GEOLOGICAL SURVEY OF CANADA
COMMISSION GEOLOGIQUE DU CANADA

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BIOSTRATIGRAPHIC ZONATION
IMP. PULLEN E-17

69°46' 16" N. LAT.; 134 19' 41" W.LONG.
NORTHWEST TERRITORIES

AUSTIN & CUMMING EXPLORATION CONSULTANTS
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C O N T E N T S

IMPERIAL PULLEN E-17

SUMMARY & CONCLUSIONS

Biostratigraphic analysis of Imp. Pullen E-17 is comprised of a palynostratigraphic study carried out by Dr. G. Norris and a micropaleontological analysis by Mr. M. B. Mickey, Anderson, Warren & Associates, Inc.

One hundred and forty two (142) palynological slides, provided by the operator, were examined for microfloral content. Use of operator material was required as unwashed samples proved incomplete and in many cases to contain inadequate quantities of material. Microfloral analysis defines seven palynological zones, three assigned to Neogene, one to Oligocene, two to Upper Eocene-Oligocene, and one to Upper Eocene age. Good correlation of zones exists between the subject well and Imp. Nuktak C-22. A gradual increase in organic maturation from light yellow at the surface to amber at the base suggests a relatively unbroken succession of sedimentation.

One hundred and thirty one (131) microfossil slides, obtained from the operator, were examined for microfaunal content. Eleven slides were obtained from sidewall cores, the remaining 120 were prepared from ditch samples. Micropaleontological examination identifies five faunal assemblages, illustrated in combination with the palynological zonation in Table 1 of the Micropaleontological report. Assemblages I and II in the upper 5,000 feet of the section correlate with similar occurrences in Imp. Taglu C-42, Imp. Nuktak C-22 and other wells in the region. Age designation of these units appears consistent with that established in other wells. Assemblages A, B and C, however, indicate a marked thinning of beds when compared to other wells in the area. Further to the discussion in the micropaleontological report, the possibility exists that this apparent thinning may be the result of mixing, through recycling, of Haplophragmoides 67 and Cyclammina 71 into beds containing the Cyclammina 7 fauna. This interpretation would be in agreement with an Upper Eocene age indicated by the palynology.

SUMMARY & CONCLUSIONS

BY

L. W. CUMMING, P. GEOL.

PALYNOSTRATIGRAPHIC STUDY

BY

G. NORRIS, PH.D.

TABLE 1
IMPERIAL PULLEN E-17
PALYNOLOGICAL ZONATION

DEPTH	PALYNOLOGICAL ZONES	ENVIRONMENT	AGE	ORG. MAT.
1000	PU-1	WEAK MARINE INFLUENCE	PLIOCENE to UPPER MIOCENE	1-2
2000	2280'			
	PU-2	TERRESTRIAL		
3000	3000'			
	PU-3			
	3900'			
4000	PU-4		OLIGOCENE	2-3
	4390'			
5000	PU-5		LOWER OLIGOCENE to UPPER EOCENE	3-4
6000				
7000	7580'			
8000	PU-6			
9000				
10,000				
11,000	11,280'			
	PU-7		UPPER EOCENE	
12,000	12,746'			

IMPERIAL PULLEN E-17

SUMMARY

One hundred and forty two samples from the subject well yielded 57 terrestrial and 3 marine palynomorph species. Two Neogene and 5 Paleogene zones are recognized in an apparently uninterrupted and largely non-marine sequence. Weak marine influence occurs only in the top zone of the well. Organic maturation increases from light yellow at the top of the well to amber spore colours at the bottom of the well.

ZONATION

Zone PU-1 (120-2190 feet)

Characterized by:

1 *Stereisporites antiquasporites*
2 *Taxodiaceaepollenites hiatus*
229 *Sigmopollis hispidus*
407 *Laevigatosporites*-1
326 *Pinus*-1
220 *Betulaceoipollenites*-1
401 *Picea*-1
409 *Stereisporites*-2
570 *Lycopodiumsporites*-2
571 *Fungitorqua*-1

Recycled Carboniferous and Cretaceous miospores are common in this zone and also recycled Lower Tertiary elements:

324 *Carpinus subtriangula*
378 *Pluricellaesporites*-1
377 *Ericaceae*-1

The only indigenous marine element is

M242 *Korojonia*-1

Zone PU-2 (2280-2910 feet)

Characterized by:

408 *periporate*-1

Zone PU-3 (3000-3810 feet)

Characterized by:

34 *Laevigatosporites ovatus*
371 *Tsuga*-1
395 *Corylus*-1
282 *Caryapollenites paleocenicus*
323 *Pterocarya levis*
370 *Tiliapollenites*-1
324 *Carpinus subtriangula*
567 *periporate*-3
572 *Clusterisporites*-2

Zone PU-4 (3900-4260 feet)

The following species characterize this zone:

377 *Ericaceae*-1 (recycled above this)
411 *Abies*-1 (probable recycled above this)
573 *Schizosporis*-1
45 *Schizosporis parvus*

Zone PU-5 (4390-7500 feet)

Characterized by:

412 *Lycopodiumsporites*-1
19 *Osmundacidites wellmanii*
52 *Biretisporites potoniaei*
320 *Ulmus*-1
574 *Striadiporites*-3
575 *Diporisporites*-4
576 *Diporisporites*-1
577 *Multicellaesporites*-8
394 *Corylus granilabrata*
373 *Tricolporopollenites*-3
387 *Tricolporopollenites*-6
418 *Polypodiisporites*-1 (at bottom of zone)

A single occurrence of M289 *Svalbardella* cf. *australina* occurs at the bottom of this zone.

Zone PU-6 (7580-11,190 feet)

Characterized by:

416 *Osmundacidites*-1
578 *Dicellaesporites*-2
291 *Tricolpites hians*

Zone PU-7 (11,280-12,746 feet)

Characterized by:

391 *Striadiporites sanctaebarbarae*
419 *tetrad*-1
579 *Fungiscissa*-1
388 *Tricolporopollenites*-1
533 *Pluricellaesporites*-2
549 *Pluricellaesporites*-3
580 *Clusterisporites*-1
239 *Sequoiapollenites paleocenicus*

AGE AND CORRELATION

Correlations with other wells are shown on the accompanying figure.

Zone PU-1 Miocene-Upper Pliocene

The common occurrence of 229 *Sigmopollis hispidus* and 407 *Laevigatosporites*-1 clearly suggests a correlation with the Neogene *Laevigatosporites*-1 zone.

Zone PU-2 Miocene-Upper Pliocene

408 *periporate*-1 occurs in this zone indicating a correlation with the *periporate*-1 zone (Neogene).

Zone PU-3 Miocene-Upper Pliocene

The frequent co-occurrence of 371 *Tsuga*-1 and 395 *Corylus*-1 suggests a close correlation with the *Tsuga*-1 zone.

Zone PU-4 Oligocene

The top of the range of 377 *Ericaceae*-1 probably occurs in this zone although it may be recycled in higher horizons. 411 *Abies*-1 co-occurs with *Ericaceae*-1 suggesting a correlation with the *Ericaceae* zone.

Zone PU-5 Upper Eocene-Oligocene

The top of 412 *Lycopodiumsporites*-1 defines this zone and suggests a correlation with the *Lycopodiumsporites*-1 zone.

Zone PU-6 Upper Eocene-Oligocene

The clearly defined top of 416 *Osmundacidites*-1 indicates a correlation of this zone with the *Osmundacidites*-1 zone.

Zone PU-7 Upper Eocene

The top of the range of 419 *tetrad*-1 defines the top of this zone and suggests a correlation with the *tetrad*-1 zone. 399 *Striadiporites sanctaebarbarae*, however, occurs to the top of this zone whereas in other wells it does not occur in the *tetrad*-1 zone. The total lack of characteristic species for the subjacent zone (e.g., 400 *Pesavis tagluensis*, 392 *Granatisporites cotalis*, M244 *Astrocysta*-1 - the latter also ranges into the base of the *tetrad*-1 zone) suggests that the well bottoms within the *tetrad*-1 zone.

PALEOENVIRONMENTS

M242 *Korojonia*-1 occurs in low abundances in Zone PU-1 indicating weak marine influence. The remaining zones are entirely non-marine except a single occurrence of M289 *Svalbardella* cf. *australina* at the bottom of Zone PU-5.

ORGANIC MATURATION

A gradual increase in spore colour occurs from light yellow at 120 feet to amber at 12,746 feet.

MICROPALEONTOLOGICAL STUDY

BY

M. B. MICKEY
Anderson, Warren & Associates, Inc.

TABLE 1
IMPERIAL
PULLEN E-17

	PALYNOLOGY NORRIS			MICROPALEONTOLOGY M.B. MICKEY	
	Zones	Environment	Age		
1000	PU - 1	WEAK MARINE	PLIOCENE to UPPER MIOCENE	ASSEMBLAGE I	MARGINAL MARINE to INNER NERITIC
				1575	
2000	2280'			NOT DIAGNOSTIC	NON-MARINE to MARGINAL MARINE
	PU - 2			2875	
3000	3000'				
	PU - 3			ASSEMBLAGE II	MARGINAL MARINE
4000	3900'				to MIDDLE NERITIC
	PU - 4 4390'		OLIGOCENE		
				5040	
5000					
6000	PU - 5			NOT DIAGNOSTIC	NON-MARINE to MARGINAL MARINE
7000	7580'		LOWER OLIGOCENE to UPPER EOCENE		
8000		TERRESTRIAL		8280	
9000				ASSEMBLAGE "A"	INNER to
	PU - 6			9600	MIDDLE NERITIC
10,000				ASSEMBLAGE "B"	
11,000	11,280'			11,130	MIDDLE NERITIC
12,000	PU - 7		UPPER EOCENE	ASSEMBLAGE "C"	to UPPER BATHYL
	12,746'			12,746	
13,000					
14,000					
15,000					

IMPERIAL PULLEN E-17

MICROPALEONTOLOGICAL STUDY

Interpreted by: M. B. Mickey
Anderson, Warren & Associates, Inc.

SUMMARY

The following micropaleontological report is based on the examination and checklisting of previously picked microfaunal slides from 120 ditch samples and 11 sidewall core samples. There were no sample residues available for examination in conjunction with these picked slides. A checklist of faunal distribution is enclosed (Fig. 2).

Five separate and distinct faunal assemblages occur in strata which appear to range from possible Paleocene to Pliocene or Pleistocene in age. Most of these faunules can be observed in wells to the south, where they are somewhat less well developed, and probably represent a relatively less marine (up-dip) expression of the faunules described here.

120-1575 feet (±45')

Assemblage I

This faunule is characterized by the occurrence of several species of the genus Elphidium along with numerous freshwater ostracod species. This assemblage is equivalent to a fauna referred to as Assemblage I by Braun and Brooke in reports on other wells from the Mackenzie Delta region. Assemblage I is equivalent to a fauna that Staplin et al. refer to as the Sigmopollis-Ostracod-Elphidium-Assemblage. Previously reported ages for this faunule would indicate that it is most likely Neogene (probably Pliocene) to Recent in age. The presence of freshwater ostracods and very shallow water calcareous foraminiferal species in these rocks would indicate that they were probably deposited in a marginal marine to inner neritic environment.

AGE: Neogene

ENVIRONMENT: Marginal Marine to Inner Neritic

1575'(±45')-2875'(±55')

This interval contains only very rare and poorly preserved occurrences of caved and probably reworked specimens. It is not age diagnostic, and probably represents non-marine to possibly marginal marine deposition.

AGE: Indeterminate

ENVIRONMENT: Non-marine to possible Marginal Marine

2875'(±55')-5040'(±60')

Assemblage II

This assemblage is dominated by the following species: Elphidium acutum, Angulogerina fluens, Nonion cf. pacificum, rotaliid (Epistominella ?) sp., Cibicides cf. perlucidus and miliolids. This faunule appears to be identical with that described as Assemblage II of Braun and Brooke from the Mackenzie Delta region. Assemblage II is also equivalent to the Asterigerina fauna discussed by Staplin, et al. from the lower part of their Neogene (Miocene) section in the Taglu C-42 well. Other available well data from the delta area indicates that this assemblage may be as old as late Paleogene (Oligocene) in some areas. This assemblage indicates a relatively shallow open marine environment of deposition for most of this section, but there do appear to be minor regressions to possibly marginal marine conditions. In general, these sediments probably represent deposition in inner to middle neritic depths with some minor periods of marginal marine deposition.

AGE: Paleogene to Neogene
(Probable Oligocene to Miocene)

ENVIRONMENT: Marginal Marine to Middle Neritic

5040'(±60')-8280'(±60')

These strata are faunally poor, possibly diluted, and contain only rare possibly caved and possibly reworked occurrences. The interval is not age diagnostic, and probably represents non-marine to marginal marine deposition. These rocks may represent sediment diluted alluvial plain and inner delta plain deposits.

AGE: Indeterminate

ENVIRONMENT: Probable Non-marine to Marginal Marine

8280'(±60')-9600'(±60')

Assemblage "A"

Assemblage "A" is characterized by the occurrence of "Cyclammina" 7, spotty occurrences of Saccammina cf. 13, Saccammina 13, and a single sample burst of Haplophragmoides 67. This assemblage appears to be a mixture of elements from Braun and Brooke's "Cyclammina" 7 Fauna, "Astrorhyzid" Fauna, and Haplophragmoides 67 Fauna. It should be noted though, that there were no astrorhyzids found on the picked slides used in this study. This fauna is probably Eocene in age, and most likely represents an environmental variation of Braun and Brooke's "Cyclammina" 7 Fauna and/or their "Astrorhyzid" Fauna, although no exact correlation can be established and the age date is subject to palynological corroboration since we could be some thirty miles down-dip? from our nearest control point to the south. These strata are probably delta plain and delta front deposits of inner to middle neritic depth.

AGE: Probable Eocene

ENVIRONMENT: Probable Inner to Middle Neritic

9600'(±60')-11,130'(±30')

Assemblage "B"

This interval is dominated by occurrences of: Haplophragmoides 67, Saccammina 13, Bathysiphon cf. vitta and "Cyclammina" 7. The above assemblage is similar to Braun and Brooke's Haplophragmoides 67 Fauna but its exact age equivalence in this well with the Haplophragmoides 67 Fauna in the Taglu C-42 well cannot be established since the fauna is facies controlled and may be climbing in the section basinward. These strata probably represent inner to middle neritic delta plain and delta front deposits similar to the strata of the overlying interval.

AGE: Probable Paleocene to Eocene

ENVIRONMENT: Probable Inner to Middle Neritic

11,130'(±30')-12,746' Bottom Sample

Assemblage "C"

Occurrences of Cyclammina 71, Bathysiphon vitta, Gaudryina 178, Haplophragmoides? 20 and Haplophragmoides? 21 suggest a similarity with the Cyclammina 71 Fauna of Braun and Brooke, but here again an exact age equivalence is tenuous due to the possible basinward (down-dip) position of this well. I feel that this assemblage is probably no younger than Eocene in age and probably no older than Paleocene in age. The abundance of large Cyclammina spp. in this interval suggests open marine middle neritic to upper bathyal conditions. These rocks are probably delta front and pro-delta deposits.

AGE: Probable Paleocene to Eocene

ENVIRONMENT: Probable Middle Neritic to Upper Bathyal

Conclusions

The relatively thinned nature of Assemblages "A", "B" and "C" together with minor differences in the faunal elements of the assemblages compared with the Taglu C-42 well suggest four possible interpretations:

1. Normal thinning and facies changes onto a topographic high (compressed section).
2. A fault at around 9600 feet.
3. An unconformity at around 9600 feet.
4. Basinward facies changes in which the faunas described in the Taglu C-42 well have climbed in the section in a basinward or down-dip direction.

With additional structural (seismic) and palynological data the multiple interpretations presented above can be evaluated to determine which is the most logical interpretation based on all disciplines. Recent receipt of palynological data on this well would indicate that interpretation number 4 above is the most logical one.

PALYNOMORPH PHOTOGRAPHIC PLATES

IMP. PULLEN E-17

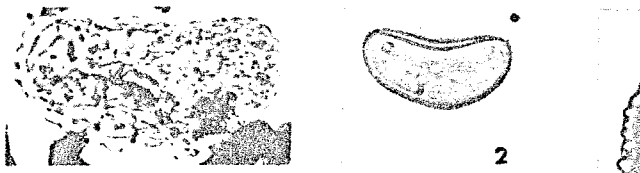
IMPERIAL PULLEN E-17

EXPLANATION OF PLATE 60

All figures 750x. Scale in top left is 100um.

PLATE 60

1	418	*Polypodiisporites*-1
2	407	*Laevigatosporites*-1
3-4	416	*Osmundacidites*-1
5-6	412	*Lycopodiumsporites*-1
7-12	570	*Lycopodiumsporites*-2
13-14	326	*Pinus*-1
15	411	*Abies*-1
16	291	*Tricolpites hians*
17-18	220	*Betulaceoipollenites*-1
19-20	395	*Corylus*-1
21	370	*Tiliapollenites*-1
22	282	*Caryapollenites paleocenicus*
23	387	*Tricolporopollenites*-6
24	386	*Rhoiipites*-2



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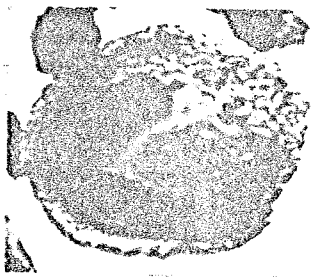

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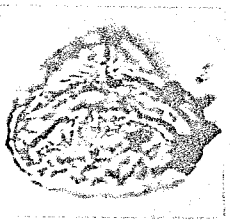

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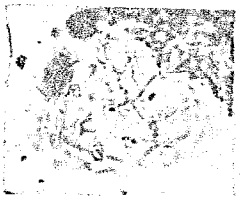

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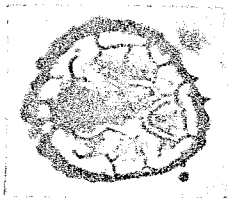

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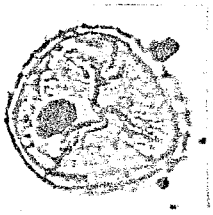

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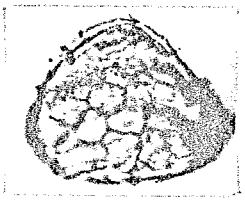

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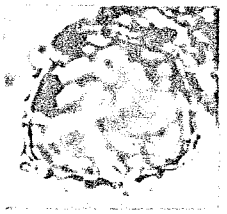

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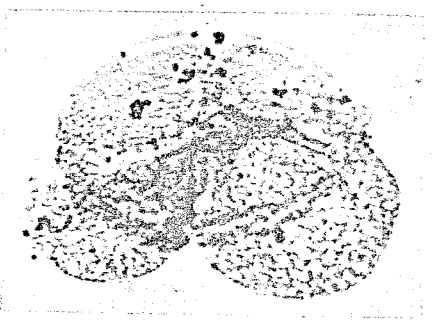

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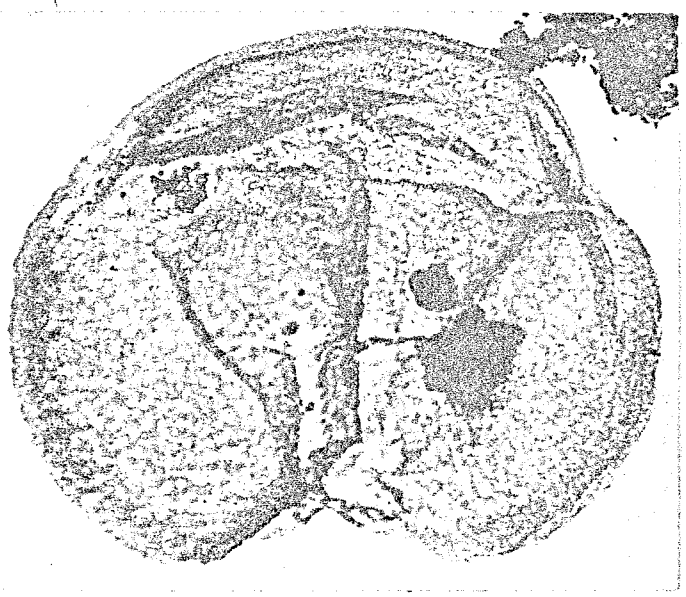

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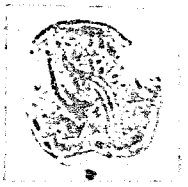

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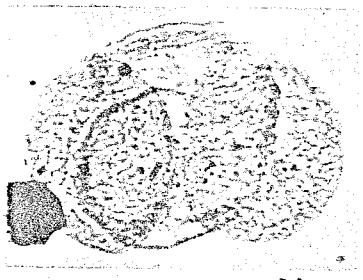

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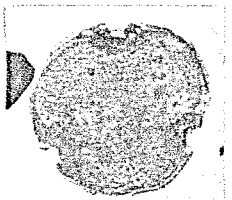

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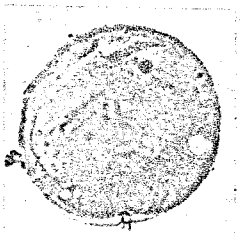

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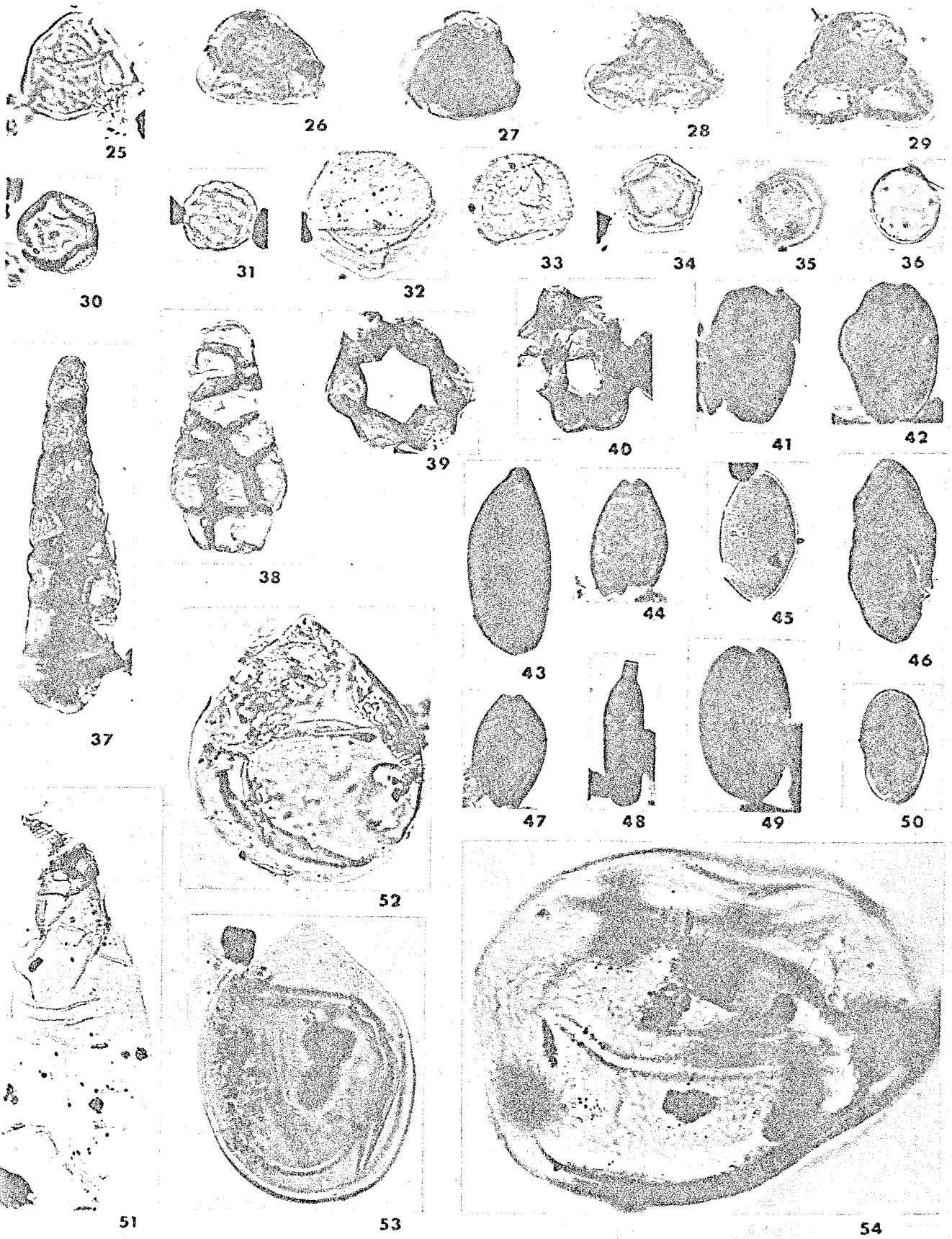
IMPERIAL PULLEN E-17

EXPLANATION OF PLATE 61

All figures 750x. Scale in top left is 100um.

PLATE 61

25	377	*Ericaceae*-1
26-29	419	*tetrad*-1
30	408	*periporate*-1
31 3	567	*periporate*-3
32	323	*Pterocarya levis*
33	320	*Ulmus*-1
34	287	*Alnipollenites*-1
35-36	229	*Sigmopollis hispidus*
37	580	*Clusterisporites*-1
38	572	*Clusterisporites*-2
39-40	571	*Fungitorqua*-1
41-42	391	*Striadiporites sanctaebarbarae*
43	575	*Diporisporites*-4
44-45	576	*Diporisporites*-1
46	578	*Dicellaesporites*-2
47	574	*Striadiporites*-3
48	577	*Multicellaesporites*-8
49-50	579	*Fungiscissa*-1
51	M289	*Svalbardella* cf. *australina*
52-53	M242	*Korojonia*-1
54	573	*Schizosporis*-1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