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EXPLORATION REPORT NO. 50

THE BIOSTRATIGRAPHY OF THE PANARCTIC HOODOO DOME H-37 WELL

ELLEF RINGNES ISLAND, DISTRICT OF FRANKLIN

by

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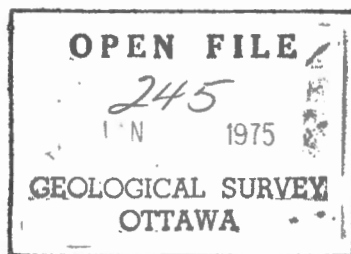
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INTRODUCTION

Panarctic Hoodoo Dome H-37 exploratory well, sited on Ellef Ringnes Island, Northwest Territories at $78^{\circ} 06' 27''$ N. and $99^{\circ} 45' 48''$ W. at a ground elevation of 513', spudded on December 20, 1969 and completed drilling on July 24, 1970 at a total depth of 11,072'. Casing was set at 22' (30" conductor pipe), 165' (20" conductor pipe), 2006' (13 3/8" casing) and 6120' (9 5/8" casing). No occurrences of hydrocarbons have been reported and the well status is abandoned.

Oversized borehole diameters were measured as a result of numerous wash-outs, especially over the shale sections in interval 3750' to 7550'.

One core was cut between 7308' and 7328' and cuttings samples were collected from the interval 60' - 11,072'.

This study was based on an examination of cuttings samples and core material made available by the Geological Survey of Canada.

METHODSi. Palynology

Approximately 25 grams of sediment are treated with hydrochloric and hydrofluoric acids to dissolve the carbonate and silicate minerals respectively and the insoluble organic residue concentrated by heavy liquid separation (Zn Br₂/HCl aqueous solution, S.G. 2.0).

After washing in distilled water the organic concentrate is sieved through 20 μ mesh "Nytral" gauze and both fractions suspended in glycerine jelly from which the assemblage slides for optical examination are prepared. When necessary the residues are oxidized to reduce colour density using nitric acid or Schulz solution.

ii. Micropalaeontology

Approximately 200 grams of sediment are heated, placed in a beaker with 'Quaternary O' and boiled for 30 minutes, the residues being washed through sieves with water to remove the fine fraction. With satisfactory breakdown, the dried residues are dry-sieved, into B.S. sieve sizes +30 (500 microns), +80 (177 microns) and -80, and the microfauna is picked from the sediment using a fine camel-haired brush. As most microfaunal remains are found in the +80 mesh-size, more emphasis is placed on the picking of this fraction than on the other two fractions. In general, two trays of +30 sieve sediment, three trays of +80 sieve sediment and two trays of -80 sieve sediment are sufficient to yield a representative microfauna from any one sample.

Although single (10') samples are occasionally utilized, more commonly composite samples over 50' intervals for micropalaeontology and 100'

intervals for palynology are examined initially. Smaller composited intervals and single samples are used where required to more accurately define biostratigraphical boundaries.

III

PALYNOLOGY

BY: M. J. Fisher, J. P. Bujak, and R. E. Dunay

The assemblages recorded from the interval 100' - ±2000' are characterized by the association of the microplankton Astrocysta cretacea, Oligosphaeridium complex, Odontochitina operculata, Cribroperidinium orthoceras, Cleistosphaeridium multispinosum, C. fimbriatum, Chlamydophorella nyei, Cyclonephelium distinctum, and Broomea jaegeri. Oligosphaeridium totum, Dingodinium cerviculum, and Pterodinium cornutum are restricted to the interval 100' - 900', whilst Canningia colliveri, Palaeohystrichophora brevispinosus, Apteodinium granulatum and Pseudoceratium pelliiferum occur below 850'. Although these species are relatively long-ranging within the Apto-Albian, the slight palynofloral break at ±850', which is coincident with the highest occurrence of Pilosisporites verus, could mark the proximity of the Aptian - Albian boundary. Typically Aptian or older microplankton are recorded below 1200' where Muderongia macwhaei and Pterodinium aliferum occur. Aptian spore/pollen assemblages are relatively well-developed below 2000', although microplankton are rare. Below 3200', however, an older spore/pollen complex is encountered which includes Maculatisporites granulatus, M. maculatus, Vitreisporites pallidus, Concavissimisporites informis, Aequitriradites spinulosis, A. baculatus, Densoisporites triradiatus, Cicatricosisporites reticatricosus, C. globosus, Cardioangulata trilobata and Ceratosporites rarus. This assemblage is correlative with younger Neocomian palynofloras and the single occurrence of Microplankton BA1 at 4200' suggests that Barremian

strata may be represented here. Certain elements of this younger Neocomian palynoflora persist at $\pm 5000'$. In the interval $4500' - 4700'$, however, species more typical of older Neocomian (Berriasian) or ?uppermost Jurassic (Tithonian) assemblages are recorded. These include Foveosporites foveoreticulatus, Cardioangulina parva, Maculatisporites microverrucatus, aff. Vastisporites vastiformis, Retitriletes parvimurus, Trilobosporites bernissartensis and Trilobosporites (Tuberosisporites) fsp. A Döring 1964. Diagnostic Jurassic palynofloras are encountered below $4700'$ where the association of the microplankton species Endoscrinium luridum, Psaligonyaulax apatela, Gonyaulacysta granuligera, Sirmiodinium grossi, Netrelytron spp. and "pareodinioid" SPIN 2 is correlative with Arctic Tithonian assemblages. Typical Kimmeridgian associations were not recorded, although the occurrence of Scriniodinium crystallinum at $5700'$ is suggestive of an older Kimmeridgian or Oxfordian age. Below $\pm 4500'$ it is evident that the cuttings samples are heavily contaminated with caved material, with Cretaceous morphotypes persisting to below $6000'$ and anomalous associations of Jurassic microplankton in the interval $\pm 5000' - 6700'$. The highest occurrence of Nannoceratopsis gracilis at $6500'$ has been arbitrarily selected as an age/stage datum, marking the top of the Bajocian. Callovian strata are represented in the interval above $6400'$ as evidenced by the association of Acanthaulax cf. aculeata, Xenicodinium densispinosum, Acanthaulax sp. 1 Johnson & Hills, 1973, common Gonyaulacysta jurassica and Leptodinium subtile. The specimens of Paragonyaulacysta calloviense, a species restricted to the Callovian, recorded at $6700'$ are

considered to have resulted from caving. Bathonian assemblages were not certainly recorded in situ, although the occurrence of Meiourogonya strongylos, M. cantrellii and Pareodinia tripartita below the highest occurrence of N. gracilis, suggest that they may be present in the well. The highest record of Scriniocassis weberi at 6950', which is coincident with a bloom of N. gracilis, marks the top of the Toarcian, whilst the first occurrence of the ?Toarcian to Upper Pliensbachian dinoflagellate Mancodinium semitabulatum at 7350' - 7390', supports a Middle Liassic age for the interval below 7350'.

The first occurrence of striate bisaccate palynomorphs at 7500' - 7590' may mark the top of the Triassic succession. However, although other Triassic forms, such as Striatoabieites sp., and specimens attributable to Cingulizonates rhaeticus are found occasionally throughout the interval 7500' - 8000', the palynofloras here are dominated by Lower Jurassic taxa. Furthermore, circumpolles type palynomorphs, especially Corollina meyeriana, are quite abundant in some samples; this group is often dominant in Lower Liassic horizons.

Definite Rhaetian palynofloras first occur at 8000' - 8090', where Ricciisporites cf. tuberculatus appears. Ricciisporites spp., occur throughout the remainder of the interval, where they are associated with other elements typical of Rhaetian palynofloras, such as Rhaetipollis germanicus, Semiretisporis gothae, Duplexisporites gyratus, Triancoraesporites reticulatus, Densosporites spp., and Lunatisporites spp.

Ricciisporites spp., Lunatisporites spp., and Rhaetipollis germanicus

persist to T.D. and are joined at 9600' - 9690' by elements of the RHNO dinoflagellate plexus. This microplankton group, represented here by the types RHNO-2 and RHNO-6, appears to be restricted to the Norian and perhaps lowermost Rhaetian of the Sverdrup Basin. These taxa, in particular Dinoflagellate RHNO-2, are quite common at certain levels, particularly at 9700' - 9890'. Associated with this Norian microplankton assemblage is a typical Rhaeto-Norian palynoflora including Cingulizonates rhaeticus, Limbosporites lundbladii, Zebrasporites interscriptus and Z. corneolus.

There is no palynological evidence to suggest that sediments older in age than Norian have been encountered in this well.

IV.

MICROPALAEONTOLOGY

by

D. R. Clowser, P. J. Rauwerda and P. F. Sherrington

The samples from the uppermost part of this well section contain a very restricted, entirely agglutinating foraminiferal assemblage. The following species are present, mostly as single occurrences: Haplophragmoides cf. topagorukensis, H. topagorukensis, Ammodiscus cf. rotalarius, Bathysiphon brosegi, B. vitta, Gaudryina canadensis, Verneuillinoidea fischeri and Haplophragmoides aff. gigas, which together suggest a Lower Cretaceous, Albian age.

In the sample at 470' - 520' there is considerable microfaunal diversification, with the appearance of several diagnostic species of calcareous foraminifera; these include Conorboides umiatensis, Eoeponidella linki, Pallaimorphina ruckerae, Globulina lacrima canadensis, G. prisca, Marginulinopsis collinsi, Saracenaria dutroi and S. projectura, and a more varied assemblage of agglutinating foraminifera. Other distinctive species occurring in samples from the interval down to 1200', are Haplophragmoides excavatus, Ammobaculites fragmentarius, Uvigerinamina manitobensis, Globorotalites alaskensis, and Saracenaria trollopei, together with a specimen of the radiolarian genus Dictyomitra, at 540' - 590'. Below approximately 1300', coincident with a lithological change from a predominantly shale sequence above to one of sand/sandstone below, and down to 2100', few new species of foraminifera are recorded, although these include Miliammina manitobensis and Trochammina eilete and many of the species recorded in the overlying interval are no longer present.

The foraminifera in this interval are almost certainly derived from thin shale and siltstone interbeds within the sandstone, although they may be caved in part. The foraminiferal species in the samples between 470' and 2100', here designated the Pallaimorphina ruckerae Assemblage Zone, are closely comparable to those recorded from Aptian and Albian age formations of Alaska (Tappan, 1962). Although the microfaunal change at ±1200' is certainly to some extent facies-controlled, it is considered that this may also mark the Aptian - Albian boundary. Ostracoda in this interval are very scarce and are long-ranging, mostly Neocomian to Albian forms.

It is uncertain how much of the microfauna, especially below 1300', is present as a result of caving, because below the casing shoe, set at 2006', there are only a few species of foraminifera present. These species, Miliammina manitobensis, M. ischnia/awunensis, Psamminopelta bowsheri, Verneulinoides borealis, and Miliammina spp., characterise the interval from 2150' to possibly 2500', although this lower boundary may again be affected by caving. This part of the well section may be designated the Miliammina manitobensis Assemblage Zone.

The underlying interval, to 3750', is barren of foraminifera and ostracoda, a feature typical of the succession of non-marine sands, sandstones and coals which comprises the Isachsen Formation.

The microfauna which appears in the samples below 3800', concurrent with the fine clastic sediments of the Deer Bay Formation, consists of Haplophragmoides topagorukensis (only to 4000'), Lenticulina spp., Globulina spp., Frondicularia sp. 16, Marginulinopsis aff. reiseri, Epistomina sp., Lenticulina audax vars., Haplophragmoides canui, "Involutina" aspera/silicea group and Trochammina aff. globigeriniformis. This association has been designated the Haplophragmoides

canui Assemblage Zone, which typifies the upper Neocomian, ?Hauterivian - Barremian interval. With increasing depth the following distinctive forms also appear Haplophragmoides kingakensis/barrowensis group, Rectoglandulina aff. brandi, Recurvoides sp., Lenticulina audax, Ammobaculites vetusta, Saracenaria oxfordiana and Marginulina erromena, reflecting the increasingly "Jurassic" aspect of the microfaunas, although these assemblages are still considered to be part of the H. canui Assemblage Zone. Ostracoda also suggest an upper Neocomian age for the interval, with the occurrence of Neocythere? sp. 1 of Hauterivian - Barremian age at 3810' - 3850', and of Eucythereura? sp., Eucythere? sp. 3 and Dolocythere sp. 3 at 4160' - 4200' of possible Barremian age.

The presence of several specimens of the Gaudryina milleri/leffingwelli group and of the Ammobaculites alaskensis/barrowensis group (their highest occurrence in the well section), together with numerous Ammobaculites cf. vetusta and rare Gaudryina topagorukensis in the samples between 4410' and 4500', is typical of the Gaudryina milleri/leffingwelli Assemblage Zone, which ranges in age from Upper Jurassic (Kimmeridgian) to Neocomian. In this section the foraminiferal assemblages have a distinctly Jurassic aspect, which together with ostracod species Aparchitocythere? sp. 2 would suggest that the Jurassic Cretaceous boundary can be drawn at $\pm 4450'$, and therefore that the Neocomian siltstone and shale succession is interrupted by one or more disconformities. However, the microfaunal evidence is insufficient to accurately delimit these.

An Upper Jurassic age is also indicated by the presence of diagnostic foraminifera and ostracoda in the underlying samples. The foraminifera include Marginulinopsis phragmites (4510' - 4550'), Lenticulina aff. dilecta (4610' - 4650'), Marginulina radiata (4710' - 4750'), Marginulinopsis aff. carievalensis, Saracenaria phaedra (4760' - 4800') and Lenticulina dilecta (4810' - 4850'),

and the ostracoda Cytheropteron? sp. 3 (4610' - 4550') and Aparchitocythere? sp. 2 (4710' - 4750'). However, these species represent only single occurrences in quite large assemblages of foraminifera in which long-ranging Jurassic - Lower Cretaceous forms predominate. Several small specimens of the genus Arenoturrspirillina, which generally characterises the lower Kimmeridgian in the Sverdrup Basin, are present in the samples between 4910' and 5050'. Undiagnostic microfaunal assemblages comprised mainly of abundant Haplophragmoides kingakensis/barrowensis and locally common Ammobaculites alaskensis/barrowensis are present in the underlying samples. However, the common occurrences of Lenticulina spp., and L. audax in the samples from 5950' to 6150', and present in small numbers to 6400' in association with other rare calcareous foraminifera, may indicate a Callovian age for the sediments at this level. Ostracoda in this interval include Procytheridea cf. crassa, Galliaecytheridea? sp. 2 and Procytheridea minuta, indicating a Middle and Upper Jurassic age. The interval from 4550' to 6400' has been designated the Marginulinopsis phragmites Assemblage Zone, characterised by the occurrence of several species of calcareous foraminifera, including those listed above.

Below 6400', foraminifera are far less common, consisting of rare, and single occurrences of Haplophragmoides kingakensis/barrowensis, Ammobaculites alaskensis/barrowensis, Lituotuba spp., and "Involutina" aspera/silicea. The persistent occurrence of "I." aspera/silicea in this restricted assemblage may indicate Toarcian-Bajocian strata are present below 6600'; however, it is not present in the large numbers which often characterises this stratigraphical level. No other diagnostic Lower Jurassic foraminifera were recovered from the samples, however the ostracod 'Procytheridea' aff. magnycourtensis indicative of Upper Pliensbachian to Lower Toarcian age, is found in the cuttings sample at 7310' - 7350' while in the core at 7308' - 7328' fragments of the ammonite genus Dactylioceras

,sensu lato, (identified by H. Frebold)

indicate Early to Middle Toarcian age.

The remainder of the well section contains sparse and poorly preserved microfaunas. Only a few of the forms recorded are indicative of a particular stratigraphical interval, these forms include the Upper Triassic species Trochammina sp. 12, Astacolus connudatus, Nodosaria shublikensis/mitis group and long-ranging Permo-Triassic ammodiscids, Ammodiscus spp. 4, 5 and 6 at several horizons. The foraminiferal assemblages are composed predominantly of poorly preserved, often fragmentary specimens, and there is evidence for a certain amount of material caved from the Jurassic. The presence of the ostracoda Healdia sp. 6 (at 10160' - 10200') and Hungarella ?sp. 2 (at 10560' - 10600') suggest that Upper Triassic strata, possibly as old as Karnian, occur.

BIOSTRATIGRAPHY

The basal section from 11070' T.D. to 9500' is composed predominantly of interbedded dark grey, carbonaceous silty shales and generally light grey, fine to medium grained, pyritic sandstones. It is distinguished palynologically by the presence at numerous levels of dinoflagellates of the RHNO plexus, indicating that the interval below 9600' is of Upper Triassic, Norian age. This and the overlying interval, to ±7550', which is composed of light grey, very fine to medium grained, locally carbonaceous and pyritic sandstones associated with coal beds above 8000', have been correlated with the Heiberg Formation. Palynological evidence suggests that the Triassic - Jurassic boundary may be drawn at ±8000'. The overlying section contains rare Triassic palynomorphs in association with sometimes rich Liassic assemblages, for which a Rhaeto-Liassic age has been indicated.* Specimens of (Upper) Triassic foraminifera occurred very sporadically throughout this entire interval. Possible transitional environments of deposition are considered to have passed into shallow marine environments at ±10,800', the lowest occurrence of Triassic dinoflagellates in this section; the disappearance of dinoflagellates from the samples above the Norian - Rhaetian boundary, may indicate a return to transitional, and, in association with coal deposits above 8000', continental sedimentary environments.

*In surface sections from the Sverdrup Basin, Rhaeto-Liassic plant remains have been identified from horizons near the top of the Heiberg Formation. Although no Liassic restricted fossils have been recorded to date, it is probable that the formation may range as young as Sinemurian in age.

Overlying the Heiberg Formation in this section is a very thin unit of white to light grey, fine to medium-grained, glauconitic sandstone, which may represent the development, albeit restricted, of the Borden Island Formation. Analysis of the induction electrical log suggests this interval is only 20 - 50 feet thick, occurring between a sandy interval below and a shale sequence above. Associated with this glauconitic sandstone are fragments of a pebbly sandstone which may be interpreted as a basal conglomerate reflecting the changing depositional environment from non-marine to transitional and shallow marine.

Dark brownish-grey and black, carbonaceous shales characterise the interval from $\pm 7530'$ to $5760'$; they are locally silty and rarely calcareous and a thin bed of light grey sandstone occurs at $\pm 6900'$. Foraminifera are virtually absent from the interval below $7200'$, however ostracoda, palynomorphs and in the core at $7308' - 7328'$, ammonites, indicate a Middle to Upper Liassic age. The overlying interval is characterised by the Toarcian - Bajocian "Involutina" aspera/silicea Assemblage Zone, and by the continued occurrence of Nannoceratopsis gracilis. It is apparent that the palynological samples, especially, are severely affected by material caving from overlying intervals, to the extent that the Bathonian palynofloras are only recorded below the proposed top of the Bajocian, and not at their normal stratigraphical level. The top of this interval has been dated as Callovian, and possibly basal Upper Jurassic, both on palynofloras and microfaunas. Deposition of these argillaceous sediments was predominantly under shallow marine conditions as evidenced by the presence of ammonites, dinoflagellates and often common calcareous foraminifera.

A thin siltstone and silty shale interval from 5760' to 5530' is considered to be, on lithological evidence only, the local expression of the Awingak Formation, which is generally composed of coarser clastic sediments than the underlying Savik Formation shales and the overlying Deer Bay Formation shales and siltstones. In this section it appears that the Awingak Formation occurs around the Middle and Upper Jurassic boundary, and the continued presence of dinoflagellates at this level would suggest continuing marine deposition.

The section from 5530' to 3750' is composed predominantly of dark grey to black, carbonaceous, silty shales with interbedded grey, fine to coarse grained sandstones and very rare buff and grey limestones between 4830' and 4550'; this has been correlated with the Deer Bay Formation. There are problems in the biostratigraphical interpretation due to the sporadic occurrence of the diagnostic forms in both micropalaeontological and palynological suites. Long ranging Jurassic - Lower Cretaceous forms predominate in the foraminiferal assemblages, although isolated diagnostic Jurassic species occur in samples up to 4550', while the presence of Jurassic ostracoda further suggests that the Jurassic - Cretaceous boundary is located at $\pm 4450'$. However, Jurassic spore and pollen assemblages are not recorded above 4700', and even at this level Lower Cretaceous taxa still predominate. Therefore the possibility that the Jurassic foraminifera have been reworked into Cretaceous strata cannot be excluded. The apparent occurrence of the Jurassic foraminifera and ostracoda in normal stratigraphical order suggests that they are in situ.

The samples from the Lower Cretaceous part of the Deer Bay Formation contain a higher proportion of siltstone and significant changes in the microfaunas and palynofloras were observed, which indicate a thin development of lower Neocomian strata, probably interpreted by nonsequences and overlain by a Barremian interval which includes the basal part of the overlying sand/sandstone interval correlated with the Isachsen Formation. Shallow marine sedimentation apparently continued throughout the Deer Bay shales, with possible exceptions at 5300' - 5050', and 4400' - 4250', two less fossiliferous intervals.

The overlying Isachsen Formation is comprised of non-marine sands, sandstones and coals, and is typically barren of foraminifera and microplankton. Spore/pollen assemblages however indicate that the Barremian - Aptian boundary may be drawn at $\pm 3200'$. Above 2200' there are shale intercalations in the sand sequence, and from these foraminifera, ostracoda and microplankton assemblages are recovered, representing marine incursions during the upper part of the Aptian. This interbedded sand/shale succession probably reflects a transitional phase between the Isachsen and Christopher Formations, the top of the Isachsen being placed at the highest occurrence of sand/sandstone at $\pm 1120'$.

Dark grey shales with some siltstones and rare interbeds of sandstone and limestone have been correlated with the Christopher Formation. The foraminiferal faunas are more diverse than those recorded in the uppermost Isachsen, but are still similar to those previously recorded from Aptian age formations. Palynological evidence would indicate that, although a top Aptian has been picked at 1300', it may extend as high as 800', thus falling within the Christopher

Formation. Shallow marine deposition is considered to have prevailed throughout the Christopher Formation at this locality, although some shallowing may well have occurred above $\pm 450'$ where the microfaunas contain only agglutinating foraminifera, often typical of more restricted environments.

CONCLUSIONS

The available cuttings samples are of generally poor quality, especially in the interval from approximately 4000' to 7500' which is composed predominantly of fine clastic sediments; despite this, several conclusions can be drawn from the Hoodoo Dome H-37 well section.

The well section comprises a thick succession of Mesozoic sediments, in which individual formations are often represented by an interval of greater thickness than has been recorded in comparable surface outcrop sections (e.g. Fortier et al, 1963).

The Heiberg Formation appears to be as young as Liassic in its uppermost part, although the evidence is not definitive.

The well section represents an almost complete succession of sediments from Upper Triassic (Norian) to Lower Cretaceous (Albian) age. These are, however, indications that non-sequences exist in the Middle Jurassic, where the interval of possible Bathonian age is relatively thin, and also within the Lower Cretaceous, which would account for the apparent absence of, at least, part of the Lower Neocomian.

VI

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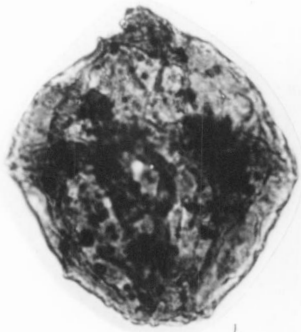
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PLATE 1

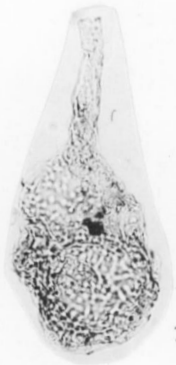
Selected palynomorphs from the Panarctic Hoodoo Dome H-37 well;
all figures x600±

- Figure 1. Gonyaulacysta sp., from depth
200 - 260 ft., Albian.
- Figure 2. Gardodinium elongatum Singh, from depth
1,300 - 1,350 ft., Aptian.
- Figure 3. Cicatricosisporites sp., from depth
1,350 - 1,450 ft., Aptian.
- Figure 4. operculum, hypotype GSC 40547 from depth 1,950 - 2,000 ft., Aptian.
- Figure 5. Aptea polymorpha Eisenack, from depth
1,950 - 2,000 ft., Aptian.
- Figure 6. Canningia colliveri Cookson, from depth
2,100 - 2,190 ft., Aptian.
- Figure 7. Apteodinium granulatum Eisenack, from depth
2,100 - 2,190 ft., Aptian.
- Figure 8. Oligosphaeridium complex (White), from depth
3,650 - 3,700 ft., Berriasian to Barremian.
- Figure 9. Cicatricosisporites hughesi Dettmann, from depth
3,650 - 3,700 ft., Berriasian to Barremian.
- Figure 10. Chytroeisphaeridia "adnata" (author?) from depth
3,960 - 4,059 ft., Berriasian to Barremian.
- Figure 11. Ceratosporites rarus Döring, from depth
4,350 - 4,450 ft., Berriasian to Barremian.
- Figure 12. Cicatricosisporites recticatricosus Döring,
from depth 4,350 - 4,450 ft., Berriasian to Barremian.
- Figure 13. Cedripites cretaceus (author?) from depth
4,350 - 4,450 ft., Berriasian to Barremian.
- Figure 14. Foveosporites foveoreticulatus Döring, from depth
4,460 - 4,550 ft., Late Jurassic.
- Figure 15. Pityosporites sp. VER, from depth
4,460 - 4,550 ft., Late Jurassic.

- Figure 16. Hymenozonotriletes lepidophytus (author?)
from depth 4,560 - 4,650 ft., Late Jurassic (derived).
- Figure 17. Vastisporites vastiformis Döring, from depth
4,950 - 5,050 ft., Late Jurassic.
- Figure 18. Trilobosporites apiverrucatus (author?) from depth
5,250 - 5,350 ft., Late Jurassic.
- Figure 19. Gonyaulacysta jurassica (Deflandre), from depth
6,260 - 6,350 ft., Callovian.
- Figure 21. Nannoceratopsis gracilis Alberti, from depth
6,860 - 6,950 ft., Bajocian.



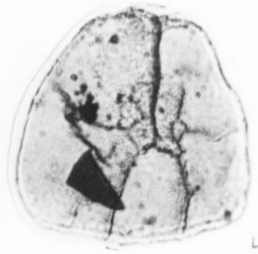
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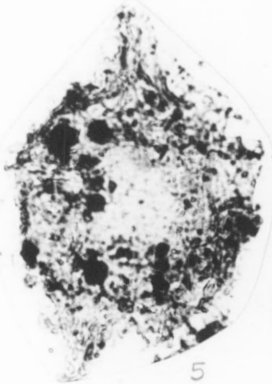
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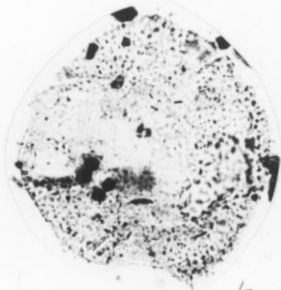
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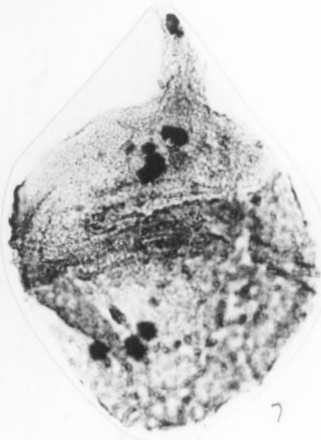
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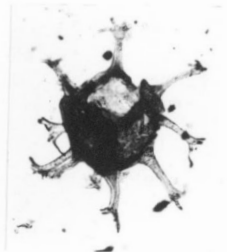
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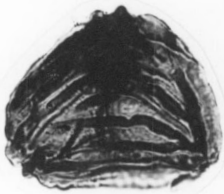
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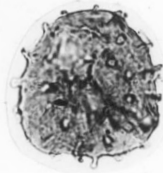
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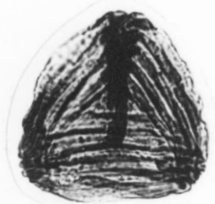
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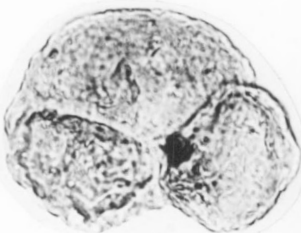
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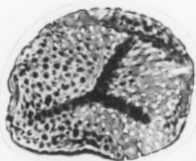
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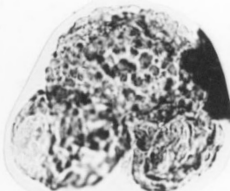
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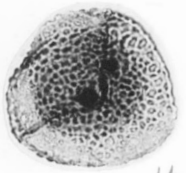
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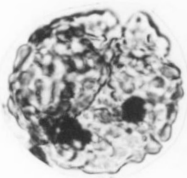
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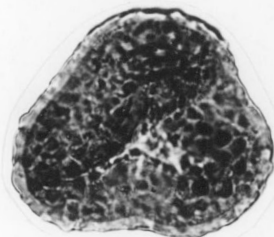
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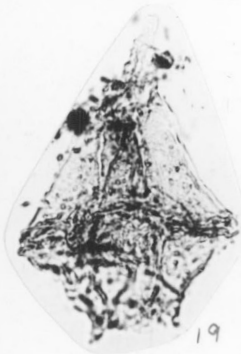
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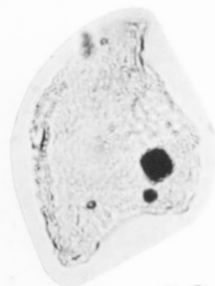
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