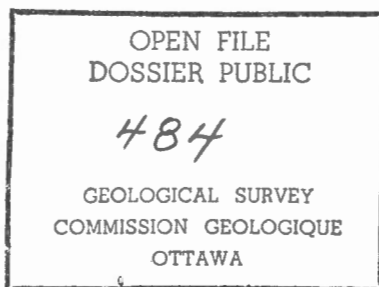


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BIOSTRATIGRAPHIC ZONATION

IMPERIAL ADGO F-28

69° 27' 22" N. LAT., 135° 51' 10" W. LONG. A

NORTHWEST TERRITORIES

*Open File 484*

AUSTIN & CUMMING EXPLORATION CONSULTANTS

CALGARY, ALBERTA

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BIOSTRATIGRAPHIC ZONATION

IMPERIAL ADGO F-28

SUMMARY AND CONCLUSIONS

The biostratigraphy on Imperial Adgo F-28 consists of palynostratigraphy and zonation by Dr. Geoffrey Norris and a micropaleontological analysis by Dr. W. Braun.

One hundred and six micropaleontological slides and 77 micropaleontological preparations from well cuttings provided by the Geological Survey of Canada were examined in detail. Samples were meagre in quantity from 50-5,000 feet and absent in the intervals 1200-1250 and 9300-9400 feet. No conventional cores were taken on the well.

A continuous zonation based on microflora was established from 10,528 feet (total depth) to near surface. Eight recognizable zones extend from Middle Eocene-Older Paleogene to Neogene. The micropaleontological investigation provides three assemblages. Assemblage I and Assemblage II (surface to 2800 feet) are mainly Neogene and possibly Oligocene in age. The Haplophragmoides 67 assemblage from 8200 to 9200 feet contained in a restricted marine section, is dated Paleogene. The remainder of the well was barren of diagnostic microfossils due to the presence of a dominantly continental terrestrial deltaic sequence.

A zonation summary is as follows.

Summary of Zonation

<u>Age</u>	<u>Interval</u>	<u>Zonation</u>	
		<u>Palynology</u>	<u>Micropaleontology</u>
Neogene	0' - 1,900'	AD-1 (100-1200')	Assemblage I (0- 1500')
		AD-2 (1300-1900')	
Oligocene	1900' - 2,800'	AD-3 (2000-2800')	Assemblage II (1500' - 2800')
Late Eocene	2800' - 4,500'	AD-4 (2900-3300')	
		AD-5 (3400-4500')	
Middle Eocene-Older Paleogene	4500-10,528'	AD-6 (4600-5900')	
		AD-7 (6000-6600')	
		AD-8 (6700-8400')	Haplophragmoides 67
		AD-9 (8500-10,528')	Fauna (8250-9200')

PALYNOSTRATIGRAPHIC STUDY

BY

DR. GEOFFREY NORRIS

PALYNOSTRATIGRAPHY  
IMPERIAL ADGO F-28  
BY  
GEOFFREY NORRIS, PH.D.

INTRODUCTION

This report is the result of palynologic analysis of material supplied by Austin and Cumming Exploration Consultants, Calgary, on the Imperial Adgo F-28 well drilled through putative Cenozoic sediments in the Mackenzie Delta region.

The objectives of the study are to establish a palynologic zonation to facilitate correlation between other wells in the region; to report on environments of deposition and paleoecology of the assemblages where possible; and to determine age relationships of the flora.

Emphasis will be placed on the local palynologic succession in each well, and a zonation will be established principally on the tops of ranges of species (successive disappearance zones of Vella). Palynofloral abundance data are notoriously variable and poorly understood - in part due to their dependence on sedimentation patterns - and impossible to assess meaningfully, other than in a general way, from cuttings samples. Staplin et al. (1975) have illustrated selected abundance curves of Neogene and Paleogene miospores from the Delta. Their data suggest a dominance of fungal spores in the lower Paleogene, a rise to dominance of monolete spores and fir pollen over other coniferous pollen in the upper Paleogene, and a change in abundance of bisaccate pollen and other types in the Neogene.

Although this method may have possibilities for crude stratigraphic correlation in the absence of index fossils, it requires heavy investment in time, personnel, statistical methods, and computer hardware and software. All are beyond the resources and time available for the present study. Consequently more effort has been expended in careful taxonomic study and identification of the material and comparative biostratigraphy amongst the wells to achieve a chronostratigraphic zonation based on species of restricted range and often of low abundance. This method is apparently used successfully by several companies operating in the Delta area (Staplin et al., 1975).

Palynologic species are designated by either a published Latin binomial or by a generic name and number, e.g., *Taxodiaceapollenites hiatus*, *Ulmus*-1, *Tricolporopollenites*-3, *Diconodinium*-5. In addition, these names are prefixed by a unique number for convenience of plotting data on paleo-logs, e.g., 1, 320, 373, and M219 respectively for the preceding species. All species are terrestrial spores and pollen except those with a unique number prefixed "M" to indicate microplankton (mostly marine dinoflagellates and acritarchs). A full numerical listing of unique numbers and their corresponding species names is provided in the Appendix. This is a comprehensive list comprising many Mesozoic-Cenozoic palynomorphs common in eastern, western, and arctic Canada. Not all will be referred to in this report.

## SUMMARY

One hundred and six samples from the subject well yielded 105 terrestrial and 20 marine palynomorph species as indicated on the accompanying chart. Zones, ages, and environments are summarized in the accompanying figure (Table 1).

Two Neogene zones AD-1 and AD-2 and 7 Paleogene zones, AD-3 to AD-9 are recognized. The Neogene rests on the Paleogene probably disconformably. The Paleogene is characterized by 4 near-shore or restricted marine horizons interdigitating with terrestrial sediments. Below 8400 feet, in a terrestrial section with sporadic marine incursions, organic maturation increases, indicated by brown spore colouration in the AD-9 zone. This zone is generally impoverished and contains a small number of rare Lower Cretaceous, Albian-Aptian palynomorphs mixed with Paleogene forms. These Lower Cretaceous forms are interpreted as recycled.

## ZONATION

### Zone AD-1 (100-1200 feet)

This zone is characterized by the following terrestrial species:

- 1 *Stereisporites antiquasporites*
- 2 *Taxodiaceapollenites hiatus*
- 407 *Laevigatosporites-1*
- 7 *Gleicheniidites senonicus*
- 34 *Laevigatosporites ovatus*

Recycled Cretaceous and Paleozoic terrestrial and marine material is common, and the following Tertiary miospores also occur sporadically, probably due in part to recycling from lower horizons:

- 287 *Alnipollenites-1*
- 220 *Betulaeapollenites-1*
- 324 *Carpinus subtriangula*
- 326 *Pinus-1*
- 378 *Pluricellaesporites-1*
- 229 *Sigmopollis hispidus*
- 282 *Caryapollenites paleocenicus*

### Zone AD-2 (1300-1900 feet)

Characterized by the rare occurrence of:

- 408 *periporate-1*

and the frequent occurrence of

- 360 *Alnus trina*
- 395 *Corylus-1*

The following species also occur frequently, but range higher in the well probably in part due to recycling:

IMPERIAL ADGO F-28

1000'	AD1	1200'	TERRESTRIAL	NOEGENE
	AD-2	1900'	RESTRICTED MARINE	
2000'	AD-3	2800'	TERRESTRIAL	OLIGOCENE (PROBABLY EARLY)
3000'	AD-4	3300'	RESTRICTED MARINE	
4000'	AD-5	4500'	NEAR-SHORE MARINE	LATE EOCENE
			TERRESTRIAL	
5000'	AD-6	5900'	NEAR-SHORE MARINE	MIDDLE EOCENE TO OLDER PALEOGENE
			TERRESTRIAL	
			NEAR-SHORE MARINE	
			TERRESTRIAL	
6000'	AD-7	6600'	TERRESTRIAL	
7000'	AD-8	8400'	RESTRICTED MARINE	
8000'			TERRESTRIAL	
9000'	AD-9		TERRESTRIAL WITH SPORADIC MARINE HORIZONS	IMPOVERISHED ZONE WITH REWORKED LOWER CRETACEOUS PALYNOMORPHS
10,000'				
10,528' TD		10,528'		

TABLE 1

287 *Alnipollenites*-1  
 220 *Betulaceaepollenites*-1  
 324 *Carpinus subtriangula*  
 326 *Pinus*-1  
 229 *Sigmopollis hispidus*

Rare sporadic species in this zone include the following which may be in whole or in part recycled or caved:

409 *Stereisporites*-1  
 407 *Laevigatosporites*-1  
 323 *Pterocarya levis*  
 374 *Granatisporites*-1  
 390 *Salix*-1  
 22 *Cyathidites minor*

M242 *Korojonia*-1 characterizes the upper part of AD-2 between 1300 feet and 1500 feet and is the only indigenous marine species in this interval.

Zone AD-3 (2000-2800 feet)

Characterized by the frequent occurrence of:

371 *Tsuga*-1  
 377 *Ericaceae*-1  
 401 *Picea*-1  
 395 *Corylus*-1  
 409 *Stereisporites*-2

and the rare species of restricted range:

524 *Ilexpollenites*-1  
 183 *Baculatisporites comaumensis*  
 411 *Abies*-1  
 396 *Tilia*-2  
 525 *Typha*-1  
 320 *Ulmus*-1 (perhaps recycled in the upper part of the zone)

The following species are represented in this zone by occasional specimens which may be recycled:

399 *Castanea*-1  
 330 *Pistillipollenites mcgregori*  
 385 *Rhoipites*-1  
 325 *Aquilapollenites cf. reticulatus*

Zone AD-4 (2900-3300 feet)

The following species have well-defined tops in this zone:

- 372 *Granatitricolpites*-1
- 373 *Tricolporopollenites*-1
- 412 *Lycopodiumsporites*-1
- 418 *Polypodiisporites*-1 (one occurrence)
- 419 *tetrad*-1 (one occurrence)
- 381 *Psilatricolpites*-1

The lowest 100 feet of Zone AD-4 contains M244 *Astrocysta*-1

Zone AD-5 (3400-4500 feet)

Several species that occur sporadically in higher zones (perhaps in part due to recycling) are very frequent in this zone:

- 378 *Pluricellaesporites*-1
- 282 *Caryapollenites paleocenicus*
- 323 *Pterocarya levis*
- 374 *Granatisporites*-1
- 370 *Tilia*-1
- 399 *Castanea*-1
- 385 *Rhoipites*-1

In addition, the following species occur less frequently but have well-defined tops in this zone:

- 367 *Azolla*
- 284 *Cupuliferoipollenites*-1
- 391 *Striadiporites sanctaebabarbarae*
- 397 *Tiliapollenites*-3
- 529 *Tiliapollenites*-4
- 392 *Granatisporites cotalis*
- 534\**Nyssapollenites*-2
- 362\**epiphyllous fungi*
- 533\**Pluricellaesporites*-2
- 400\**Pesavis tagluensis*

Species marked with an asterisk (\*) have tops in the bottom 300 feet of this zone. They may be sensitive to marine facies characterizing the upper part of AD-5 above their ranges.

A number of rare species also occur in Zone AD-5:

- 388 *Tricolporopollenites*-7
- 327 *Podocarpidites maximus*
- 526 *Granatitricolpites*-3
- 384 *Retitricolpites*-1
- 16 *Deltoidospora hallei*
- 527 *Liliacidites*-1
- 528 *Fusiformisporites*-1 (probably recycled)
- 239 *Sequoiapollenites paleocenicus*
- 380 *Tricolporopollenites*-4
- 530 *Pachysandra*-1
- 531 *Momipites tenuipolis*
- 369 *Cranwellia striata*
- 532 *Ctenosporites eskerensis* (possibly recycled)
- 383 *Laricoidites*-1

A well-defined marine assemblage occurs in this zone between 3400 feet and 4100 feet:

- M244 *Astrocysta*-1
- M229 *Wetzeliella hampdenensis*
- M222 *Ceratiopsis*-1
- M220 *Lejeunia*-1
- M246 *Samlandia*-1

Zone AD-6 (4600-5900 feet)

The following sporadic terrestrial species of restricted range characterize this zone:

- 535 *Sapotaceae*-1
- 537 *Polygoniaceae*-1
- 375 *Granatisporites*-2
- 394 *Corylus granilabrata*
- 389 *Nyssapollenites*-1
- 536 *Retitricolporopollenites*-1
- 538 *Retitricolporopollenites*-2
- 539 *Acnepollis*-1
- 544 *Sapotaceae*-2
- 413 *Stereisporites*-3
- 540 *Tricolpites*-2
- 541 *Symplocoipollenites*-1
- 542 *Foveosporites*-1
- 543 *periporate*-2
- 6 *Cingutritetes clavus*
- 19 *Osmundacidites wellmanii*
- 31 *Lycopodiumsporites austroclavatidites*
- 545 *Retitricolporopollenites*-3

A marine microflora characterizes the upper part of this interval (4600-4900 feet):

- M226 *Diconodinium*-6
- M225 *Deflandrea*-3
- M233 *Horologinella*-1
- M230 *Cannosphaeropsis* cf. *reticulensis*

M255 *Wetzeliella homomorpha quinquelata* occurs in the lower part of Zone AD-6 between 5300 feet and 5600 feet.

Zone AD-7 (6000-6600 feet)

This zone is characterized by the fungal spores:

- 546 *Punctodiporites*-1
- 547 *Punctodiporites*-2
- 548 *Fusiformisporites*-2

386 *Rhoipites*-2 has a single occurrence in this zone.

Zone AD-8 (6700-8400 feet)

The range tops of these species define this zone:

- 13 *Alisporites grandis*
- 549 *Pluricellaesporites*-3
- 550 *Striadisporites*-1
- 551 *Striadisporites*-2
- 552 *Stephanocolporites*-1
- 24 *Podocarpidites multisimus*
- 52 *Biretisporites potoniaei*
- 532 *Ctenosporites eskerensis* (probably reworked above this zone)
- 528 *Fusiformisporites*-1 (occurs rarely at higher horizons perhaps due to recycling)

A restricted marine interval between 7000 feet and 7300 feet is marked by:

- M257 *Rhombodinium*-1
- M256 *Ceratiopsis*-2

Zone AD-9 (8500-10,528 feet)

A poorly characterized zone with rare specimens of:

- 5 *Alisporites bilateralis*
- 26 *Vitreisporites pallidus*
- 10 *Perinopollenites elatoides*
- 4 *Cicatricosisporites hallei*
- M35 *Broomea jaegeri*
- M36 *Odontochitina operculata*
- M15 *Leiofusa jurassica*

However, in addition to these Cretaceous species, the following Tertiary elements continue to recur frequently in this interval:

- 2 *Taxodiaceapollenites hiatus*
- 324 *Carpinus subtriangula*
- 378 *Pluricellaesporites*-1
- 392 *Granatisporites cotalis*
- 400 *Pesavis tagluensis*
- 13 *Alisporites grandis*

PALEOENVIRONMENTS

Precise depths of intervals mentioned in this section are indicated in the accompanying figures.

A restricted marine environment of deposition in Zone AD-2 is indicated by the presence of *Korojonia*-1.

A well-defined marine interval (probably near-shore due to the presence of diverse spores and pollen) occupies most of Zone AD-5 and is characterized by 7 marine palynomorph species. The lowest 200 feet of AD-4 contains M241 *Astrocysta*-1 representing the final phase of marine withdrawal.

Zone AD-6 is occupied by two distinct assemblages of marine palynomorphs comprising 6 species. Terrestrial floras in AD-6 are very diverse suggesting near-shore conditions of deposition for both.

A restricted, perhaps brackish marine interval occupies part of Zone AD-8 between 7,000 feet and 7300 feet characterized by two rare dinoflagellate species and a profusion of terrestrial palynomorphs suggesting estuarine conditions.

Sporadic and rare dinoflagellates in Zone AD-9 also suggest an estuarine environment but terrestrial species are less diverse than in the higher part of the well.

#### AGE AND CORRELATION

##### AD-1:

The paucity of the palynoflora and general lack of temperate elements (other than presumed recycled material) suggests a Neogene age for this zone. These characteristics, together with the presence of 229 *Sigmopollis hispidus* and 407 *Laevigatosporites*-1 indicates a correlation with NT-1.

##### AD-2:

The presence of 408 *periporate*-1, 360 *Alnus trina*, and frequent 220 *Betulaceoipollenites*-1 indicate a correlation with NT-2 (Neogene). However, 395 *Corylus*-1 (frequent in AD-2) occurs most frequently in NT-3.

M242 *Korojonia*-1 occurs relatively lower in NT-5 but the distribution of this restricted marine species is probably controlled largely by depositional environment.

##### AD-3:

The common co-occurrence of 371 *Tsuga*-1, 377 *Ericaceae*-1, and 401 *Picea*-1 and the sporadic occurrence of 396 *Tiliapollenites*-2, 320 *Ulmus*-1, and 411 *Abies*-1 suggests a correlation with NT-4 and NI-2 (Lower Oligocene). The lack of a zone precisely correlative with NT-3 and NI-1 may be due to local ecologic factors or to a hiatus (possibly a disconformity) at this horizon. The abrupt truncation of range zones at the top of AD-3 suggests the latter alternative.

## AD-4:

412 *Lycopodiumsporites*-1, 419 tetrad-1, and *Polypodiisporites*-1 occur together at the top of NT-7 (Upper Eocene). M244 *Astrocysta*-1 occurs at the bottom of both NT-7 and AD-4. The lack of NT-5 and NT-6 correlatives is difficult to assess; the absence of some NT species may be due to local ecologic or environmental factors operating at Adgo or to a loss of section correlative with zones NT-5 and NT-6.

## AD-5:

A clear correlation between this zone, NT-8 and NI-4 is established on the basis of the presence of 391 *Striadiporites sanctaebarae*, 400 *Pesavis tagluensis*, 367 *Azolla*, 392 *Granatisporites cotalis*, and 362 epiphyllous fungi.

This correlation is supported by the presence of dinoflagellates in AD-5 that also occur in NT-8 and NI-4. Some of these species occur higher in NI-3 and NI-2. The chronostratigraphic significance of this is not understood at present; local marine transgressions occurring somewhat later in NI-2 and NI-3 than in AD-5 and NT-8 may be responsible.

## AD-6:

This unique terrestrial palynomorph assemblage has no correlatives in the wells examined to date. However, the marine assemblages comprising M226 *Diconodinium*-6, M225 *Deflandrea*-3, and M230 *Cannosphaeropsis reticulensis* suggest affinities with Eocene marine elements of Zones NI-2 (bottom), NI-4, and NT-8 (bottom). Since these dinoflagellates tend to be facies sensitive and their distributional controls are not fully understood, it is impossible to assess precisely their stratigraphic significance. The balance of evidence suggests that AD-6 is somewhat older than NT-8 but certain marine species range upwards in other zones as components of marine transgressive horizons. A correlation with NI-5 is impossible since the floras are extremely impoverished in this zone compared with the rich assemblages of AD-6. A lithologic change or a local disconformity may be responsible for the lack of AD-6 correlatives in NI. M255 *Wetzeliella homomorpha quiquelata* indicates a Paleocene-Middle Eocene age for AD-6; NI-5 also falls somewhere within this interval.

## AD-7:

No correlatives of this unique fungal assemblage are known in wells examined to date. It is presumably Paleocene-Middle Eocene in age to judge from commonly occurring species.

## AD-8:

No known correlatives. The presence of 532 *Ctenosporites eskerensis* indicates a Paleogene age (this species occurs in the Late Eocene of Alaska).

AD-9:

The presence of terrestrial and marine Aptian-Albian palynomorphs suggests at first sight an Early Cretaceous age for this interval. However, these species are not common. Tertiary elements such as 324 *Caprinus subtriangula*, 378 *Pluricellaesporites-1*, 392 *Granatisporites cotalis*, and 400 *Pesavis tagluensis* recur more frequently. Thus it is considered more likely that this zone is Paleogene with reworked Cretaceous, rather than Lower Cretaceous with caved Paleogene.

A Tertiary interpretation of AD-9 would suggest a correlation with the lower part of the Niglintgak well below 5,939 feet which contains a similarly impoverished flora.

Core material from this interval would resolve the question.

#### ORGANIC MATURATION

The Neogene between 100 feet and 2,000 feet has low maturation levels (1-3). The Paleogene between 2,000 feet and 8400 feet represents more or less uniform conditions of maturation with spore colours in the dark yellow-amber range (3-4). An abrupt change of colour (4-5) at 8800 feet occurs concomitantly with a deterioration in preservation state and ranges over most of the AD-9 and is probably associated with the Lower Cretaceous recycled material.

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EXPLANATION OF PLATE #1IMPERIAL ADGO F-28

All figures approximately 750x. Scale in top left is 100um.  
All species new to this study are illustrated, together with some others that require re-illustration.

PLATE 1

1-2.	542	<i>Foveosporites</i> 1
3.	418	<i>Polypodiisporites</i> 1
4.	327	<i>Podocarpidites maximus</i>
5.	527	<i>Liliacidites</i> 1
6.	372	<i>Granatitricolpites</i> 1
7.	380	<i>Tricolporopollenites</i> 4
8.	373	<i>Tricolporopollenites</i> 3
9-10.	524	<i>Ilexpollenites</i> 1
11.	382	<i>Tricolporopollenites</i> 5
12-13.	385	<i>Rhoipites</i> 1
14.	369	<i>Cranwellia striata</i>
15.	386	<i>Rhoipites</i> 2
16.	387	<i>Tricolporopollenites</i> 6
17-18.	388	<i>Tricolporopollenites</i> 7
19-20.	399	<i>Castanea</i> 1
21.	526	<i>Granatitricolporopollenites</i> 3
22.	389	<i>Nyssapollenites</i> 1
23.	534	<i>Nyssapollenites</i> 2
24.	397	<i>Tiliapollenites</i> 3
25-26.	534	<i>Nyssapollenites</i> 2
27-28.	529	<i>Tiliapollenites</i> 4
29-31.	544	<i>Sapotaceae</i> 2
32-33.	535	<i>Sapotaceae</i> 1
34-35.	537	<i>Polygonaceae</i> 1
36-37.	545	<i>Retitricolporopollenites</i> 3
38-39.	536	<i>Retitricolporopollenites</i> 1
40.	538	<i>Retitricolporopollenites</i> 2
41-42.	552	<i>Stephanocolporopollenites</i> 1
43.	540	<i>Tricolpites</i> 2
44.	541	<i>Symplocoipollenites</i> 1
45-48.	539	<i>Acnepollis</i> 1
49.	541	<i>Symplocoipollenites</i> 1
50.	220	<i>Betulaceoipollenites</i> 1
51.	324	<i>Carpinus subtriangula</i>
52.	394	<i>Corylus granilabrata</i>
53-54.	531	<i>Momipites tenuipolis</i>
55.	282	<i>Caryapollenites paleocenicus</i>

EXPLANATION OF PLATE #2IMPERIAL ADGO F-28

All figures approximately 750x. Scale in top left is 100um.  
 All species new to this study are illustrated, together with some others  
 that require re-illustration.

PLATE 2

56.	377	<i>Ericaceae</i> 1
57.	330	<i>Pistilipollenites mcgregorii</i>
58-59.	525	<i>Typha</i> 1
60.	530	<i>Pachysandra</i> 1
61.	287	<i>Alnipollenites</i> 1
62.	408	<i>periporate</i> 1
63.	323	<i>Pterocarya levis</i>
64-65.	543	<i>periporate</i> 2
66.	547	<i>Punctodiporites</i> 2
67-69.	546	<i>Punctodiporites</i> 1
70-72.	551	<i>Striadiporites</i> 2
73.	391	<i>Striadiporites sanctaeberberae</i>
74-76.	528	<i>Fusiformisporites</i> 1
77-78.	548	<i>Fusiformisporites</i> 2
79.	550	<i>Striadiporites</i> 1
80-81.	400	<i>Pesavis tagluensis</i>
82.	532	<i>Ctenosporites eskerensis</i>
83.	374	<i>Granatisporites</i> 1
84.	392	<i>Granatisporites cotalis</i>
85-86.	533	<i>Pluricellaesporites</i> 2
87.	548	<i>Fusiformisporites</i> 2
88.	378	<i>Pluricellaesporites</i> 1
89.	362	<i>epiphyllous fungi</i>
90-91.	549	<i>Pluricellaesporites</i> 3.

EXPLANATION OF PLATE #3

IMPERIAL ADGO F-28

All figures approximately 750x. Scale in top left is 100 um.  
All species new to this study are illustrated, together with some others  
that require re-illustration.

PLATE 3

- |        |       |  |
|--------|-------|--|
| 92.    | M229  | <i>Wetzeliella hampdenensis</i>                  |
| 93.    | M257  | <i>Rhombodinium</i> 1                            |
| 94-95. | M255- | <i>Wetzeliella homomorpha</i> <i>quinquelata</i> |
| 96.    | M15   | <i>Leiofusa jurassica</i>                        |
| 97.    | M35   | <i>Broomea jaegeri</i>                           |
| 98.    | M246  | <i>Samlanida</i> 1                               |
| 99.    | M222  | <i>Ceratiopsis</i> 1                             |
| 100.   | M244  | <i>Astrocysta</i> 1                              |
| 101.   | M226  | <i>Diconodinium</i> 6                            |
| 102.   | M256  | <i>Ceratiopsis</i> 2                             |

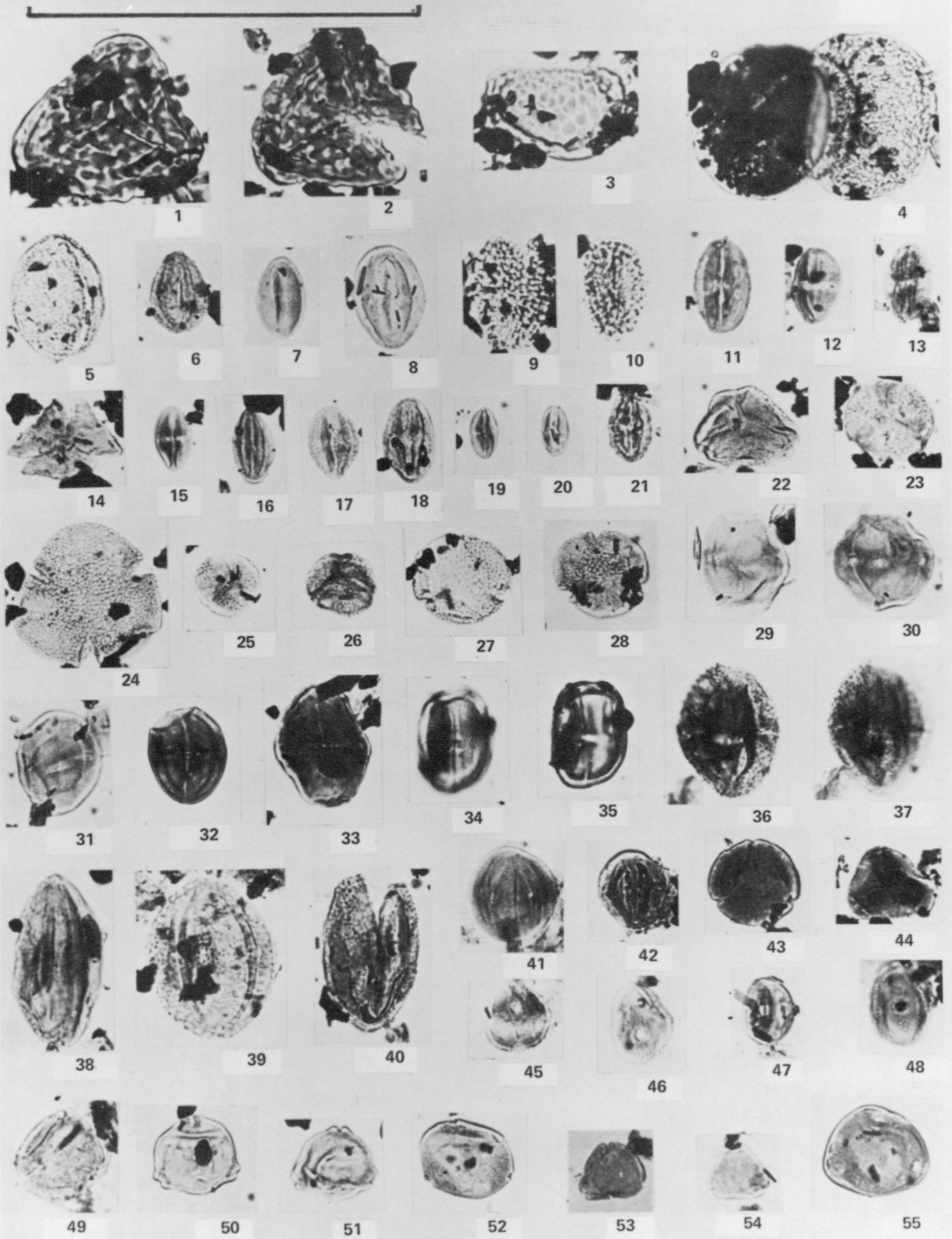
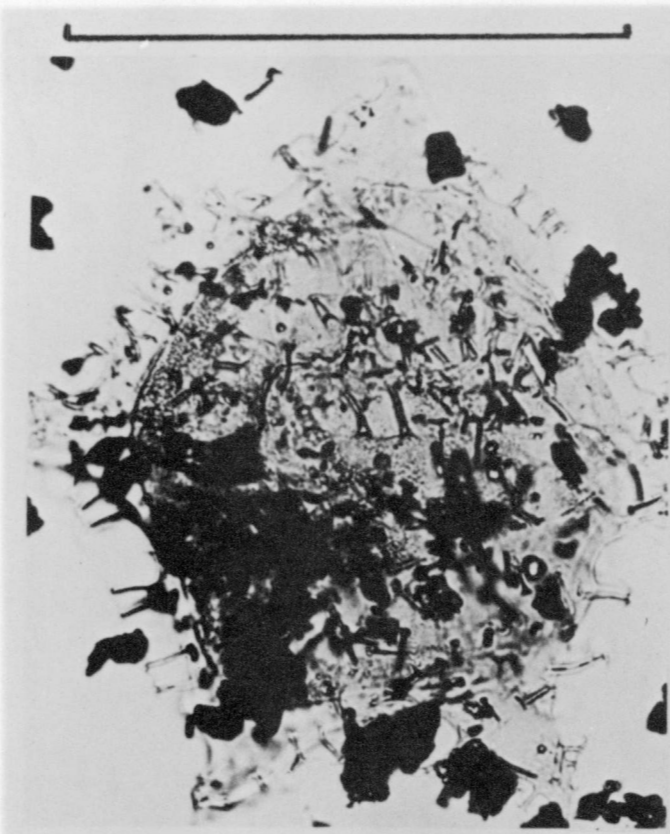
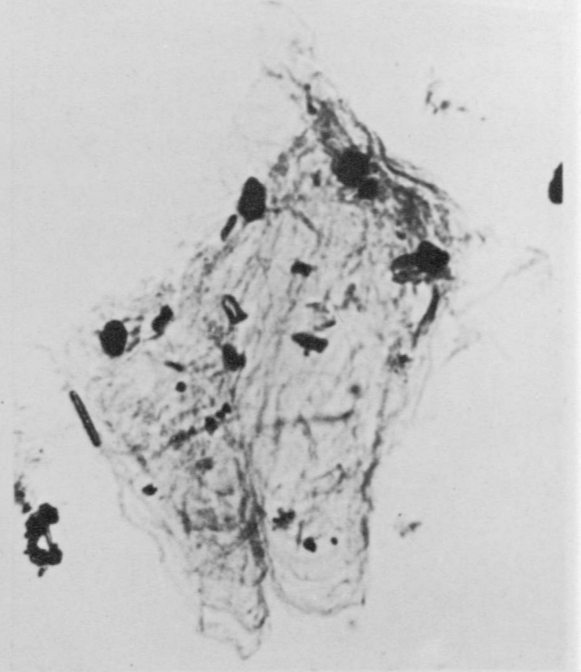




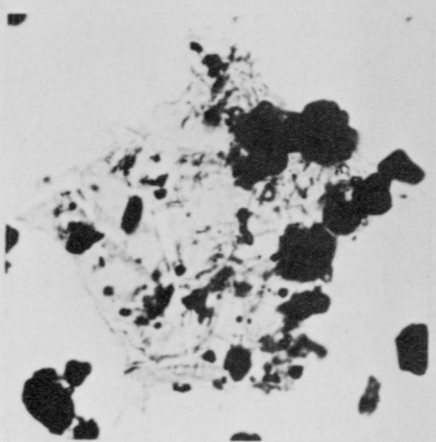
PLATE 2



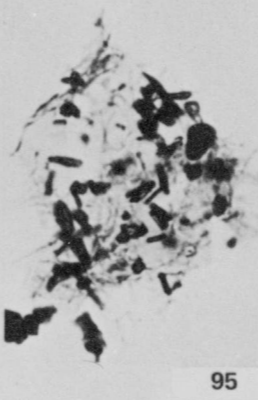
92



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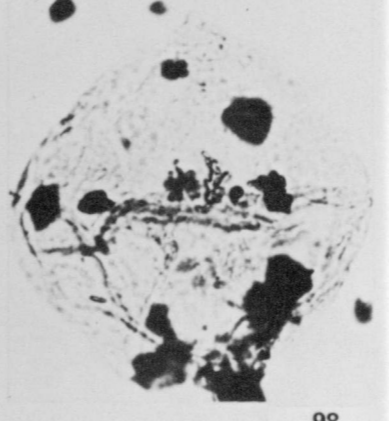
94



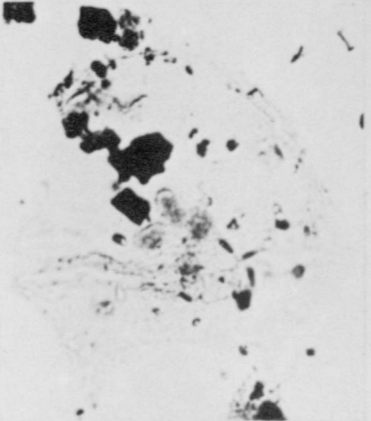
95



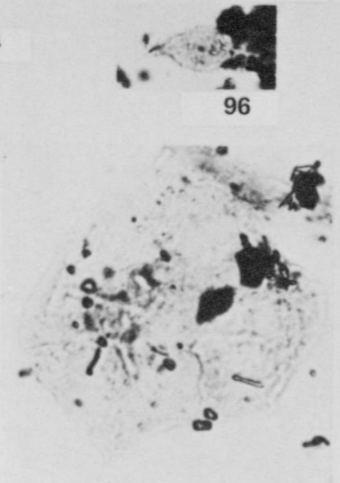
97



98



99



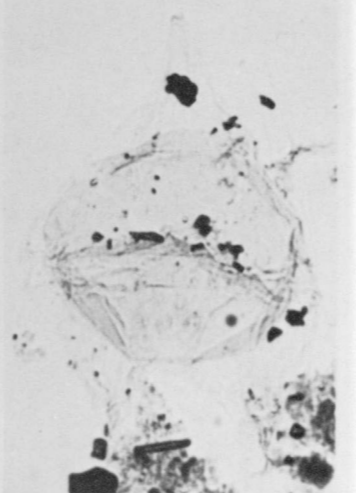
100



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101



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FOSSIL APPENDIX

Numerical Listing of Unique Numbers  
and Corresponding Palynomorph Species  
Names Common in Eastern, Western, and  
Arctic Canada.

## Terrestrial palynomorphs

1. *Stereisporites antiquasporites* (Wilson and Webster) Dettmann
2. *Taxodiaceapollenites Hiatus* (Potonie) Kremp
3. *Classopollis torosus* (Reissinger) Balme
4. *Cicatricosisporites hallei* Delcourt and Sprumont
5. *Alisporites bilateralis* Rouse
6. *Cingutriletes clavus* (Balme) Dettmann
7. *Gleicheniidites senonicus* Ross
8. *Cedripites cretaceous* Pocock
9. *Cerebropollenites mesozoicus* (Couper) Nilsson
10. *Perinopollenites elatoides* Couper
11. *Concavissimisporites punctatus* (Delcourt and Sprumont) Brenner
12. Recycled Carboniferous-Devonian spores.
13. *Alisporites grandis* (Cookson) Dettmann
14. *Lycopodiumsporites marginatus* Singh
15. *Cicatricosisporites annulatus* Archangelski and Gamberro
16. *Deltoidospora hallei* Miner
17. *Cicatricosisporites* cf. *A. exilioides* (Maljavkina) Bolchovitina
18. *Tigrisporites scurrandus* Norris
19. *Osmundacidites wellmanii* Couper
20. *Cicatricosisporites australis* (Cookson) Potonie
21. *Cicatricosisporites hughesi* Dettmann
22. *Cyathidites minor* Couper
23. *Ginkgocycadophytus nitidus* (Balme) de Jersey
24. *Podocarpidites multisimus* (Bolchovitina) Pocock
25. Recycled Permo-Triassic pollen.
26. *Vitreisporites pallidus* (Reissinger) Potonie
27. *Ephedripites multicostatus* Brenner
28. *Neoraistrickia robusta* Brenner
29. *Cicatricosisporites augustus* Singh
30. *Phyllocladidites inchoatus* (Pierce) Norris
31. *Lycopodiumsporites austroclavatidites* (Cookson) Potonie
32. *Hymenozonotriletes* cf. *H. mesozoicus* Pocock
33. *Cyathidites australis* Couper
34. *Laevigatosporites ovatus* Wilson and Webster
35. *Cicatricosisporites pseudotripartitus* (Bolchovitina) Dettmann
36. *Lycopodiumsporites reticulumsporites* (Rouse) Dettmann
37. *Kuylisporites lunaris* Cookson and Dettmann
38. *Aequitriradites spinulosus* (Cookson and Dettmann) Cooks. and Dettmann
39. *Foraminisporis wonthaggiensis* (Cookson and Dettmann) Dettmann
40. *Sestrosporites pseudoalveolatus* (Couper) Dettmann
41. *Rouseisporites laevigatus* Pocock
42. *Araucariacites australis*
43. *Klukisporites pseudoreticulatus* Couper
44. *Polycingulatisporites reduncus* (Bolchovitina) Palyford and Dettmann
45. *Schizosporis parvus* Cookson and Dettmann
46. *Porvisaccites radiatus* Couper
47. *Classopollis minor* Pocock
48. *Circulina parva* Brenner
49. *Converrucosisporites variverracatus* (Couper) Norris
50. *Coronatispora valdensis* (Couper) Dettmann

51. *Callialosporites* cf. *C. dampieri* (Balme) Dev
52. *Biretisporites potonieii* Delcourt and Sprumont
53. *Leptolepidites* cf. *L. psarosus* Norris
54. *Distaltriangulisporites perplexus* (Singh) Singh
55. *Appendicisporites jansonii* Pocock
56. *Deltoidospora juncta* (Kara-Murza) Singh
57. *Trilobosporites* cf. *T. marylandensis* Brenner
58. *Trilobosporites trioreticulosus* Cookson and Dettmann
59. *Contignisporites multimuratus* Dettmann
60. *Rousesporites reticulatus* Pocock
61. *Eucommiidites troedssonii* Erdtman
62. *Exesipollenites tumulus* Balme
63. *Pilososporites trichopapillosus* (Thiergart) Delcourt and Sprumont
64. *Tripartina* cf. *T. variabilis* Maljavkina
65. *Contignisporites glebulentus* Dettmann
66. *Trilobosporites* cf. *T. apiverrucatus* Couper
67. *Densoisporites microrugulatus* Brenner
68. *Concavissimisporites parkini* (Pocock) Singh
69. *Reticulisporites* 1
70. *Contignisporites dorsostriatus* (Bolchovitina) Dettmann
71. *Todisporites major* Couper
72. *Callialasporites* 1
73. *Marattisporites scabratus* Couper
74. *Leptolepidites epacrornatus* Norris
75. *Perinopollenites* 1
76. *Cristatisporites* 1
77. *Contignisporites cooksoni* (Balme) Dettmann
78. *Podocarpidites* cf. *P. rousei* Pocock
79. *Antulsporites* 1
80. *Chasmatosporites* 1
81. *Ovalipollis canadensis* Pocock
82. *Dictyophyllidites harrisii* Couper
83. *Cirratriradites* cf. *Leiotriletes incertus* Bolchovitina
84. *Camarozonosporites* 1
85. *Acanthotriletes* 1
86. *Calamospora mesozoica* Couper
87. *Rubinella* 1
88. *Annulispora* 1
89. *Foraminisporis asymmetricus* (Cookson and Dettmann) Dettmann
90. *Protohaploxylinus chaloneri* Clarke
91. *Striatopodocarpidites* 1
92. *Alisporites* cf. *A. parvus* de Jersey
93. *Klausipollenites* 1
94. *Alisporites* 2
95. *Ovalipollis* 1
96. *Platysaccus* 1
97. *Taeniaesporites* 1
98. *Inaperturopollenites* 1
99. *Taeniaesporites novimundi* Jansonius
100. *Lueckisporites* 1
101. *Cordaitina* 1
102. *Protohaploxylinus* 2

103. *Cedripites* 2
104. *Cyclogranisporites* 1
105. *Lueckisporites* 2
106. *Guttulapollenites* 1
107. *Tsugaepollenites jonkeri* Jansonius
108. *Anaplanisporites* 1
109. *Cedripites* 1
110. *Sulcatisporites* cf. *S. institatus* Balme
111. *Stereisporites* 1
112. *Falcisporites nuthallensis* (Clarke) Balme
113. *Cycadopites follicularius* Wilson and Webster
114. *Densoisporites* cf. *D. nejburgi* (Schulz) Balme
115. *Protohaploxypinus samoilovitchi* (Jansonius) Hart
116. *Platysaccus* 2
117. *Taeniaesporites* 3
118. *Punctatisporites* 1
119. *Punctatosporites* cf. *P. minutus* Ibrahim
120. *Apiculatisporis* 1
121. *Alisporites* 3
122. *Illinites klausii* Clarke
123. *Taeniaesporites* cf. *T. labdacus* Klaus
124. *Taeniaesporites albertae* Jansonius
125. *Taeniaesporites hexagonalis* Jansonius
126. *Nevesisporites* 1
127. *Nevesisporites* 2
128. *Lundbladispota* 1
129. *Gnetaceaepollenites steevis* Jansonius
130. *Gnetaceaepollenites paenesaccatus* Jansonius
131. *Klausipollenites fastidiosus* Jansonius
132. *Kraueselisporites* 1
133. *Kraueselisporites* 2
134. *Raistrickia* 1
135. *Gnetaceaepollenites multistriatus* Jansonius
136. *Taeniaesporites* cf. *T. nubilis* (Leschik) Clarke
137. *Apiculatisporis* 2
138. *Grandispora* 1
139. *Gnetaceaepollenites scotti* Jansonius
140. *Schizosporis scissus* (Balme and Hennelly) Hart
141. *Taeniaesporites noviaulensis* Leschik
142. *Grandispora* 2
143. *Pretricolpipollenites* 1
144. *Ceratosporites* 1
145. *Lophotriletes* 1
146. *Endosporites* 1
147. *Aratrisporites* 1
148. *Endosporites* 2
149. *Striatites richteri* (Klaus) Jansonius
150. *Paravittatina* 1
151. *Pilosisporites* 1
152. *Rugubivesiculites reductus* Pierce
153. *Camarozonosporites insignia* Norris
154. *Appendicisporites bilateralis* Singh

155. *Appendicisporites cristatus* (Markov) Pocock
156. *Tricolpopollenites micromunus* Groot and Penny
157. *Psilatricolpites parvulus* (Groot and Penny) Norris
158. *Sequoiapollenites* sp.
159. *Appendicisporites bifurcatus* Singh
160. *Appendicisporites* cf. *jansonii* Pocock
161. *Schizosporis grandis* Pocock
162. *Penetetrapites mollis* Hedlund and Norris
163. *Appendicisporites matesovai* (Bolchovitina) Norris
164. *Cupuliferoipollenites minutus* (Brenner) Singh
165. *Tricolpites sagax* Norris
166. *Liliacidites dividuus* (Pierce) Brenner
167. *Klukisporites foveolatus* Pocock
168. *Costatoperforosporites foveolatus* Deak
169. *Appendicisporites erdtmanii* Pocock
170. *Schizosporis spriggi* Cookson and Dettmann
171. *Rugubivesiculites rugosus* Pierce
172. *Ornamentifera* cf. *echinata* (Bolchovitina) Bolchovitina
173. *Todisporites minor* Couper
174. *Foveotriletes subtriangularis* Brenner
175. *Antulsporites distaverrucosus* (Brenner) Archangelsky and Gammero
176. *Clavatipollenites minutus* Brenner
177. *Cicatricosisporites* cf. *subrotundus* Brenner
178. *Spheripollenites scabratus* Couper
179. *Cicatricosisporites* cf. *hughesi* Dettmann
180. *Trilobosporites marylandensis* Brenner
181. *Cicatricosisporites subrotundus* Brenner
182. *Cicatricosisporites potomacensis* Brenner
183. *Baculatisporites comaumensis* (Cookson) Potonie
184. *Appendicisporites tricornitatus* Weyland and Greifeld
185. *Pilososporites verus* Delcourt and Sprumont
186. *Appendicisporites potomacensis* Brenner
187. *Acanthotriletes varispinosus* Pocock
188. *Appendicisporites problematicus* (Burger) Singh
189. *Cicatricosisporites* cf. *pseudotripartitus* (Bolch.) Dettmann
190. *Appendicisporites* cf. *bilateralis* Singh
191. *Trilobosporites* cf. *perverulentus* Dettmann
192. *Pilososporites* cf. *trichopapillosus* (Thiergart) Del. and Sprumont
193. *Contignisporites multimuratus* Dettmann
194. *Contignisporites* cf. *multimuratus* Dettmann
195. *Cicatricosisporites* cf. *australisensis* (Cookson) Potonie
196. *Trilobosporites minor* Pocock
197. *Deltoidospora psilostoma* Rouse
198. *Sestrosporites* cf. *pseudoalveolatus* (Couper) Dettmann
199. *Matonisporites phlebopteroides* Couper
200. *Callialasporites dampieri* (Balme) Sukh Dev
201. *Trilobosporites apiverrucatus* Couper
202. *Cicatricosisporites* cf. *potomacensis* Brenner
203. *Tauocusporites segmentatus* Stover
204. *Appendicisporites* cf. *A. macrorhiza* (Maljavkina) Bolchovitina
205. *Chomotriletes fragilis* Pocock
206. *Cicatricosisporites purbeckensis* Norris

207. *Microreticulatisporites* cf. *uniformis* Singh
208. *Ischyosporites punctatus* Cookson and Dettmann
209. *Retitricolpites vulgaris* Pierce
210. *Reticulisporites elongatus* Singh
211. *Foveosporites canalis* Balme
212. *Striatopollis paraneus* (Norris) Singh
213. *Liliacidites textus* Norris
214. *Cirratriradites teter* Norris
215. *Lycopodiumsporites expansus* Singh
216. *Appendicisporites unicus* (Markova) Singh
217. *Quadrapollenites* cf. *vagus* Stover
218. *Nyssapollenites albertensis* Singh
219. *Tricolpites fissilis* Couper
220. *Betulaceoipollenites* 1
221. *Proteacidites thalmanii* Anderson
222. *Liliacidites mirus* Srivastava
223. *Triorites inferius* Dutta and Sah
224. *Duplopollis carlquistii* Drugg
225. *Aquilapollenites calvus* Tschudy and Leopold
226. *Conclavipollis* 1
227. *Cicatricosisporites* cf. *ludbrookii* Dettmann
228. *Tricolporopollenites* 1
229. *Sigmopollis hispidus* Hedlund
230. *Neoraistrickia truncata* (Cookson) Potonie
231. *Loranthacites macrosolenoides* Mtchedlishvili
232. *Aquilapollenites trialatus* Rouse
233. *Aquilapollenites quadrilobus* Rouse
234. *Aquilapollenites catenireticulatus* Srivastava
235. *Ornamentifera baculata* Singh
236. *Schizosporis reticulatus* Cookson and Dettmann
237. *Syncolporites* cf. *lisamae* van der Hammen
238. *Aquilapollenites venustus* Srivastava
239. *Sequoiapollenites paleocenicus* Stanley
240. *Hazaria canadiana* Srivastava
241. *Triatriopollenites costatus* Norton
242. *Grewipollenites canadensis* Srivastava
243. *Proteacidites retusus* Anderson
244. *Foveotricolporites rhombohedralis* Pierce
245. *Sigmopollis* 1
246. *Aquilapollenites reductus* Norton
247. *Aquilapollenites attenuatus* Funkhouser
248. *Symplocoipollenites vestibulum* (Potonie) Potonie
249. *Aquilapollenites bertillonites* Funkhouser
250. *Foraminisporis* cf. *assymmetricus* (Cookson and Dettmann) Dettmann
251. *Caryapollenites* cf. *veripites* Wilson and Webster
252. *Stereisporites australe* (Cookson)
253. *Cercidiphyllites brevicolpatus* Mtchedlishvili
254. *Tricolporopollenites* 2
255. *Zlivisporis* cf. *novamexicanum* (Anderson) Leffingwell
256. *Kuylisporites scutatus* Newman
257. *Aquilapollenites clarireticulatus* (Samoilovitch) Tschudy
258. *Aquilapollenites amygdaloides* Srivastava

259. *Umbosporites callosus* Newman
260. *Lusatisporis dettmannae* Srivastava
261. *Aquilapollenites rigidus* Tschudy and Leopold
262. *Marcelloporites basilicus* Srivastava
263. *Senipites drumhellerensis* Srivastava
264. *Liburnispiris adnacus* Srivastava
265. *Tricolpites reticulatus* Cookson
266. *Liliacidites morrinensis* Srivastava
267. *Tubulifloridites aedicula* Srivastava
268. *Cingulatisporites dakotaensis* Stanley
269. *Coriariipites* cf. *alienus* Srivastava
270. *Balmeisporites* 1
271. *Erdtmanipollis pachysandroides* Krutzsch
272. *Kuylisporites* cf. *lunaris* Cookson and Dettmann
273. *Aquilapollenites turbidus* Tschudy and Leopold
274. *Faguspollenites granulatus* (Martin and Rouse) Srivastava
275. *Tetracolpites* 1
276. *Trudopollis meekeri* Newman
277. *Polyporina globosa* Sah
278. *Callistopollenites* 1
279. *Pulcheripollentites krempi* Srivastava
280. *Symplocoipollenites morrinenses* Srivastava
281. *Proteacidites magnus* Samoiloitch
282. *Caryapollenites paleocenicus* (Stanley) Srivastava
283. *Triporopollenites* 1
284. *Cupuliferoidpollenites* 1
285. *Hazaria sheoperii* Srivastava
286. *Triporopollenites* 2
287. *Alnipollenites* 1
288. *Stereisporites regius* (Drozstchich)
289. *Wodehousia spinata* Stanley
290. *Hamulatipollis* 1
291. *Tricolpites hians* Stanley
292. *Triporina globosa* Chlonova
293. *Tripoprojectus unicus* (Chlonova) Mtchedlishvili
294. *Syncolpites porosus* Mtchedlishvili
295. *Aquilapollenites senonicus* (Mtchedlishvili) Tschudy and Leopold
296. *Leiotriletes* 1
297. *Punctatisporites* 2
298. *Endosporites* 3
299. *Stenozonotriletes* 1
300. *Stenozonotriletes* 2
301. *Reticulatisporites* 1
302. *Densosporites* 1
303. *Cirratriradites* 1
304. *Inaperturopollenites* 2
305. *Stenozonotriletes* 3
306. *Hystricosporites* 1
307. *Acanthotriletes* 2
308. *Granulatisporites* 1
309. *Hymenozonotriletes* 1
310. *Calamospora* 1

311. *Retusotriletes* 1
312. *Perotrilites* 1
313. *Trilobosporites purverulentus* (Verbitskaya) Dettmann
314. *Cicatricosisporites spiralis* Singh
315. *Trilobosporites* cf. *obsitus* Norris
316. *Callialasporites trilobatus* (Balme)
317. *Trilobosporites* cf. *hannonicus* Delcourt and Sprumont
318. *Eucommiidites minor* Groot and Penny
319. *Fraxinopollenites variabilis* Stanley
320. *Ulmus* 1
321. *Alnipollenites* 1
322. *Tilia danei* Anderson
323. *Pterocarya levis* Stanley
324. *Carpinus subtriangula* Stanley
325. *Aquilapollenites* cf. *reticulatus* Stanley
326. *Pinus* 1
327. *Podocarpus maximus* Stanley
328. *Ericipites* 1
329. *Pororeticulites* 1
330. *Pistillipollenites mcgregori* Rouse
331. *Triorites* 1
332. *Pediastrum* sp.
333. *Aquilapollenites spinulosus* Funkhouser
334. *Aquilapollenites* cf. *amygdaloides* Srivastava
335. *Costatoperforosporites fistulosus* Deak
336. *Cicatricosisporites auritus* Singh
337. *Rogalskisporites cicatricosus* (Rogalska) Danse, Corsin and Levin
338. *Foraminisporis daileyi*
339. *Taurocusporites* cf. *segmentatus*
340. *Januasporites spiniferus*
341. *Trilobosporites* cf. *minor*
342. *Hymenozonotriletes* 2
343. *Phyllocladidites* 1
344. *Cicatricosisporites annulatus*
345. *Couperisporites complexus*
346. *Cicatricosisporites angicanalis*
347. *Distalanulisporites verrucosus*
348. *Podocarpidites arcticus*
349. *Pteruchipollenites microsaccus*
350. *Ceratosporites varispinosus*
351. *Circulina* 1
352. *Distalanulisporites incertus*
353. *Corrugatisporites amplexiformis*
354. *Matthesisporites tumulosus*
355. *Staplinisporites jurassicus*
356. *Corrugatisporites anagrammensis*
357. *Concentrisporites pseudosulcatus*
358. *Apiculatisporites variabilis*
359. *Rhoipites pissinis*
360. *Alnus trina*
361. *Aquilapollenites* cf. *trialatus*
362. *Epiphyllous fungi fruiting body*

363. *Tricolpites parvus*
364. *Stephanoporites* 1
365. *Liliacidites leei* Anderson
366. *Rubinella major* (Couper) Norris
367. *Azolla* sp.
368. *Apilobium* 1
369. *Cranwellia striata*
370. *Tiliapollenites* 1
371. *Tsuga* 1
372. *Granatitricolpites* 1
373. *Tricolporopollenites* 3
374. *Granatisporites* 1
375. *Granatisporites* 2
376. *Triad* 1
377. *Ericaceae* 1
378. *Pluricellaesporites* 1
379. *Granatitricolpites* 2
380. *Tricolporopollenites* 4
381. *Psilatricolpites* 1
382. *Tricolporopollenites* 5
383. *Laricoidites* 1
384. *Retitricolpites* 1
385. *Rhoipites* 1
386. *Rhoipites* 2
387. *Tricolporopollenites* 6
388. *Tricolporopollenites* 7
389. *Nyssapollenites* 1
390. *Salix* 1
391. *Striadiporites sanctaebarae*
392. *Granatisporites cotalis*
393. *Tricolporopollenites* 8
394. *Corylus granilabrata*
395. *Corylus* 1
396. *Tiliapollenites* 2
397. *Tiliapollenites* 3
398. *Basopollis* 1
399. *Castanea* 1
400. *Pesavis tagluensis*
401. *Picea* 1
402. *Ginkgo* 1
403. *Aquilapollenites delicatulus*
404. *Triprojectus* cf. *echinatus*
405. *Cicatricosisporites intersectus*
406. *Stephanocolpites* 1
407. *Laevigatosporites* 1
408. *Periporate* 1
409. *Stereisporites* 2
410. *Engelhardtia* 1
411. *Abies* 1
412. *Lycopodiumsporites* 1
413. *Stereisporites* 3
414. *Triatriopollenites* 1
415. *Aquilapollenites* cf. *murus* Stanley
416. *Osmundacidites* 1
417. *Contignisporites* cf. *fornicatus* Dettmann

418. *Polypodiisporites* 1
419. *tetrad* 1
420. *Laevigatosporites* 2
421. *Leptolepidites* 1
422. *Parviprojectus* 1
510. Recycled Cretaceous spores.
513. *Hamulatisporis* cf. *rugulatus* (Couper) Srivastava
518. *Trilobosporites* cf. *bernissartensis* (Delcourt and Sprumont)
522. *Leptolepidites* cf. *tenuis* Stanley
523. *Triquitrites* sp. indet.
524. *Ilexpollenites* 1
525. *Typha* 1
526. *Granatitricolpites* 3
527. *Liliacidites* 1
528. *Fusiformisporites* 1
529. *Tiliapollenites* 4
530. *Pachysandra* 1
531. *Momipites tenuipolis* Anderson
532. *Ctenosporites eskerensis* Elsik and Jansonius
533. *Pluricellaesporites* 2
534. *Nyssapollenites* 2
535. *Sapotaceae* 1
536. *Retitricolporopollenites* 1
537. *Polygoniaceae* 1
538. *Retitricolporopollenites* 2
539. *Acnepollis* 1
540. *Tricolpites* 2
541. *Symplocoipollenites* 1
542. *Foveosporites* 1
543. *periporate* 2
544. *Sapotaceae* 2
545. *Retitricolporopollenites* 3
546. *Punctodiporites* 1
547. *Punctodiporites* 2
548. *Fusiformisporites* 2
549. *Pluricellaesporites* 3
550. *Striadiporites* 1
551. *Striadiporites* 2
552. *Stephanocolporites* 1
553. *Pulcheripollenites* cf. *krempi* Srivastava
554. *Pesavis simplex* Elsik and Jansonius
555. *Ctenosporites wolfei* Elsik and Jansonius
556. *Pesavis* 1

Marine palynomorphs

- M1. *Oligosphaeridium complex* (White) Davey and Williams
- M2. *Astrocysta cretacea* (Pocock) Davey
- M3. *Micrhystridium* 1
- M4. *Odontochitina striatoperforata* Cookson and Eisenack
- M5. *Apteodinium* cf. *A. reticulatum* Singh
- M6. *Leiofusa bernesga* Cramer
- M7. *Hystrichosphaeridium cooksoni* Singh
- M8. *Gonyaulacysta tenuiceras* (Eisenack) Sarjeant
- M9. *Veryhachium europaeum* Stockmans and Williere
- M10. *Meiourogonaulax* cf. *M. stoveri* Millioud
- M11. *Baltisphaeridium crameri* Singh
- M12. *Scrinioidinium* cf. *S. eurypylum* Manum and Cookson
- M13. *Micrhystridium stellatum* Deflandre
- M14. *Pseudoceratium* cf. *P. regium* Singh
- M15. *Leiofusa jurassic* Cookson and Eisenack
- M16. *Chlamydophorella nyei* Cookson and Eisenack
- M17. *Palaeostomocystis* 1
- M18. *Cyclonephelium distinctum* Deflandre and Cookson
- M19. *Pseudoceratium pelliferum* Gocht
- M20. *Tanyosphaeridium* sp. Singh
- M21. *Canningia colliveri* Cookson and Eisenack
- M22. cf. *Aptea polymorpha* Eisenack
- M23. *Cleistosphaeridium polypes* (Cookson and Eisenack) Davey
- M24. *Baltisphaeridium whitei* (Deflandre and Courtville) Sarjeant
- M25. *Cribroperidinium orthoceras* (Eisenack) Davey
- M26. *Diplotesta angelica* Cookson and Hughes
- M27. *Gardodinium elongatum* Singh
- M28. *Oligosphaeridium anthophorum* (Cookson and Eisenack) Davey
- M29. *Hystrichosphaera cingulata* (Wetzel) Deflandre and Cookson
- M30. *Gonyaulacysta* sp. B Singh
- M31. *Gonyaulacysta* cf. *G. striata* Clarke and Verdier
- M32. *Carpodinium* 1
- M33. *Palaeoperidinium* cf. *P. ventriosum* (Wetzel) Deflandre
- M34. *Oligosphaeridium albertense* Pocock
- M35. *Broomea jaegeri* Alberti
- M36. *Odontochitina operculata* (Wetzel) Deflandre
- M37. *Hystrichosphaera ramosa* (Ehrenberg) Wetzel
- M38. *Cyclonephelium* cf. *C. vannophorum* Davey
- M39. *Pseudoceratium* cf. *P. expolitum* Brideaux
- M40. *Apteodinium* cf. *A. granulatum* Eisenack
- M41. *Deflandrea pirnaensis* Alberti
- M42. *Pterospermopsis australiensis* Deflandre and Cookson
- M43. *Cantulodinium* 1
- M44. *Oligosphaeridium* cf. *O. diastema*
- M45. *Dingodinium cerviculum* Cookson and Eisenack
- M46. *Oligosphaeridium* cf. *O. pulcherrimum* (Deflandre and Cookson) Davey & Wetzel
- M47. *Veryhachium reductum* (Deunff) de Jeckowski
- M48. *Palaeostomocystis fragilis* Cookson and Eisenack
- M49. *Botryococcus* 1
- M50. *Gardodinium eisenacki* Alberti

- M51. *Doidyx* 1  
M52. *Sirmiodinium grossi* Alberti  
M53. *Tasmanites suevicus* (Eisenack) Wall  
M54. *Pareodinia ceratophora* Deflandre  
M55. *Fromea amphora* Cookson and Eisenack  
M56. *Cleistosphaeridium* cf. *C. ancoriferum* (Cookson and Eisenack) D.D.S.&W  
M57. *Scrinioidinium* 1  
M58. *Ctenidodinium* 1  
M59. *Endoscrinium* cf. *E. campanula* (Gocht)  
M60. *Gonyaulacysta* cf. *G. jurassica* (Deflandre)  
M61. *Tenua* 1  
M62. *Baltisphaeridium* 1  
M63. *Gonyaulacysta* 1  
M64. *Meiourogonyaulax* 1  
M65. *Wanaea digitata* Cookson and Eisenack  
M66. microforaminifera  
M67. *Pareodinia* 1  
M68. *Gonyaulacysta* cf. *G. granuligera* (Klement)  
M69. *Xenicodinium* 1  
M70. *Paleohystrichophora* cf. *P. multispina* Deflandre and Cookson  
M71. *Diconodinium* 1  
M72. *Diconodinium* 2  
M73. *Baltisphaeridium* 2  
M74. *Micrhystridium* cf. *inconspicuum*  
M75. *Micrhystridium stipulatum*  
M76. *Micrhystridium* 2  
M77. chitinozoa  
M78. *Micrhystridium* 3  
M79. *Baltisphaeridium* 3  
M80. *Deflandrea diebeli* Alberti  
M81. *Oligosphaeridium pulcherrimum* (Deflandre and Cookson) D.D.S.&W  
M82. *Canningia reticulata*  
M83. *Areoligera* sp.  
M84. *Deflandrea* cf. *victoriensis* Cookson and Manum  
M85. *Cleistosphaeridium armatum* (Deflandre) Davey  
M86. *Surculosphaeridium longifurcatum* (Firtion) D.D.S.&W  
M87. *Exochosphaeridium phragmites* D.D.S.&W  
M88. *Pterodinium perforatum* (Clarke and Verdier) Davey and Verdier  
M89. *Spinidinium vestitum* Brideaux  
M90. *Gonyaulacysta* cf. *fetchamensis* D.D.S.&W  
M91. *Hystrichodinium pulchrum* Deflandre  
M92. *Baltisphaeridium multispinosum* Singh  
M93. *Dinopterygium cladoides* Deflandre  
M94. *Hystrichosphaeridium stellatum* Maier  
M95. *Polysphaeridium laminaspinosum* D.D.S.&W  
M96. *Exochosphaeridium* cf. *scitulum* Singh  
M97. *Systematophora turonica* (Alberti)  
M98. *Circulodinium* cf. *deflandrei* Alberti  
M99. *Perisseiasphaeridium* sp.  
M100. *Broomea pellifera* Alberti  
M101. *Muderongia simplex* Alberti  
M102. *Circulodinium* cf. *hirtellum* Alberti

- M103. *Surculosphaeridium* cf. *vestitum* (Deflandre) D.D.S.&W  
M104. *Gonyaulacysta* cf. *pachydermis* (Deflandre) D.D.S.&W  
M105. *Wanaea* cf. *spectabilis* Cookson and Eisenack  
M106. *Batisphaeridium* *stimuliferum* (Deflandre) Sarjeant  
M107. *Baltisphaeridium* *multifurcatum* (Deflandre) Klement  
M108. *Cyclonephelium* cf. *reticulatum*  
M109. *Systematophora* *schindelwolffi* (Alberti)  
M110. *Oligosphaeridium* cf. *albertense* Pocock  
M111. *Muderongia* *tetracantha* (Gocht) Alberti  
M112. *Ctenidodinium* *elegantulum* Millioud  
M113. *Dingodinium* *albertii* D.D.S.&W  
M114. *Oligosphaeridium* cf. *anthophorum* (Cookson and Eisenack) D.D.S.&W  
M115. *Systematophora* cf. *fasciculigera* Klement  
M116. *Hystrichosphaeridium* cf. *readi* D.D.S.&W  
M117. *Cannosphaeropsis* *aemula* (Deflandre) Deflandre  
M118. *Broomea* *exigua*  
M119. *Gonyaulacysta* cf. *longispinosa*  
M120. *Diconodinium* *arcticum* Manum and Cookson  
M121. *Deflandrea* *minor* Alberti  
M122. *Deflandrea* *cooksoni* Alberti  
M123. *Deflandrea* cf. *granulifera* Manum  
M124. *Tenua* 2  
M125. *Astrocysta* cf. *cretacea* (Pocock) Davey  
M126. *Fromea* 1  
M127. *Systematophora* cf. *turonica* (Alberti)  
M128. *Deflandrea* cf. *cooksoni* Alberti  
M129. *Deflandrea* cf. *magnifica* Stanley  
M130. *Diconodinium* 3  
M131. *Palambages* A  
M132. *Palambages* B  
M133. *Schizocystia* *levigata* Cookson and Eisenack  
M134. *Micrhystridium* *deflandrei*  
M135. *Hystrichosphaeridium* *recurvatum* (White) Lejeune-Carpentier  
M136. *Sirmiodinium* 1  
M137. *Deflandrea* 1  
M138. *Cannosphaeropsis* 1  
M139. *Deflandrea* 2  
M140. *Epilidosphaeridia* 1  
M141. *Deflandrea* *granulifera* Manum  
M142. *Chytrosphaeridia* 1  
M143. *Tenua* 3  
M144. *Canningia* cf. *senonica* Clarke and Verdier  
M145. *Apteodinium* *grande* Cookson and Hughes  
M146. *Cyclonephelium* cf. *paucispinum* Davey  
M147. *Pterospermopsis* 1  
M148. *Diconodinium* *pusillum* Singh  
M149. *Deflandrea* cf. *verrucosa* Manum  
M150. *Scolecodont*  
M151. *Ascodinium* *verrucosum* Cookson and Hughes  
M152. *Micrhystridium* cf. *piliferum* Deflandre  
M153. *Veryhachium* cf. *lairdi* (Deflandre) Deunff  
M154. *Pseudoceratium* *expolatum* Brideaux

- M155. *Hystrichosphaeridium* cf. *recurvatum* (White) Lejeune-Carpentier  
M156. *Microdinium opacum* Brideaux  
M157. *Deflandrea* cf. *pirnaensis* Alberti  
M158. *Canningia* cf. *aspera* Singh  
M159. *Diploresta* cf. *bidigitata* Manum and Cookson  
M160. *Broomea longicornuta* Alberti  
M161. *Heliodinium voigti* Alberti  
M162. *Cannosphaeropsis* 1  
M163. *Muderongia staurota* Sarjeant  
M164. *Wetzeliella* cf. *tabulata* Wilson  
M165. *Deflandrea* cf. *microgranulata* Stanley  
M166. *Deflandrea* cf. *cretacea* Cookson  
M167. *Deflandrea* cf. *tenera*  
M168. *Cyclonephelium lemniscutatum* Stanley  
M169. *Deflandrea scheii* Manum  
M170. *Canningia* cf. *colliveri*  
M171. *Pterodinium* cf. *cornutum*  
M172. *Micrhystridium* cf. *stellatum*  
M173. *Gonyaulacysta* cf. *Kostromiensis* Vozzhenikova  
M174. *Gardodinium*-1  
M175. *Imbatodinium villosum* Vozzhenikova  
M176. *Muderongia* cf. *simplex* Alberti  
M177. *Kalyptea monoceras* Cookson and Eisenack  
M178. *Tenua hystrix* Eisenack  
M179. *Prolixosphaeridium deirense*  
M180. *Tubotuborella rhombiformis* Vozzhenikova  
M181. *Doidyx anaphrissa* Sarjeant  
M182. *Muderongia mcwhaei* Cookson and Eisenack  
M183. *Pareodinia Albertii* Warren MS  
M184. *Chytroesphaeridia pococki* Sarjeant  
M185. *Gonyaulacysta hyalodermopsis* Cookson and Eisenack  
M186. *Sirmiodinium* 2  
M187. *Valensiella* 1  
M188. *Scrinidinium crystallinum* (Deflandre) Klement  
M189. *Chytroesphaeridia* 2  
M190. *Gonyaulacysta jurassica*  
M191. *Nannoceratopsis pellucida* Deflandre  
M192. *Gonyaulacysta nealei* Sarjeant  
M193. *Ellipsoidictum* 1  
M194. *Hystrichosphaeridium pattei* Valensi  
M195. *Ctenidodinium ornatum* (Deflandre) Sarjeant  
M196. *Kalyptea* cf. *diceris* Cookson and Eisenack  
M197. *Gonyaulacysta* cf. *cladophora* (Deflandre)  
M198. *Nannoceratopsis gracilis* Alberti  
M199. *Palaeohystrichophora* 1  
M200. *Nannoceratopsis* cf. *gracilis* Alberti  
M201. *Crassosphaera* 1  
M202. *Leiofusa deunffi* Pocock  
M203. *Spinidinium* 1  
M204. *Pterospermopsis eurypteris* Cookson and Eisenack  
M205. *Xenicodinium* 2

- M207. *Adnatosphaeridium* cf. *vittatum* Williams and Downie  
M208. *Exochosphaeridium* 1  
M209. *Pseudoceratium* cf. *nudum* Gocht  
M210. *Wetzeliella* cf. *reticulata* Williams and Downie  
M211. *Cannosphaeropsis* cf. *densiradiata* Cookson and Eisenack  
M212. *Nelsoniella* 1  
M213. *Deflandrea* cf. *micracantha*  
M214. *Achomosphaera* cf. *ramulifera*  
M215. *Diconodinium* 4  
M216. *Ovoidinium* *scabrosum* (Cookson and Hughes)  
M217. *Microdinium* cf. *setosum* Sarjeant  
M218. *Cyclonephelium* *eisenacki*  
M219. *Diconodinium* 5  
M220. *Lejeunia* 1  
M221. *Oligosphaeridium* 1  
M222. *Ceratiopsis* 1  
M223. *Multiplicisphaeridium* 1  
M224. *Gonyaulacysta* 2  
M225. *Deflandrea* 3  
M226. *Diconodinium* 6  
M227. *Cleistosphaeridium* 1  
M228. *Veryhachium* *rhomboidinium* Downie  
M229. *Wetzeliella* cf. *hampdenensis* Wilson  
M230. *Cannosphaeropsis* cf. *reticulensis* Pastiels  
M231. *Hystriosphærina* cf. *turonica* Alberti  
M232. *Hystriosphæridium* cf. *radiculatum*  
M233. *Horologinella* 1  
M234. *Palaeohystriosphæra* 2  
M235. *Diconodinium* 7  
M236. *Diphyes* *colligerum* (Deflandre and Cookson)  
M237. *Svalbardella* 1  
M238. *Gonyaulacysta* cf. *orthoceras* (Eisenack)  
M239. *Ophiobolus* 1  
M240. *Deflandrea* *ditissima* McIntyre  
M241. *Deflandrea* cf. *dakotaensis* Stanley  
M242. *Korojonia* 1  
M243. *Deflandrea* cf. *acutula* Wilson  
M244. *Astrocysta* 1  
M245. *Cordosphaeridium* cf. *diktyoplokus* (Klumpp)  
M246. *Samlandia* 1  
M247. *Baltisphaeridium* 4  
M248. Recycled Cretaceous dinoflagellates  
M249. *Deflandrea* *biapertura* McIntyre  
M250. *Pareodinia* *osmingtonense* (Sarjeant) Wiggins  
M251. *Deflandrea* cf. *wetzeli* Morgenroth  
M252. *Deflandrea* *microgranulata* Stanley  
M253. *Leptodinium* 1  
M254. *Cannosphaeropsis* sp. indet.  
M255. *Wetzeliella* *homomorpha* *quinquelata* Williams and Downie  
M256. *Ceratiopsis* 2  
M257. *Rhombodinium* 1

MICROPALEONTOLOGICAL STUDY

BY

DR. W. BRAUN

## SUMMARY OF MICROPALAEONTOLOGICAL STUDY

## General Remarks

Seventy-seven samples were disintegrated, picked, and analyzed for their microfaunal content. The recovery of microfossils was confined mainly to the upper 2000 feet of the section and a 1500-foot interval close to its base. The microfauna is composed of 68 species of Foraminifera and ostracods and a number of other fossil fragments, including also some characteristic minerals.

All microfossils that could be identified, including certain characteristic fragments were provided with species numbers, and their sequence is shown on the chart. Whenever possible, the forms were identified to generic rank or as close as possible, but no attempt has been made to search the "international" literature for identical or closely related forms. Only a thorough paleontological study, based on extensive collections would do justice to such an attempt. It would require also an intimate knowledge of the paleontological and stratigraphical problems, and bias, contained "in between the lines" in any published account. There is no obvious similarity to any fauna published from North America, except for the fauna of the youngest and pre-Recent assemblages in the uppermost part of this borehole. Faunas from Siberia, however, show closer relationship but literature search is made difficult for many reasons. So the microfauna of the Delta region has to be evaluated on its own merits first and for the time being, and there is nothing wrong with this procedure provided certain steps are taken in the right order.

One of the most critical requirements in any paleontological study is consistency in identification, and this consistency is best achieved by giving an adequate, visual impression of the taxa recovered, and document in detail their occurrences and distribution in distribution charts, summary range-charts, etc. Charts are usually given in reports or publications, but rarely are good photographs included. For this reason, emphasis was placed on photographic documentation of the key species, and also of many of the background fauna. Such documentation, it is hoped, will serve to unify the many existing number codes used by other investigators in speciation and which are at times hard to translate into ones own work, and which make even detailed studies rather confusing to interpret.

The micropaleontological data are plotted from "top to bottom", a standard

PALYNOLOGY Norris, 1976			MICROPALAEONTOLOGY Braun & Brooke, 1976	
Zones	Environment	Age		
AD-1 1200'	terrestrial	NEOGENE	ASSEMBLAGE I	open, shallow-marine, near-shore to lagoonal some lacustrine (?) intercalations
AD-2 1900'	restricted-marine			
AD-3 2800'	terrestrial	OLIGO-CENE (EARLY?)	ASSEMBLAGE II	open-marine with minor restrictions.
AD-4 3300'	restricted-marine	LATE EOCENE		
AD-5 4500'	near-shore marine	LATE EOCENE	no diagnostic microfauna	terrestrial
	terrestrial			
AD-6 5900'	near-shore marine	MIDDLE EOCENE TO OLDER PALEOGENE	no diagnostic microfauna	terrestrial
	terrestrial			
	near-shore marine			
AD-7 6600'	terrestrial			
AD-8 8400'	restricted-marine			
	terrestrial			
AD-9 10,528'	terrestrial with sporadic marine horizons			
10,528 T.D.				
			HAPLOPHRAGMOIDES 67 FAUNA	restricted- marine
			8250'	
			9200'	

procedure in subsurface studies. First occurrences are used to delineate the upper boundary of a faunal complex, although, in reality, these are last occurrences. Lower boundaries are hard to define without the results from core samples, but the "trailing" of specimens through the Adgo borehole seem to be minimal.

The usefulness as time indicators of the microfauna recovered is very limited, in fact it is non-existent. The lack of planktonic forms, the endemic nature of many of the benthonic forms discovered, the sporadic and erratic occurrence of the fauna being restricted essentially to a few marine intervals in an essentially terrestrial-deltaic sequence make it extremely hazardous to tie the microfauna into a proper time framework. The microfaunal assemblages are for this reason simply traced by number or name, without any age connotation attached. They can be used as such readily in correlation from one borehole to the other, provided the fauna, or part of it, is the same. Any references to stage and ages that are used are those adopted from palynological studies, and the micropaleontological data are summarized in a table with the palynological ones shown alongside.

#### Microfaunal Assemblages

Three microfaunal assemblages or zones are recognized: two that characterize the upper 2800 feet of the section, and the older one spread over an interval between 8000 to 9650 feet.

#### ASSEMBLAGE I

A relatively high diversity, mixed foraminiferal and ostracod fauna constitutes Assemblage I. This fauna is probably the best preserved, the most varied and also most widespread of all microfaunas in the Delta region. It is the youngest also and, unfortunately, as such of no great help to geologists interested in oil exploration. The fauna extends from 100 to about 1500 feet of the section.

The fauna in itself is composed of two components: a few freshwater ostracods, and a rich, open-marine, shallow-water, mixed foraminiferal and ostracod assemblage. Unfortunately no core samples were available from this interval to reconstruct in detail the shift in the environment of deposition, but the first freshwater ostracods appear at about the 650-foot level and continue to about 1150 feet. They indicate that either lacustrine sediments are intercalated, or that the few freshwater ostracods were transported from land and deposited with the marine fauna. This latter possibility has to be mentioned as the freshwater ostracods in this borehole were by far not as numerous and as varied as is the case in other wells.

The open-marine component of the fauna is typically dominated by the elphidiids, here summarily referred to the genus Elphidium, although other related genera are present. The ostracods include heavily sculptured forms with well-developed hinges, indicating shallow-water conditions, but the miliolid Foraminifera, more numerous in other wells, are conspicuous by their absence in this interval. Species of Elphidium are known to occur also in lagoons and embayments where freshwater influences are minimal or non-existent.

Assemblage I is referred to as the "Sigmopolis-Ostracod-Elphidium-Assemblage" in Staplin's (et al.) summary, and is shown on their correlation chart to occupy the highest part of the Neogene section and Zone T4 c in Taglu C-42. Chamney shows a relatively thick Pleistocene to Recent section (unit 1 and possibly 2) in the Reindeer D-27 borehole which contains ostracods and Chara. This section seems to be particularly thick in the Tuk F-18 well and was found in many other wells according to his cross-section. Zones AD 1 and part of AD 2 of Norris, both of Neogene age, are also equivalent to Assemblage I.

#### ASSEMBLAGE II

Staplin and co-workers show and discuss an Asterigerina-fauna that marks the lower part of their Neogene section and the upper part of their T4 a-Zone in the Taglu C-42 borehole. This assemblage seems to be identical to that recovered from about 1500 to 2800 feet of the Adgo well and underneath Assemblage I.

The fauna of Assemblage II is moderately diverse, with rotalids and miliolid Foraminifera as the most distinctive elements, but excluding the elphidiids that are so characteristic for Assemblage I. Species of the genera Epistomina, Eponides, Nonion and others probably form part of Staplin's Asterigerina-fauna, but it is doubtful if any true Asterigerinas are present that far north. Species of this diagnostic genus occur and flourish only in tropical to sub-tropical waters, and are commonly associated with a host of benthonic and planktonic forms. However, exact identifications are often hard to make for the specimens are frequently corroded and deeply "weathered", with rust or iron oxides replacing parts of the tests. This rusty appearance is quite distinctive for fossils of this zone, although it can be found also to afflict fossils above and below. This phenomenon does not necessarily indicate surficial weathering, but may be caused also by groundwater leaching.

The boundary to the overlying Assemblage I is only tentatively defined and may occur in the faunal spectrum where the elphidiids disappear either completely, or where they diminish drastically, and where species of such genera as Eponides, Epistomina, Bulimina, Uvigerina etc. appear. Also, the ostracods are rare in this assemblage.

The fauna indicates that relatively open-marine conditions prevailed at the time of deposition, possibly also slightly deeper waters or farther off-shore conditions, in comparison to Assemblage I. However, it is not without restrictions, for the diversity is not varied enough to be compared to a fully open-marine fauna of the middle to outer neritic zone.

#### HAPLOPHRAGMOIDES 67 - FAUNA

Practically no diagnostic microfossils were recovered from 2800 to 8250 feet of the section, indicating that terrestrial conditions prevailed without any detectable, marine influence. A restricted-marine fauna, the Haplophragmoides 67 - Fauna, however, characterizes the interval from 8250 to about 9200 feet, associated with Saccamina 13 and a few other, agglutinated forms.

The Haplophragmoides 67 - Fauna is widespread in the Delta region. It covers the lowermost part of Norris' AD 6 and the uppermost third of his AD 7-Zone of Middle Eocene to older Paleogene age. The fauna also seem to be equivalent to the Haplophragmoides 4106 zone of Staplin et al. that they trace in their cross-section from Taglu C-42 and Ya Ya P-53 in the lower part of their Paleogene. Chamney's unit 3 or his Haplophragmoides G 21 horizon seem to be identical too with Haplophragmoides 67, and his unit 6 of the Reindeer D-27 borehole is the same; however, he considers these horizons to be of Paleocene (?Eocene) to Maestrichtian age.

As most other Tertiary microfaunas of the Delta Region, the Haplophragmoides 67-Fauna is of low diversity, indicating minor marine influences in an otherwise deltaic setting.

#### References cited:

- Chamney, T.P., 1973: Tuktoyaktuk Peninsula Tertiary and Mesozoic Biostratigraphy. Correlations; Geol. Surv. Can., Paper 73-1, part B, p. 171-179, 3 figs., 1 table.
- Staplin, F.L. et al.: Tertiary Biostratigraphy, MacKenzie Delta Region, Canada; copy of manuscript of a joint oral presentation to C.S.P.G. by paleontological staffs of Gilf - Imperial and Mobil Oil Canada. In press.

PLATES and PLATE EXPLANATIONS

All magnifications approximately X 35 to 40

\* Forms listed on chart, but no photograph taken  
(specimens too badly preserved).

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Plate I

Assemblage I - ostracods of open-marine and shallow-water origin.

Ostracod 1

Ostracod 5

Ostracod 6

Ostracod 7

Ostracod 8

Ostracod 9

\*Ostracod 21

\* No photos, specimens too badly preserved.

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Plate II

Assemblage I - Foraminifera: Elphidiidae. Open-marine and shallow-water (including embayments and lagoons) Fauna.

Elphidium 25

Elphidium 26

Elphidium 155

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Plate III

Assemblages I and II - calcareous Foraminifera

buliminid	166	
lagenid	163	
miliolid	43	
miliolid	54	
miliolid	160	
miliolid	162	
*polymorphinid	44, 51	ind.
rotaliid (Cassidulina?)	159	
rotaliid (lenticular)	6	
rotaliid (Nonion?)	42	
*rotaliid (Nonion?)	156	
*rotaliid (Nonion?)	167	
Uvigerina	168	

Assemblage I - fresh water ostracods

Ostracod	2
Ostracod	4
Ostracod	11
Ostracod	23

\* No photos, specimens too badly preserved.

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Plate IV

Assemblage II - calcareous Foraminifera

Cyclogyra?	164
Genus ind.	81
rotaliid	174
rotaliid	176
rotaliid	165
rotaliid (Anomalina?)	171
rotaliid (Epistomina?)	*4, 5
rotaliid (Epistomina?)	161
rotaliid (Epistomina?)	173
rotaliid (Eponides?)	172

Assemblage II - ostracods

*Ostracod	24
*Ostracod	25

\* No photos, specimens too badly preserved.

Plate V

Assemblage I and II - arenaceous Foraminifera and main faunal components  
of Haplophragmoides - 67 Fauna

Ammobaculites	63
*Ammobaculites	86
Ammobaculites?	157
Ammodiscus	170
Ammomarginulina	177
astrorhizid?	15
Bathysiphon?	75
Gaudryina	178
Glomospira	83
Glomospira	175
Haplophragmoides	67
*Haplophragmoides	67-16 ind.
Hyperammina	17
Saccammina	13
Spirolocammina	158
*Spiroplectammina	102
Trochammina?	68

\* No photos, specimen too badly preserved.

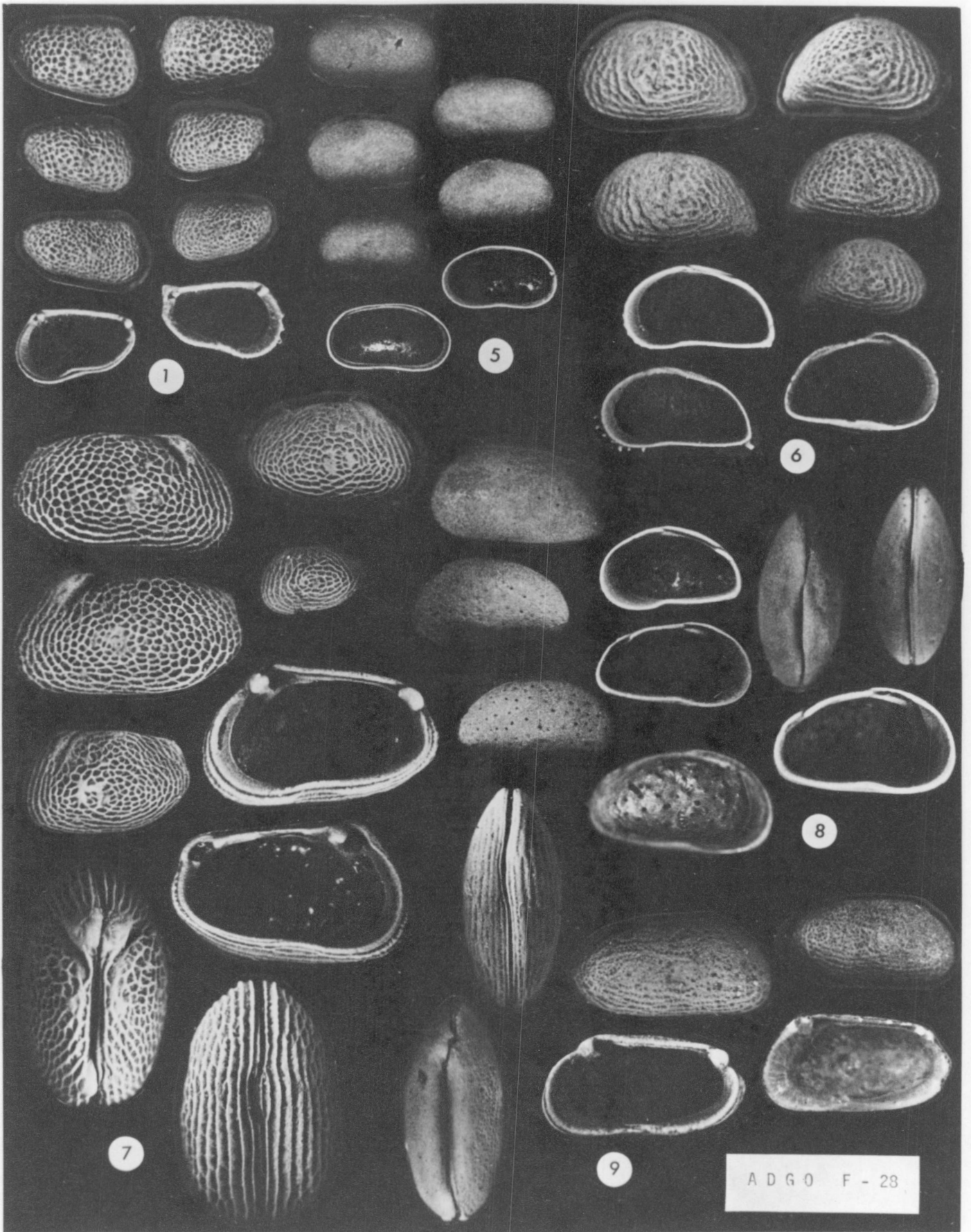


Plate I

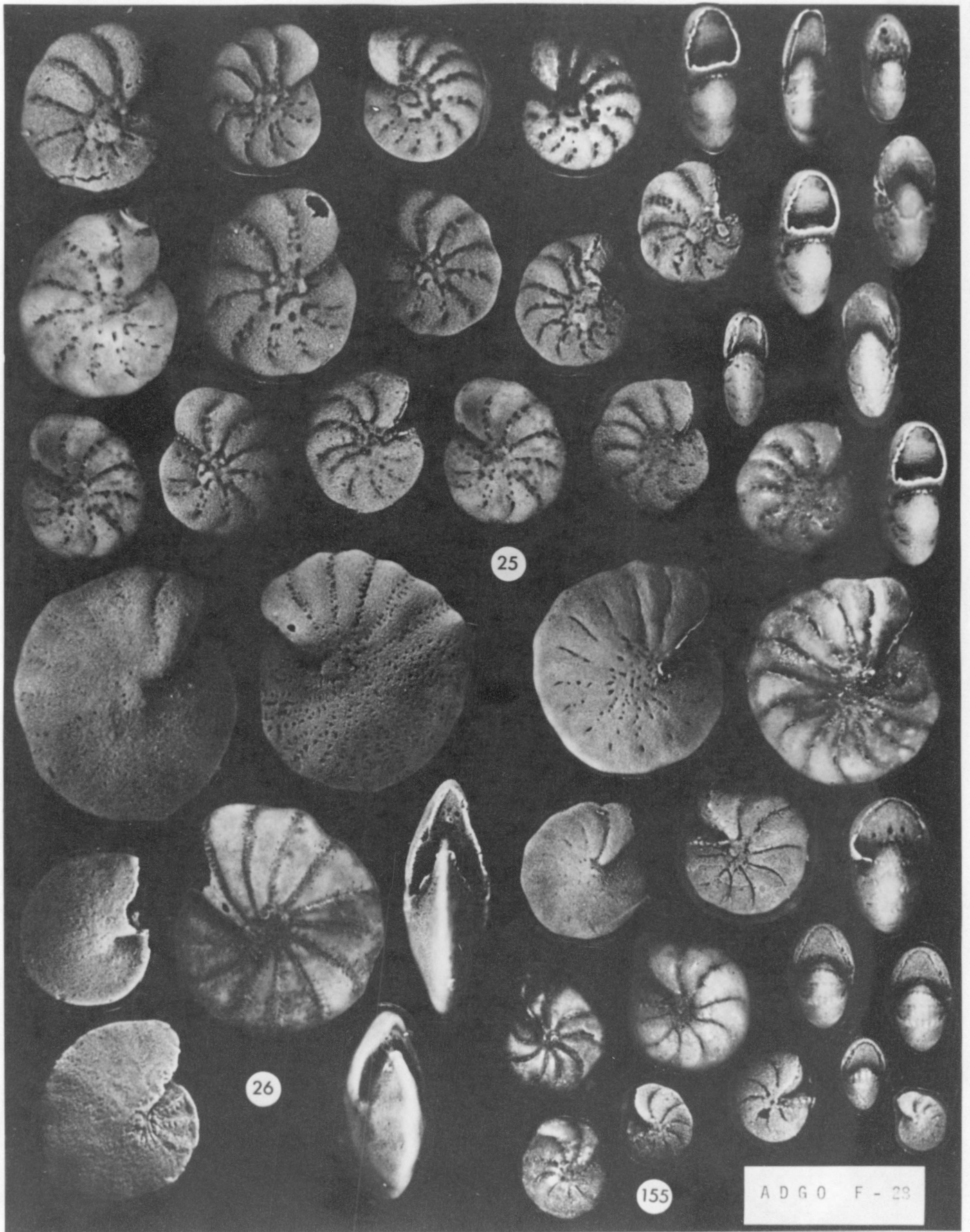


Plate II

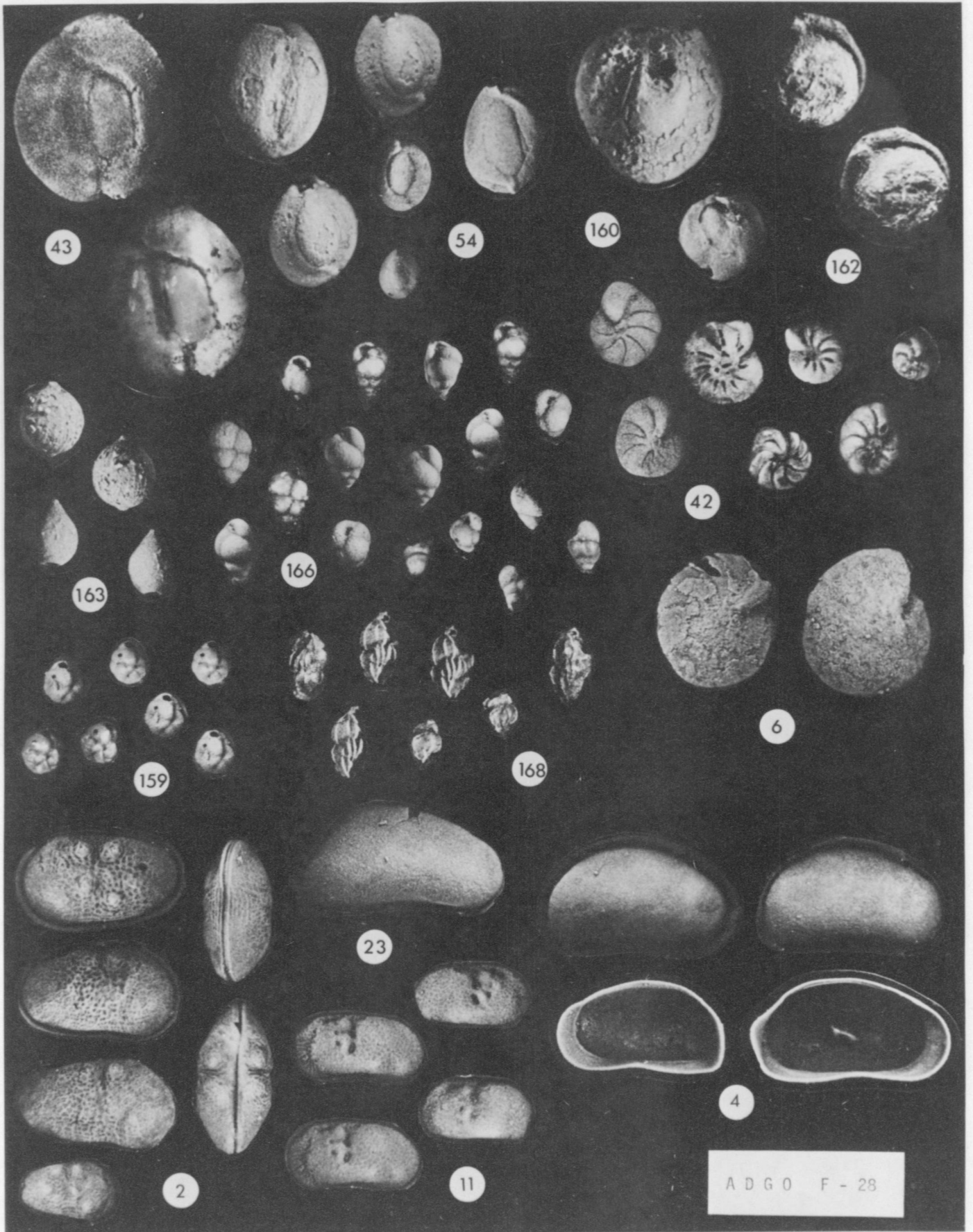


Plate III

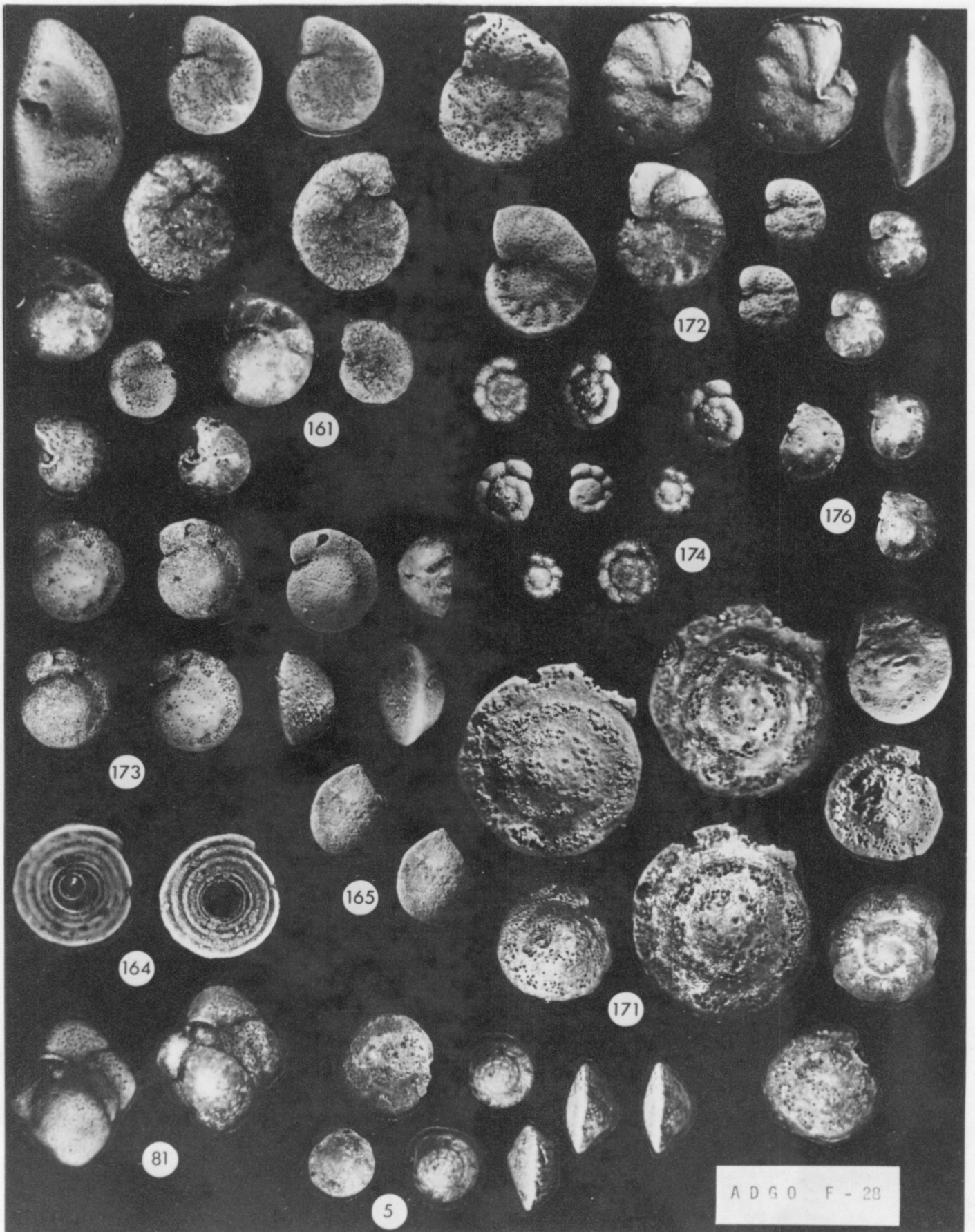
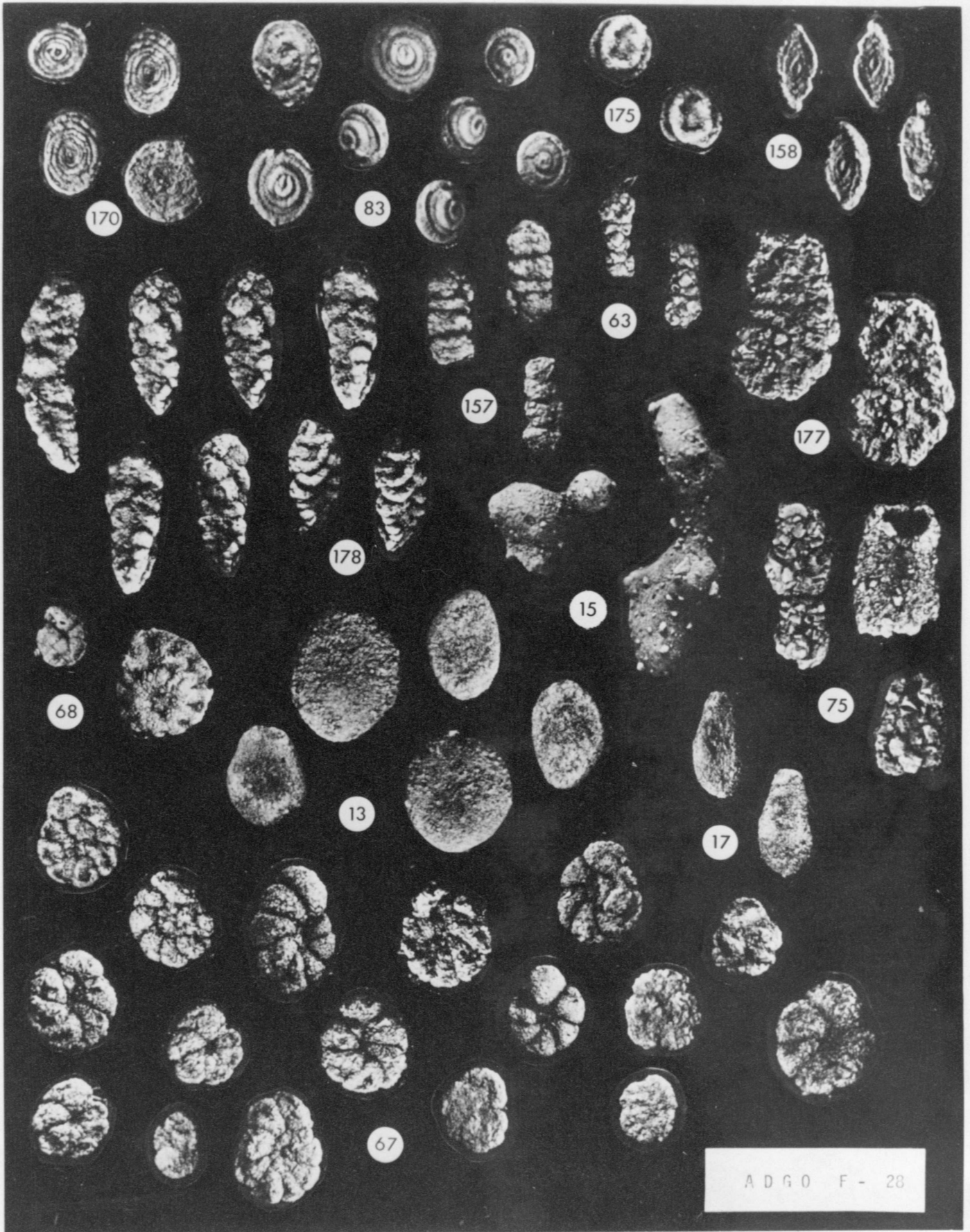


Plate IV



ADGO F - 28

Plate V

PALYNOMORPH DISTRIBUTION CHART

IMP. ADGO F-28

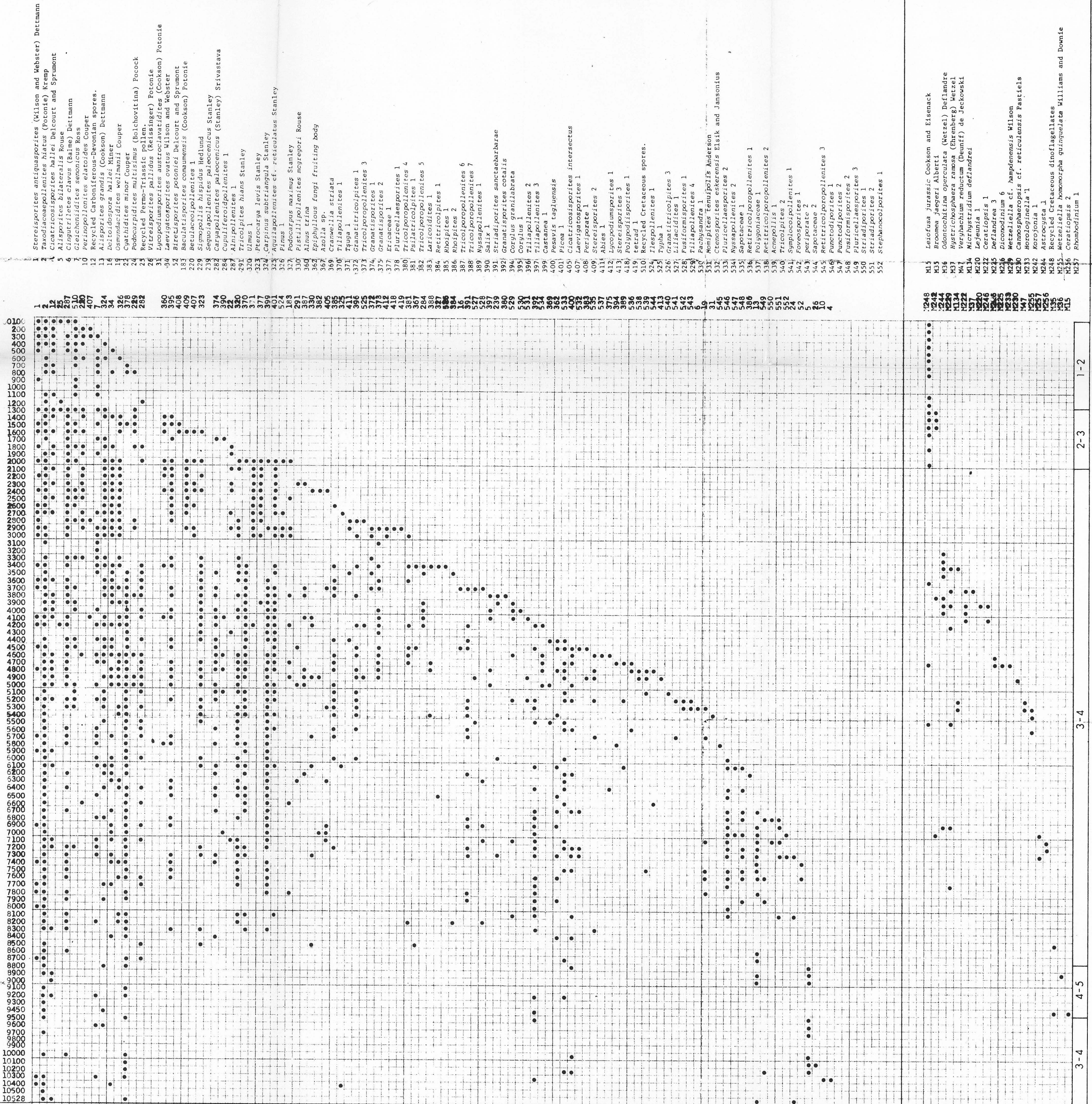
N.W.T.

OPEN FILE 484  
DOSSIER PUBLIC

GEOLOGICAL SURVEY  
COMMISSION GEOLOGIQUE  
OTTAWA

TERRESTRIAL

MARINE



1-2  
2-3  
3-4  
4-5

IMPERIAL  
ADGO F-28

ATTENTION

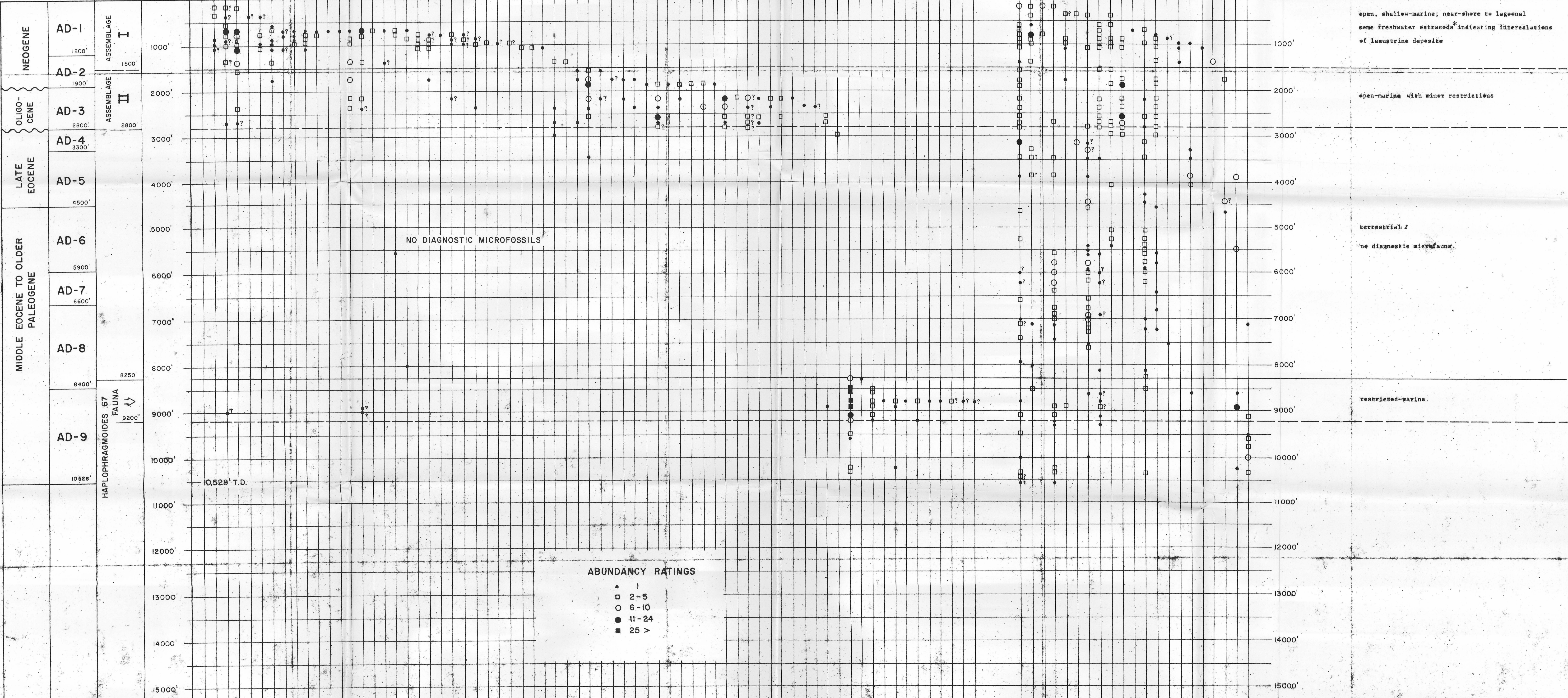
\* freshwater ostracods  
Numbers in front of generic  
names for cross-reference only

PALYNOLOGY AFTER NORRIS, 1976  
MICROPALAEONTOLOGY BRAUN - BROOKE, 1976

FORAMINIFERA AND OSTRACODS	
1	Ostracod
2	retalid (Nonten?)
3	Elphidium
4	Sacamina
5	Ammebaulites?
6	Ostracod
7	Ammebaulites
8	Ostracod
9	Ostracod
10	Ostracod
11	Ostracod
12	Ostracod
13	Elphidium
14	Elphidium
15	polymorphid 44 - 51
16	Ammebaulites
17	Ostracod
18	Haplophragmoides
19	Ostracod
20	Haplophragmoides 67 - 16
21	retalid
22	Spirolocamina
23	Ammebaulites
24	Glenospira
25	Ostracod
26	Ammebaulites
27	Spirolocamina
28	Ammebaulites
29	Glenospira
30	Glenospira
31	retalid (Nonten?)
32	retalid (Epistomin?) 4-5
33	Trochammina?
34	retalid (Epistomin?) 4-5
35	retalid (Gastrolina?)
36	Ostracod
37	miloid
38	retalid
39	Ostracod
40	retalid (Epistomin?)
41	retalid (Epistomin?)
42	miloid
43	lenticular
44	retalid (lenticular)
45	Cycolysia?
46	bolinaid
47	Uvigerina
48	miloid
49	retalid (Nonten?)
50	retalid
51	retalid (Epistomin?)
52	Ammebaulites
53	lenticular
54	Genus ind.
55	retalid (Glenospira?)
56	retalid
57	Haplophragmoides
58	Ostracod
59	Sacamina
60	Glenospira
61	Glenospira
62	retalid
63	Haplophragmoides
64	polymorphid
65	Ammebaulites
66	Bathysiphon?
67	Hyporhammina
68	astehisid?
69	Ammebaulites
70	Ammebaulites
71	Ammebaulites
72	Ammebaulites
73	Ammebaulites
74	Ammebaulites
75	Ammebaulites
76	Bathysiphon?
77	bolinaid
78	bolinaid
79	bolinaid
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200	bolinaid

INVERTEBRATES - FRAGMENTS - PLANTS - MINERALS, etc.

- plant fragments
- spores
- fragments ind.
- pyrite
- spines
- calcite prism
- bone - tooth fragments
- shell fragments
- agglutinated foraminiferal fragments
- calcareous foraminiferal fragments
- chlorophyll \*
- amber
- oxidized remains
- carbonized remains
- ostracods
- black spheres
- "honeycomb" frgs.
- palaeosols
- Maennleite
- spheres ind.
- Fe-concretions



open, shallow-marine; near-shore to lagoonal  
some freshwater ostracods indicating interrelations  
of lacustrine deposits

open-marine with minor restrictions

terrestrial?  
no diagnostic microfossils

restricted-marine

ABUNDANCY RATINGS  
 • 1  
 ○ 2-5  
 ○ 6-10  
 ● 11-24  
 ■ 25+