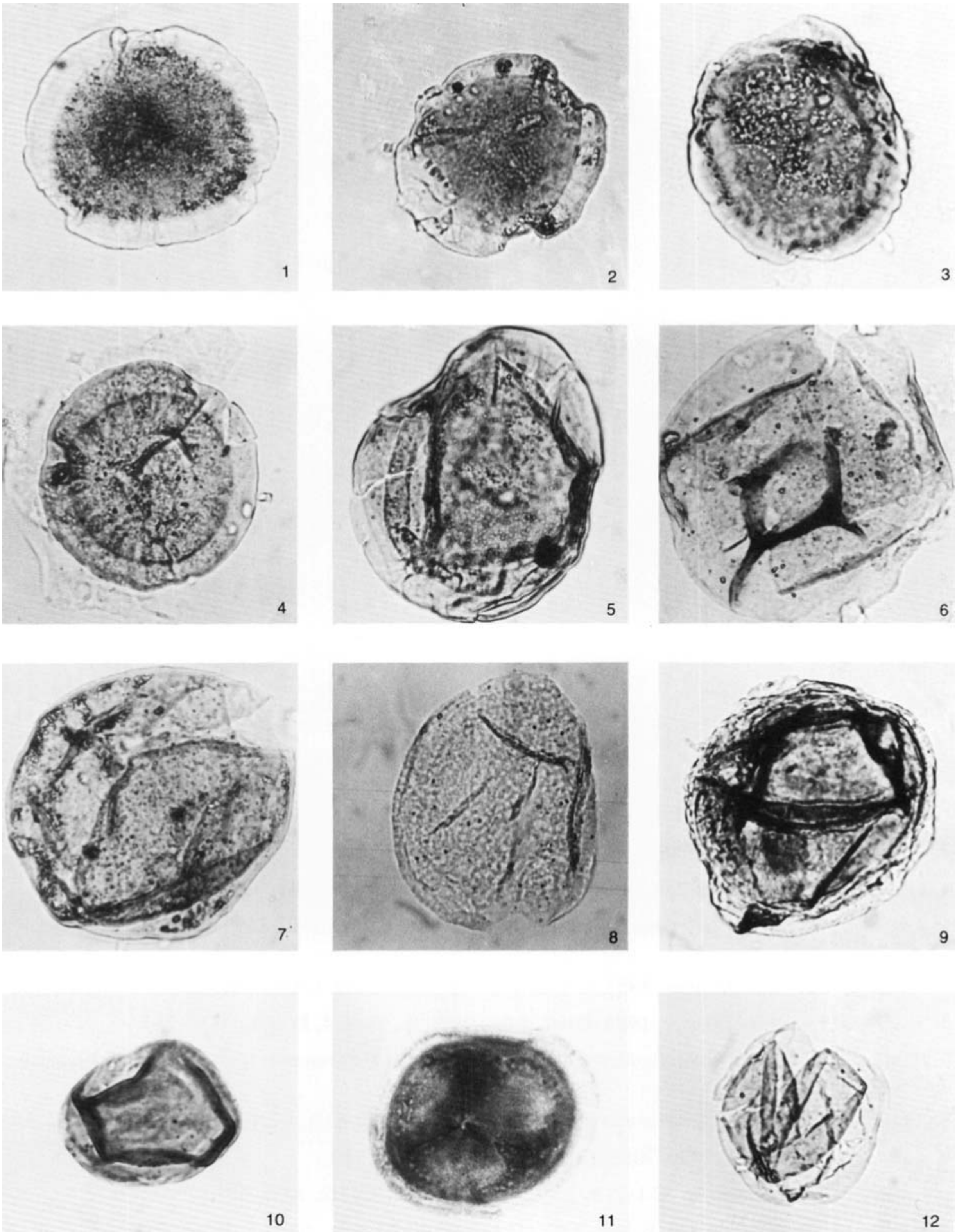
Plate 46



Explanation of Plate 47
All figures are × 500

Fig. 1. *Deltoidospora psilostoma* Rouse, 1959. C 1–2, 8450–8500 ft., Slide 4, U29/1, AGC 512.

Fig. 2. *Todisporites sp.* C 1–2, 8200–8250 ft., Slide 4, V31, AGC 513.

Fig. 3. *Dictyophyllidites* sp. C 1–2, 8250–8300 ft., Slide 2, M36/2, AGC 514.

Fig. 4. *Converrucosisporites variverrucatus* (Couper) Norris, 1969. C 1–2, 8390–8400 ft., Slide 2, X–Y31/3, AGC 515.

Fig. 5. *Cyathidites australis* Couper, 1953. C 1–2, 7200–7250 ft., Slide 3, U43, AGC 516.

Fig. 6. *Cyathidites australis* Couper, 1953. C1–2, 8400–8450 ft., Slide 4, D37/3, AGC 517.

Fig. 7. *Pilosisporites* sp. cf. *P. trichopapillosus* (Thiergart) Delcourt & Sprumont, 1955. C 1–2, 8300–8350 ft., Slide 3, O36/1, AGC 518.

Fig. 8. *Concavissimisporites variverrucatus* (Couper) Singh, 1964. J1-81A, 6740–80 ft., Slide 3, M31, AGC 519.

Fig. 9. *Cyathidites* sp. C 1–2, 7000–7050 ft., Slide 1 W35/4, AGC 520.

Fig. 10. *Microreticulatisporites* sp. C 1–2, 8350–8390 ft., Slide 2, U43/2, AGC 521.

Fig. 11. *Concavisporites jurienensis* Balme, 1957. C 1–2, 8380–8390 ft., Slide 1, J41/3, AGC 522.

Fig. 12. *Cyathidites minor* Couper, 1953. J1-81A, 6700–6710 ft., Slide 3, G44, AGC 523.

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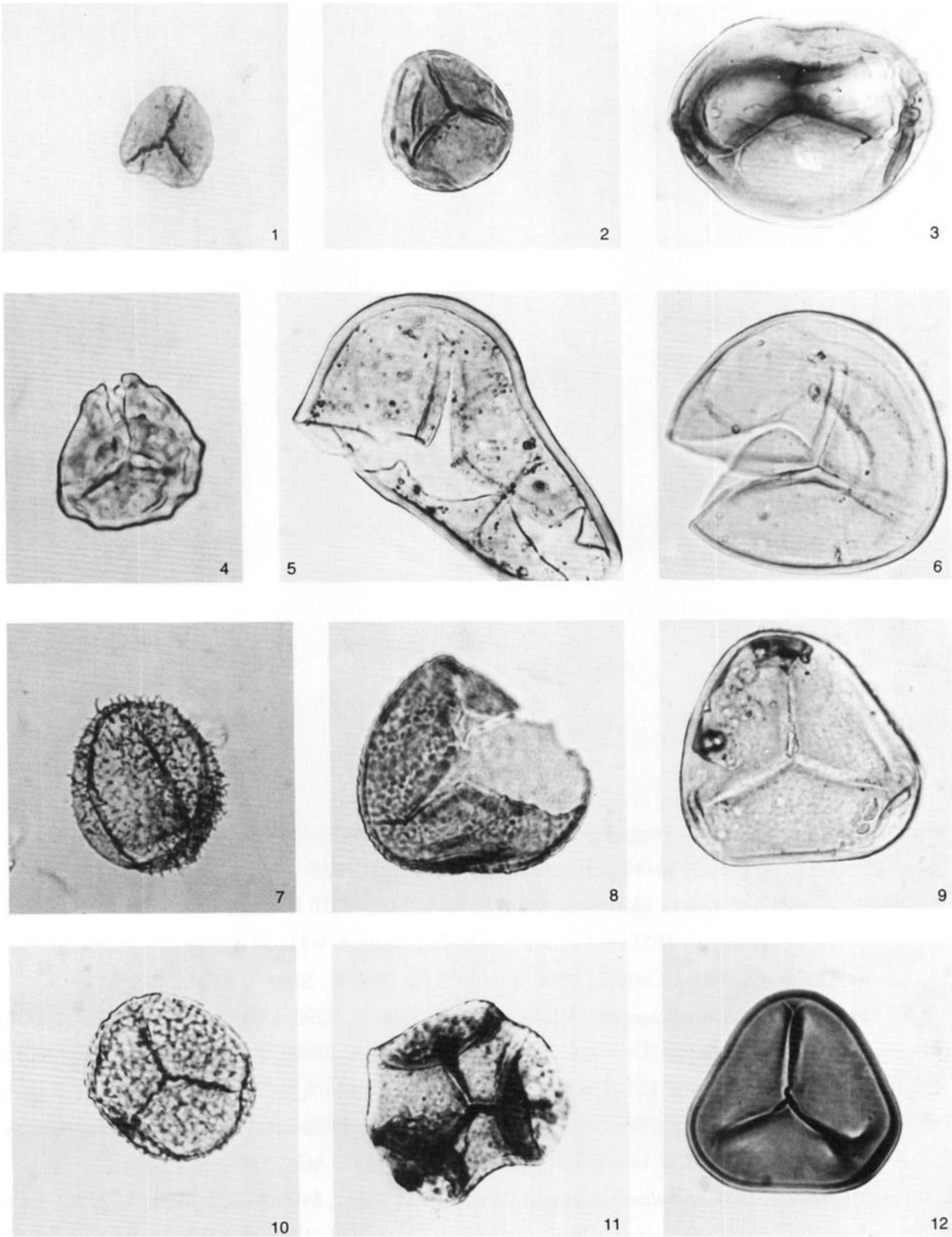
Late Bathonian – Tithonian Miospores and Pollen

Plate 47



Explanation of Plate 48
All figures are × 500

Fig. 1. *Coronatisporites valdensis* (Couper) Dettmann, 1963. C 1–2, 8450–8500 ft., Slide 4, M31/2, AGC 524.

Fig. 2. *Leptolepidites* sp. C 1–2, 8250–8300 ft., Slide 2, P41/42, AGC 525.

Fig. 3. *Cicatricosisporites avnimelechi* Horowitz, 1970. J1-81A, 5290–5320 ft., Slide 3, K36/2, AGC 526.

Fig. 4. *Todisporites minor* Couper, 1958. C 1–2, 8200–8250 ft., Slide 4, V31, AGC 527.

Fig. 5. *Trilobosporites apiverrucatus* Couper, 1958. C 1–2, 7350–7400 ft., Slide 2, K39/2, AGC 528.

Fig. 6. *Dictyophyllidites equiexinus* (Couper) Dettmann, 1963. J1-81A, 5290–5320 ft., Slide 3, F29/1, AGC 529.

Fig. 7. *Cicatricosisporites australiensis* (Cookson) Potonié, 1956. J1-81A, 5290–5320 ft., Slide 3, K25/1, AGC 530.

Fig. 8. cf. *Densoisporites* sp. ? caved. C 1–2, 7200–7250 ft., Slide 3, M44/3, AGC 531.

Fig. 9. *Cicatricosisporites* sp. cf. *C. purbeckensis* Norris, 1969. C 1–2, 8300–8350 ft., Slide 3, T35, AGC 532.

Fig. 10. Cretaceous spore, ? caved. C 1–2, 6940–7000 ft., Slide 2, H34, AGC 533.

Fig. 11. *Couperisporites* sp. cf. *C. complexus* (Couper) Pocock, 1962. C 1–2, 8400–8450 ft., Slide 4, M35/1, AGC 534.

Fig. 12. *Sestrosporites pseudoalveolatus* (Couper) Dettmann, 1963. C 1–2, 8450–8500 ft., Slide 4, M-N41/42, AGC 535.

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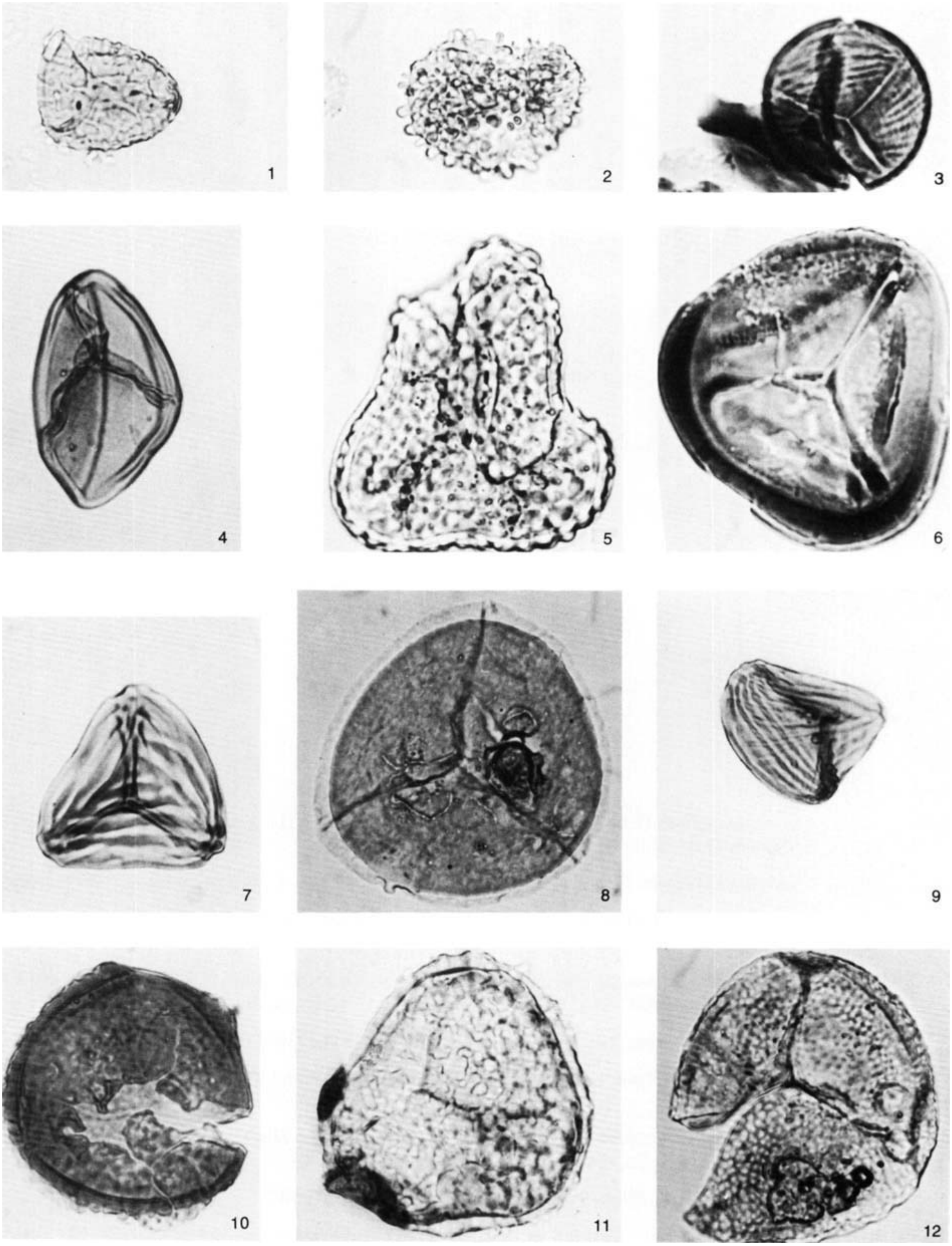
Plate 48



Explanation of Plate 49
All figures are × 500

Figs. 1,12 *Systematophora penicillata* (Ehrenberg, 1943) Sarjeant, 1980. 1. C1-2, 800–8050 ft., W 45/0, AGC 536. 12. A1-NC 92, 6650–6660 ft., Slide 3, S38/0, AGC 537.

Fig. 2. *Pareodinia* cf. *mutabilis* Riley *in* Fisher & Riley, 1980. A1-36, 11344–11346 ft., Slide 4, Z30/0, AGC 538.

Fig. 3. *Adnatosphaeridium caulleryi* (Deflandre, 1938) Williams & Downie, 1969. A1-NC 92, 6650–6660 ft., Slide 3, Q 43/2, AGC 539.

Figs. 4-6. *Pareodinia ceratophora* Deflandre, 1947. 4. A1-NC 92, 6640–6650 ft., Slide 6, E30/1, AGC 540. 5. C1-33, 8153–8155 ft., Slide 2, P42/0, AGC 541. 6. A1-NC 92, 9700–9710 ft., Slide 5, R26/2, AGC 542.

Fig. 7. *Pareodinia* sp. E. *Sensu* Wiggins, 1975. A1-NC 92, 6640–6650 ft., Slide 6, G32/1, AGC 543.

Fig. 8. *Escharisphaeridia pocockii* (Sarjeant, 1968) Erkmen & Sarjeant, 1980. C1-2, 8550–8600 ft., Slide 3, X27/0, AGC 544.

Figs. 9,10 *Ellipsoidictyum gochtii* Fensome, 1979. 9. C1-2, 8550–8600 ft., Slide 3, R37/3, AGC 545. 10. C1-2, 8550–8600 ft., Slide 3, O36/0, AGC 546.

Fig. 11. *Systematophora* sp. A. C1-2, 8000–8050 ft., Slide 4, S33/4, AGC 547.

Figs. 13,14. *Sentusidinium echinatum* (Gitmez & Sarjeant, 1972) Sarjeant & Stover, 1978. 13. A1-NC 92, 7170–7180 ft., Slide 4, U43/1, AGC 548. 14. C1-2, 8200–8250 ft., Slide 2, V36/4, AGC 549.

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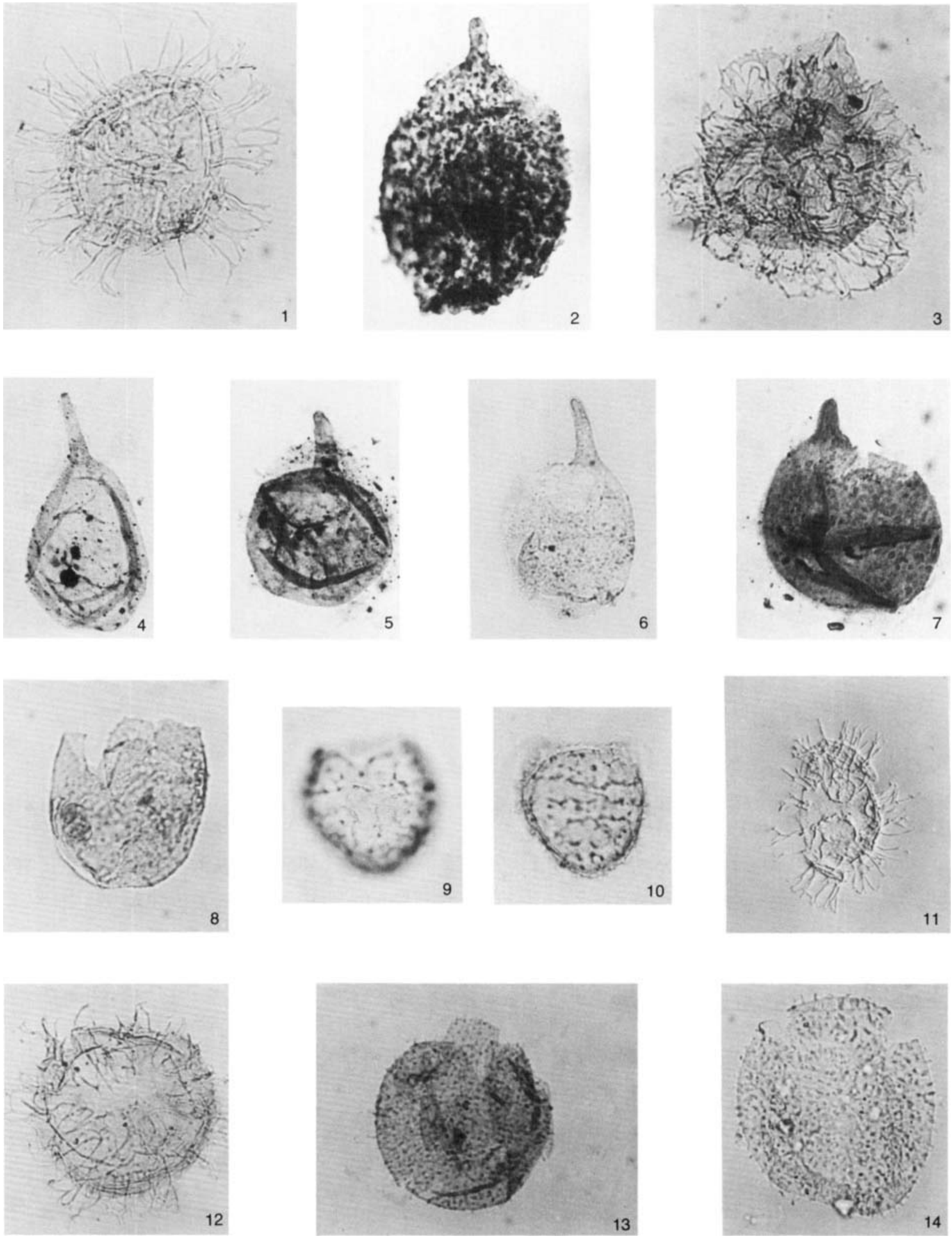
Plate 49



Explanation of Plate 50
All figures are × 500

Fig. 1. *Ellipsoidictyum* sp. A. C1-2, 8550–8600 ft., Slide 2, H32/3, AGC 550.

Fig. 2. *Spiniferites ramosus* (Ehrenberg, 1938) Loeblich & Loeblich, 1966. A1-45, 9450 ft., Slide 1, V36/4, AGC 551. (Caved specimen from Cretaceous sediments).

Fig. 3. *Dimidiadinium dangeardii* (Sarjeant, 1968) Brideaux, 1977. C1-2, 8550–8600 ft., Slide 3, N35/0, AGC 552.

Fig. 4. *Ellipsoidictyum gochtii* Fensome, 1979. C1-33, 8153–8155 ft., Slide 2, M51/3, AGC 553.

Fig. 5. *Exiguisphaera phragma* Duxbury, 1979. A1-36, 11314–11346 ft., Slide 4, M42/2, AGC 554. (Probably caved specimen).

Fig. 6. *Leptodinium aceras* Eisenack, 1958. *Sensu* Gitmez & Sarjeant, 1972. A1-36, 11751–11759 ft., Slide 2/2, E34/4, AGC 555.

Fig. 7. *Ctenidodinium* cf. *tenellum* Deflandre, 1938. C1-33, 8157–8159 ft., Slide 2, J52/0, AGC 556.

Fig. 8. *Sentusidinium* sp. A. A1-NC 92, 6700–6710 ft., Slide 6, T33/1, AGC 557.

Figs. 9,12. *Chytroeisphaeridia granulata* Courtinant & Gaillard, 1980. 9. A1-36, 11751–11759 ft., Slide 2, Y33/0, AGC 558. 12. C1-2, 8200–8250 ft., Slide 2, M34/0, AGC 559.

Figs. 10,13. *Chytroeisphaeridia chytroeides* (Sarjeant, 1962) Downie & Sarjeant, 1965 emend. Davey, 1979. 10. C1-2, 8000–8050 ft., Slide 4, W45/0, AGC 560. 13. C1-2, 8100–8150 ft., Slide 1, R29/4, AGC 561.

Fig. 11. *Bradleyella (Dichadogonyaulax)* sp. A1-NC 92, 6650–6660 ft., Slide 4, V39/1, AGC 562.

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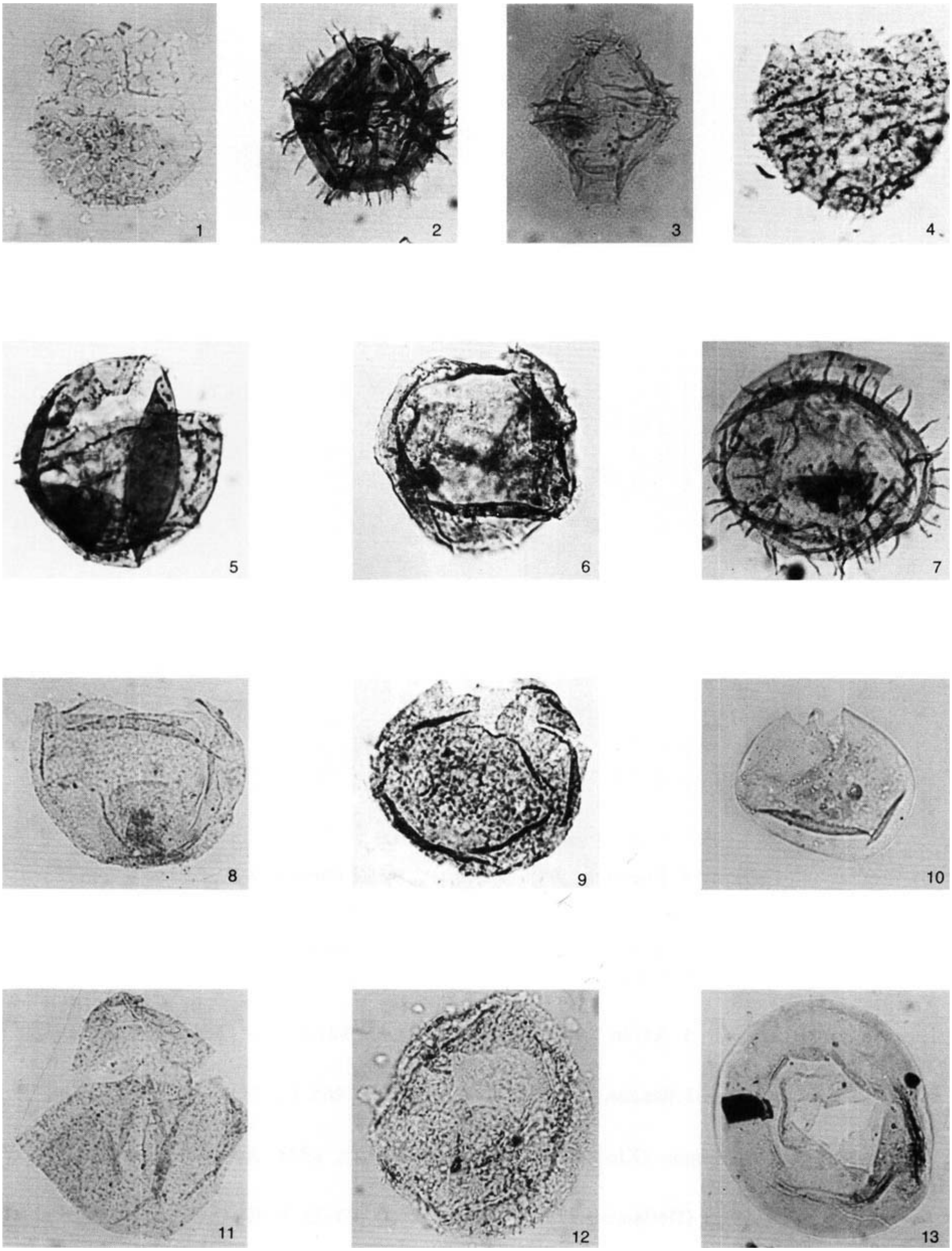
Plate 50



Explanation of Plate 51
All figures are × 500

Fig. 1. *Wanaea digitata* Cookson & Eisenack, 1958. A1-NC 92, 6650–6660 ft., Slide 3, P35/0, AGC 563.

Fig. 2. *Millioudodinium* sp. A. A1-36, 11341–11346 ft. Slide 4, S34/4, AGC 564.

Figs. 3,4,6. *Energlynia acollaris* (Dodekova, 1975) Sarjeant, 1978 emend. Lentin & Williams, 1981. 3. C1-33, 8162 ft., Slide 2, 041/0, AGC 565. 4. B1-33, 12502–12507 ft., Slide 2, L45/3, AGC 566. 6. C1-33, 8157–8159 ft., Slide 2, F49/2, AGC 567.

Figs. 5,10. *Gonyaulacysta* sp. A. 5. A1-36, 11751–11759 ft., Slide 1, T42/0, AGC 568. 10. C1-2, 8200–8250 ft., Slide 2, K35/0, AGC 569.

Fig. 7. *Gonyaulacysta jurassica* (Deflandre, 1938) Norris & Sarjeant, 1965. C1-33, 8153–8155 ft., Slide 2, O36/1, AGC 570.

Fig. 8. *Cribroperidinium granulatum* (Klement, 1960) Stover & Evitt, 1978. A1-36, 12070-12160 ft., Slide 3, K35/0, AGC 571.

Fig. 9. *Korystocysta pachyderma* (Deflandre, 1938) Woollam, 1983. C1-33, 8150 ft., Slide 2, U49/3, AGC 572.

Fig. 11. *Gonyaulacysta scarburghensis* Sarjeant, 1964. B1-33, 12602 ft., Slide 2, H49/4, AGC 573.

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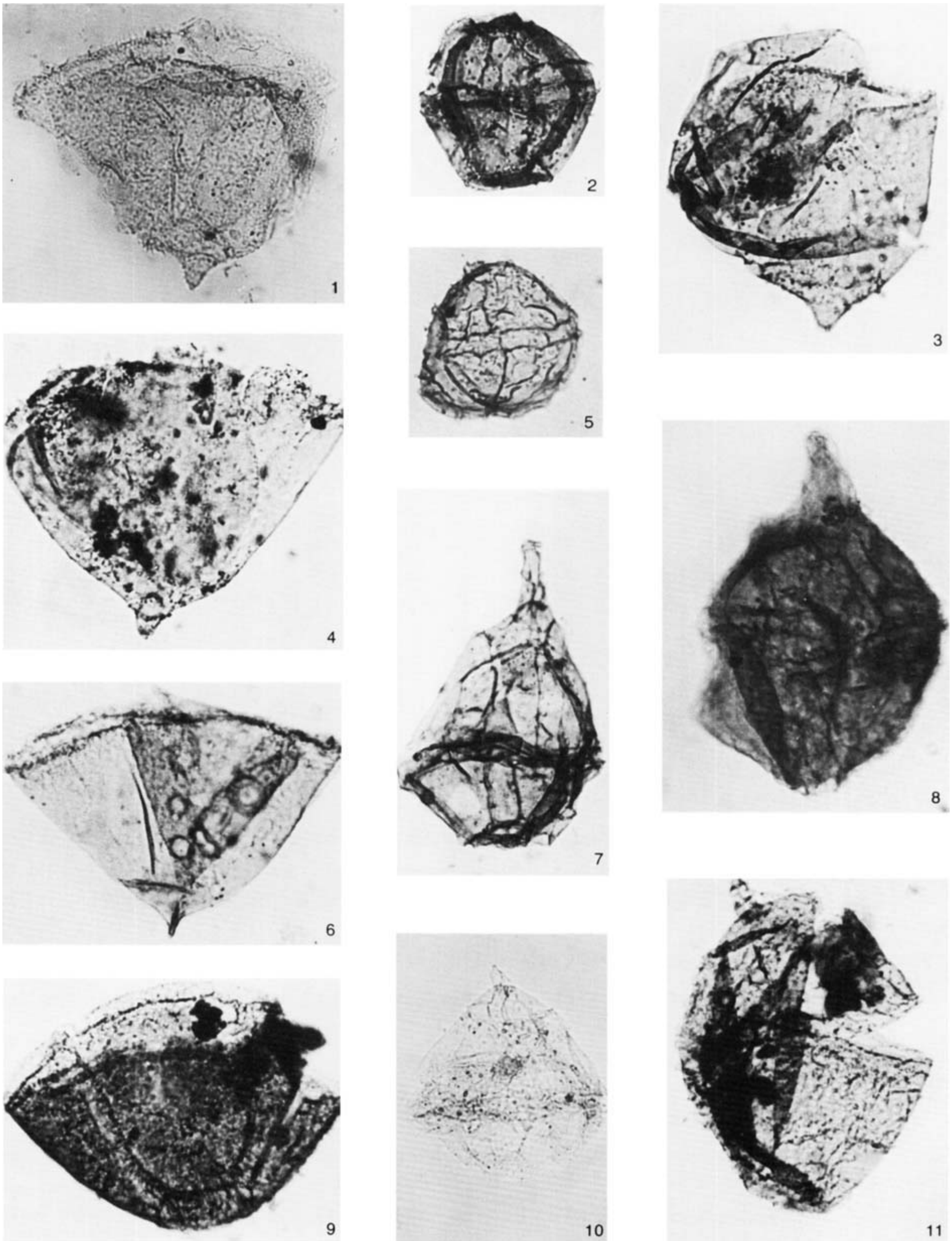
Late Bathonian – Tithonian Dinoflagellate Cysts

Plate 51



Explanation of Plate 52
All figures are × 500

Fig. 1. *Meiourogonyaulax callomonii* Sarjeant, 1972. A1-NC92, 6800–6810 ft., Slide 1, Q 32/4, AGC 574.

Figs. 2-4. *Millioudodinium globatum* (Gitmez & Sarjeant, 1972) Stover and Evitt, 1978. 2. C1-2, 8100–8150 ft., Slide 1, P 40/2, AGC 575. 3. C1-2, 8250–8300 ft., Slide 1, R 33/4, AGC 576. 4. A1-36, 11751–11759 ft., Slide 2/2, X 26/0, AGC 577.

Fig. 5. *Muderongia* sp. A. *Sensu* Davey, 1979. A1-36, 11751–11759 ft., Slide 2/1, S 31/4, AGC 578.

Fig. 6. *Leptodinium* cf. *aceras* (Eisenack, 1958) *Sensu* Gitmez & Sarjeant, 1972. C1-2, 8450–8500 ft., Slide 3, S 34/4, AGC 579.

Fig. 7. *Ctenidodinium panneum* (Norris, 1965) Lentin & Williams, 1973. A1-NC92, 6700–6710 ft., Slide 6, M 43/4, AGC 580.

Fig. 8. *Systematophora* sp. B. A1-NC92, 6650–6660 ft., Slide 3, N 37/4, AGC 581.

Figs. 9,12. *Lithodinia* cf. *jurassica* Eisenack, 1935. Sensu Ioannides, Stavrinos & Downie, 1976. 9. A1-NC92, 6700–6710 ft., Slide 6, U 44/0, AGC 582. 12. C1-2, 8500–8550 ft., Slide 2, S 26/1, AGC 583.

Fig. 10. *Korystocysta kettonensis* (Sarjeant, 1976) Woollam, 1983. B1-33, 12603 ft., Slide 2, O 44/0, AGC 584.

Fig. 11. Gen. et. sp. indet. A1-NC92, 6950–6960 ft., Slide 5, P 32/3, AGC 585.

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