

1-216

Open.

1

STRATIGRAPHIC CORRELATION
BIOSTRATIGRAPHIC ZONATION

IMP. NETSERK B-44

69° 33' 03.04" N. LAT.; 135° 55' 57.74" W. LONG.

NORTHWEST TERRITORIES

AUSTIN & CUMMING EXPLORATION CONSULTANTS

CALGARY, ALBERTA

JULY, 1977

C O N T E N T S

	<u>Page</u>
SUMMARY AND CONCLUSIONS.....	1
Summary of Zonation - Table 1.....	2
Discussion of Zonation.....	3
Table 2 - Palynostratigraphic Correlation.....	following 5
 PALYNOSTRATIGRAPHY	
Table 3 - Palynological Zonation	
Summary.....	6
Zonation.....	6
Paleoenvironments.....	9
Age and Correlation.....	9
Organic Maturation.....	9
 MICROPALAEONTOLOGY	
Table 4 - Micropaleontological- Palynological Integration Chart	
General Remarks.....	10
Microfaunal Assemblages.....	10
 IN POCKET	
Palynomorph Distribution Chart	(Fig. 1)
Microfossil Distribution Chart	(Fig. 2)
Biostratigraphic Summary Log	(Fig. 3)
 APPENDIX	
PALYNOMORPH PHOTOGRAPHS	

SUMMARY AND CONCLUSIONS
Discussion of Zonation

BY

L. W. CUMMING, P. GEOL.

IMP. NETSERK B-44SUMMARY AND CONCLUSIONS

Biostratigraphic analysis of Imp. Netserk B-44 consists of a palynological study by Dr. G. Norris and a micropaleontological analysis by Drs. W. Braun and M. Brooke.

Microfloral analysis of one hundred and thirty seven (137) palynological slides, provided by the operator, indicate eight palynozones ranging in age from Quaternary at the surface to probable Paleocene at the base.

Contamination of samples, due to the recycling of material derived from earlier beds and caving of material from younger beds, necessitates interpretive analysis of the biostratigraphic results. Consequently, an alternate zonation based on a combination of biostratigraphic data, lithology, mechanical log evaluation and regional stratigraphic correlations is presented.

Two hundred and fifty seven (257) micropaleontological slides, also provided by the operator, were analyzed for microfaunal content. Microfossil recoveries proved nearly continuous throughout the hole, establishing the Netserk B-44 well as the most fossiliferous Tertiary section analyzed to date in the Mackenzie Delta area.

The following summary of zonation (Table 1) integrates the palynological, alternate palynological and micropaleontological zonation with identifiable stratigraphic units.

Table 2, following the discussion of zonation, illustrates a tentative palynostratigraphic correlation of Netserk B-44 (alternate zonation) with definitive stratigraphic units encountered at Imp. Nuktak C-22.

A summary log (Fig. 3) relates palynological, alternate palynological and micropaleontological zonation to mechanical logs and lithology at normal reduced log scale of 1 inch = 100 feet.

TABLE 1
 IMP. NETSERK B-44
SUMMARY OF ZONATION

<u>AGE</u>	<u>PALYNOLOGICAL UNIT</u>	<u>ALTERNATE PALYNOLOGICAL UNIT</u>	<u>MICROFOSSIL ASSEMBLAGE</u>
<u>NEOGENE</u>			
Quaternary	Quaternary (0-410)	Quaternary (0-410)	Assemblage I (230-1650)
U. Miocene- Pliocene	<i>Laevigatosporites</i> -1 (410-660)	<i>Laevigatosporites</i> -1 (410-660)	
	<i>periporate</i> -1 (660-1740)	<i>periporate</i> -1 (660-1740)	
Miocene	-	<i>Tsuga</i> -1 (1740-3090) * <i>Tsuga</i> Mudstone Unit	
<u>PALEOGENE</u>			
Oligocene	<i>Ericaceae</i> -1 (1740-2408)	-	Assemblage II Upper (1650-2500)
Upper Eocene- Oligocene	<i>Lycopodiumsporites</i> -1 (2408-6830)	<i>Lycopodiumsporites</i> -1 (3090-5890)	Assemblage II Lower (2500-4200)
	Not Picked	<i>Osmundacidites</i> -1 (5890-7650?)	" <i>Cyclammina</i> " 7 (5050-9500)
Upper Eocene	<i>Parviprojectus</i> -1 (6830-8520)	<i>Parviprojectus</i> -1 (7650?-8520) *"Overpressured" Shale Unit	
Middle Eocene	<i>Pesavis tagluensis</i> (8520-9690)	<i>Pesavis tagluensis</i> (8520-9690)	
Paleocene?	<i>Striadiporites</i> -1 (9690-11,575)	<i>Striadiporites</i> -1 (9690-11,575)	

*Stratigraphic Unit

DISCUSSION OF ZONATION

(Tables 1 & 2)

Palynological zonation of Imp. Netserk B-44, as presented by Norris, is based on first or uppermost occurrences of characteristic microfloral groups found consistently throughout the Mackenzie Delta. Due to a marked discrepancy between tops based on uppermost occurrences and correlatable stratigraphic units, an alternate zonation incorporating stratigraphic data and detailed analysis of microfloral groupings is presented. We believe the true palynological zone (*Tsuga*-1) and other zone tops (*Lycopodiumsporites*-1 and others) are masked to a large degree by excessive recycling of material derived from earlier subjacent beds with an apparent upward shifting of zone boundaries into younger sediments.

Correlation of this well with Imp. Nuktak C-22 (Table 2) is based on the alternate zonation, using stratigraphic data as a guide.

NEOGENE

Quaternary (230-410')

This unit is characterized by recycled Mesozoic and Cenozoic spores, and is provisionally placed in the Quaternary.

Upper Miocene-Pliocene

Laevigatosporites-1 (410-660')

The presence of *Laevigatosporites*-1 below 410 feet identifies this palynozone. The base of this unit is placed at the uppermost appearance of the *periporate*-1 flora.

Miocene

Alternate Zonation

Tsuga-1 (1740-3090')

Common occurrences of *Corylus*-1, *Tsuga*-1 and *Betulaceoipollenites*-1 through this interval suggests the presence of beds equivalent to the *Tsuga* Mudstone Unit of Imp. Pullen E-17, Imp. Ivik K-54 and other wells. The presence of recycled material is common in this unit as evidenced by the following species; *Pistillipollenites mcgregorii*, *Caryapollenites paleocenicus*, *Tiliapollenites*-1, etc. Common occurrences of *Ericaceae*-1 and associated species within this sequence of mudstones are also believed to result from the recycling of material derived from older (Eocene-Oligocene) beds. The base of this unit is placed at 3090 feet coincident with a lithological change from mudstones above this depth to alternating cherty

sandstones and mudstones of the *Lycopodiumsporites*-1 zone below. The presence of *Lycopodiumsporites*-1 species through the interval 2408-3090 feet is also believed to result from recycling of the Lycopod flora above a possible unconformity at the base of the Tsuga Mudstone Unit (3090 feet).

The presence of Assemblage II microfossils throughout this zone suggests these beds are of marine origin and equivalent to the *Tsuga*-1 palynozone at Imp. Pullen E-17.

Oligocene

Ericaceae-1 (1740-2408')

Based on the uppermost occurrence of *Ericaceae*-1 and related flora, Norris interprets this interval as the *Ericaceae*-1 palynozone. However, as discussed above, stratigraphic correlations suggest these beds may be equivalent to the Tsuga Mudstone Unit of probable Miocene age. The base of this palynozone is placed at 2408 feet by Norris at the first occurrence of the *Lycopodiumsporites*-1 flora. This placement of the *Lycopodiumsporites*-1 zone top, within the mudstone stratigraphic unit, appears inconsistent with other wells. The presence of the Lycopod flora within these mudstones is believed to result from recycling.

Eocene-Oligocene

Lycopodiumsporites-1 (2408-6830')

The uppermost presence of the *Lycopodiumsporites*-1 floral assemblage occurs in a core sample at 2408 feet. The lower boundary is placed palynologically at 6830 where flora commonly associated with the *Parvi-projectus*-1 species first occurs. Adjustments for both boundaries are indicated stratigraphically and are discussed further under alternate zonation.

Alternate Zonation

Lycopodiumsporites-1 (3090-5890')

Stratigraphic correlations suggest this zone should be confined to an alternating sequence of mudstone and thin cherty sandstones occupying the interval 3090-5890 feet. A marked lithological change at 3090 is chosen as the upper boundary and the first occurrence of the *Osmundacidites*-1 species marks the lower boundary. Lycopod-1 flora present through the interval 2408-3090 feet in the lower portion of the mudstone unit are believed to represent recycled material.

Beds equivalent to the *Ericaceae* Sandstone Unit (Imp. Pullen E-17, Imp. Ivik K-54, etc.) appear to be absent at this location, suggesting complete erosion by a pre-Miocene unconformity.

Microfossil recoveries of the "Cyclammina" 7 faunal assemblage toward the base of this unit (5050 feet) is generally compatible with placement in other wells (Imp. Ivik K-54, *Lycopodiumsporites*-1, Imp. Pullen E-17 and Imp. Nuktak C-22, *Osmundacidites*-1).

Alternate Zonation*Osmundacidites*-1 (5890-7650?)

The presence of *Osmundacidites*-1 flora within this interval suggests the presence of the *Osmundacidites*-1 palynozone encountered at Imp. Nuktak C-22, Imp. Pullen E-17, Imp. Ivik K-54 and other wells. The base of this unit is tentatively placed at 7650 feet at a lithological change indicated by mechanical logs.

Upper Eocene*Parviprojectus*-1 (6830-8520')Alternate Zonation (7650-8520')

The presence of *Striadiporites sanctaebabarbarae* and *Pluricellaesporites*-2 indicate the presence of the *Parviprojectus*-1 palynozone. Single occurrences of *Striadiporites sanctaebabarbarae* and *Pluricellaesporites*-4 within the 6830 foot (core) sample suggest the upper boundary of this zone may occur at this point. However, repeated recoveries of *Striadiporites sanctaebabarbarae* below 7655 appears to coincide with an indicated lithological change (mechanical logs) at 7650 feet that may mark the top of this zone.

The base of the zone is placed palynologically at 8520 feet on the first appearance of the marine dinoflagellate assemblage containing *Wetzeliella* cf. *hampdenensis*.

Middle Eocene*Pesavis tagluensis* (8520-9690)

The upper boundary of this palynological zone is chosen to coincide with the uppermost appearance of marine beds containing *Wetzeliella* cf. *hampdenensis*, *Deflandrea*-3, etc. This assemblage is included within Norris' *Pesavis tagluensis* zone and generally marks the top of the zone. Sandstone beds scattered through the interval 8920-9500 feet are, therefore, considered equivalent to the productive sandstones in the Taglu field.

Paleocene*Striadiporites*-1 (9690-11,575')

Occurrences of *Ctenosporites eskerensis*, *Pesavis*-1, *Fusiformisporites*-1 and *Striadiporites*-1 through this lower unit indicates the presence of the *Striadiporites*-1 (previously referred to as *Striadiporites*-1, *Pulcheripollenites*-1 and *Pesavis*-1 zones). A late Paleocene age has previously been assigned to this unit on the basis of *Wetzeliella* flora.

TABLE 2
 PALYNOSTRATIGRAPHIC CORRELATION
 IMP. NETSERK B-44 WITH IMP. NUKTAK C-22

IMP. NETSERK B-44		PALYNOLOGICAL ZONE OR *STRATIGRAPHIC UNIT		IMP. NUKTAK C-22	
QUATERNARY	410'				
PLIOCENE TO UPPER MIOCENE	660'	ASSEM. I	LAEVIGATOSPORITES - 1	ASSEM. I	950'
	1740'		PERIPORATE - 1		
MIOCENE	3090'	ASSEMBLAGE II	? *TSUGA MUDSTONE UNIT	ASSEMBLAGE II	2370'
			*ERICACEAE SANDSTONE UNIT		2920'
OLIGOCENE TO UPPER EOCENE	5890'	ASSEMBLAGE II	LYCOPODIUMSPORITES - 1	ASSEMBLAGE II	5370'
	7650'		**OSMUNDACIDITES - 1		7682'
UPPER EOCENE	8520'	CYCLAMMINA 7	? PARVIPROJECTUS - 1	CYCLAMMINA 7 EQUIV.	8695'
MIDDLE TO LOWER EOCENE	9690'		WETZELIELLA cf. HAMPDENENSIS		11,160'
UPPER PALEOCENE	11,575'	CYCLAMMINA 7	*PESAVIS TAGLUENSIS	CYCLAMMINA 7 EQUIV.	12,600'
			STRIADIPORITES - 1		MIDDLE EOCENE

INTERPRETED BY: L. W. CUMMING

PALYNOSTRATIGRAPHIC STUDY

BY

DR. G. NORRIS

TABLE 3
IMP. NETSERK B-44

PALYNOLOGICAL ZONATION

DEPTH	ZONE	DEFINITIVE PALYNOMORPHS	ENVIRONMENT	AGE	
1000	NE-1 410'	LAEVIGATOSPORITES-1	NON-MARINE	QUATERNARY	
	NE-2 660'			UPPER MIOCENE TO PLIOCENE	
	NE-3 1740'		WEEK MARINE INFLUENCE		
2000	NE-4 2408'	ERICACEAE - 1	NON-MARINE	OLIGOCENE	
3000	NE-5	LYCOPODIUMSPORITES-1		NON-MARINE	LOWER OLIGOCENE TO UPPER EOCENE
4000					
5000					
6000					
7000	NE-6 6830'	PARVIPROJECTUS-1	NON-MARINE	UPPER EOCENE	
8000					
9000	NE-7 8520'	PESAVIS TAGLUENSIS	MARINE	MIDDLE EOCENE	
10,000	NE-8 9690'	STRIADIPOROITES-1	NON-MARINE	UPPER PALEOCENE	
11,000			MARINE HORIZ.		
	11,575'		NON-MARINE		

PALYNOLOGICAL ZONES BASED ON UPPERMOST OCCURENCE OF CHARACTERISTIC MICROFLORA

IMPERIAL NETSERK B-44SUMMARY

One hundred thirty seven (137) samples from the subject well yielded 95 terrestrial and 15 marine palynomorph species. Eight palynozones are recognized and indicate Neogene resting with a small break at 1,650 feet on thick Paleogene. Another possible hiatus in the Paleogene occurs at 9600 feet. Weak marine influence occurs in the Lower Neogene between 840 feet and 1650 feet. The Paleogene is essentially non-marine except for a clearly defined marine interval between 8160 feet and 9510 feet, and a single marine assemblage in core at 10,384 feet. Organic maturation increases steadily from light yellow at the top to amber spore colours at the bottom of the well. Zones, possible ages, correlations and paleoenvironments are summarized in the accompanying figures.

ZONATION

The following zones are characterized by extinction of the species indicated.

NE-1 230-410 feet (Zone A - Quaternary)

A poorly defined interval above the top of 407 *Laevigatosporites-1* characterized by recycled Mesozoic and Cenozoic spores.

NE-2 410-660 feet (Zone B - *Laevigatosporites-1*)

- 407 *Laevigatosporites-1*
- 409 *Steriesporites-2*
- 326 *Pinus-1*
- 1 *Stereisporites antiquasporites*

NE-3 660-1740 feet (Zone C - *periporate-1*)

- 229 *Sigmopollis hispidus*
- 408 *periporate-1*
- 220 *Betulaceoipollenites-1*
- 287 *Alnipollenites-1*
- 592 *Lacrimasporonites-1*
- 593 *Compositae-1*
- 594 *Tricolpites-3*
- 2 *Taxodiaceaeipollenites hiatus*
- M242 *Korojonia-1*
- M290 *Chytroeisphaeridia-3*

NE-4 1740-2408 feet (Zone E - *Ericaceae*)

Considerable recycling has occurred in this zone but the following are probably indigenous:

- 34 *Laevigatosporites ovatus*
- 395 *Corylus*-1
- 401 *Picea*-1
- 411 *Abies*-1
- 371 *Tsuga*-1
- 323 *Pterocarya levis*
- 377 *Ericaceae*-1
- 596 *Caprifoliaceae*-1

The following are probably recycled in this zone: 330 *Pistillipollenipollenites mcgregori*, 282 *Caryapollenites paleocenicus*, 370 *Tiliapollenites*-1, 19 *Osmundacidites wellmannii*, 183 *Baculatisporites comaumensis*.

NE-5 2408-6830 feet (Zone F - *Lycopodiumsporites*-1)

Recycling is also common at the top of this zone which is characterized by the following indigenous species:

- 382 *Tricolporopollenites*-5
- 320 *Ulmus*-1
- 374 *Granatisporites*-1
- 378 *Pluricellaesporites*-1
- 362 *epiphyllous fungi*
- 418 *Polypodiiisporites*-1
- 19 *Osmundacidites wellmannii*
- 183 *Baculatisporites comaumensis*
- 16 *Deltoidospora hallei*
- 394 *Corylus granilabrata*
- 412 *Lycopodiumsporites*-1
- 597 *Tsuga igniculus*
- 327 *Podocarpidites maximus*
- 598 *Diporisorites*-5
- 22 *Cyathidites minor*
- 414 *Triatriopollenites*-1
- 419 *tetrad*-1
- 324 *Carpinus subtriangula*
- 567 *periporate*-1
- 36 *Lycopodiumsporites reticulumsporites*
- 582 *Onagraceae*-1
- 42 *Araucariacites australis*
- 599 *microthyriaceous germling*
- 580 *Clusterisporites*-1
- 600 *Aceraceae*-1
- 576 *Diporisorites*-1

570 *Lycopodiumsporites*-2
 585 *Multicellaesporites*-3
 583 *Dicellaesporites*-3
 291 *Tricolpites hians*
 386 *Rhoiipites*-2
 373 *Tricolporopollenites*-3
 601 *Dyadosporites*-1
 586 *Leptolepidites*-2
 416 *Osmundacidites*-1

NE-6 6830-8520 feet (Zone G - *Parviprojectus*)

603 *Pluricellaesporites*-4
 391 *Striadiporites sanctaebarae*
 606 *Tetracellaesporites*-1
 387 *Tricolporopollenites*-6
 555 *Ctenosporites wolfei* (possibly recycled)
 604 *Schizophacus*-1
 533 *Pluricellaesporites*-2
 M291 *Deflandrea* cf. *sagittula*
 M220 *Lejeunia*-1
 M292 *Tanyosphaeridium*-2
 M245 *Cordosphaeridium* cf. *diktyoplokus*
 M244 *Astrocysta*-1
 M226 *Diconodinium*-6

NE-7 8520-9690 feet (Zone H - *Pesavis tagluensis*)

392 *Granatisporites cotalis*
 400 *Pesavis tagluensis*
 367 *Azolla*
 590 *Multicellaesporites*-5
 549 *Pluricellaesporites*-3
 605 *Dyadosporites*-2
 607 *Dicellaesporites*-6
 M229 *Wetzeliella* cf. *hampdenensis*
 M225 *Deflandrea*-3
 M155 *Hystrichosphaeridium* cf. *recurvatum*
 M230 *Cannosphaeropsis* cf. *reticulensis*
 M293 *Dinoflagellate* S-1 Staplin

NE-8 9690-11,575 feet (Zone K - *Striadiporites*)

532 *Ctenosporites eskerensis*
 608 *Fungididyma*-1
 556 *Pesavis*-1
 569 *Fusiformisporites*-3
 609 *Clusterisporites*-3
 546 *Punctodiporites*-1
 522 *Leptolepidites* cf. *tenuis* (possibly recycled)
 578 *Dicellaesporites*-2
 610 *Multicellaesporites*-6
 611 *Multicellaesporites*-7

602 *Multicellaesporites*-2
547 *Punctodiporites*-2
550 *Striadiporites*-1
M294 *Thalassiphora pelagica*

PALEOENVIRONMENTS

The entire section appears to be non-marine except for weak marine influence between 840 feet and 1650 feet in NE-3, and a well-defined marine interval at the bottom of NE-6 and top of NE-7 between 8160 feet and 9510 feet. A further marine assemblage occurs in a single core sample at 10,384 feet.

AGE AND CORRELATION

Possible ages for the Netserk zones and correlation with the palynofloral zones recognized in the Mackenzie Delta region are indicated in the accompanying figure.

It should be emphasized that age determinations are tentative and subject to change as new information becomes available.

The presence of M294 *Thalassiphora pelagica* near the middle of Zone K (*Striadiporites*) is noteworthy. This zone has previously been dated Late Paleocene in the upper part on *Wetzeliella* floras. M294 *Thalassiphora pelagica* has not been reported previously elsewhere below the Eocene, although the genus evolved in the Cretaceous.

The presence of 522 *Leptolepidites* cf. *tenuis* at 10,344 feet is interpreted as recycling. If, however, it proves to be in place, a revision of the zonations and a re-evaluation of the *Leptolepidites* cf. *tenuis* zone (Zone L) in other wells will be necessary.

ORGANIC MATURATION

Spore colours increase steadily from light yellow at the top to amber at the bottom of the well as indicated on the log.

MICROPALEONTOLOGICAL STUDY

BY

DR. W. BRAUN

DR. M. BROOKE

TABLE 4

 IMPERIAL
NETSERK B-44

		PALYNOLOGY					
WELL ZONES	ZONE		AGE		MICROPALEONTOLOGY	BRAUN & BROOKE 1977	
	Norris	Cumming	Norris	Cumming			
NE-1	410'	A	QUATERNARY		----- 230'		
NE-2	660'	B LAEVIGATO-1	PLIOCENE TO U. MIOCENE		ASSEMBLAGE I open - marine shallow - water middle neritic ?		
NE-3	1740'	C PERIPORATE-1					
NE-4	2408'	E ERICA.	TSUGA	OLIGO	UPPER	open - marine middle to outer neritic	
				MIOCENE	----- 2500'		
NE-5	6830'	F LYCOPODIUMSPORITES	LYCOPODIUMSPORITES	UPPER EOCENE - OLIGOCENE	ASSEMBLAGE II LOWER	----- 4200'	
			3090'		NOT DIAGNOSTIC		
			OSMUND.	UPPER EOCENE - OLIGOCENE		----- 5050'	
NE-6	8520'	G PARVIPROJETUS	OSMUND.	UPPER EOCENE	"CYCLAMMINA" 7 ALVEAPHRAGMIUM 154 - 349 ASSEMBLAGE	marine with "restrictions" deeper water ? (outer neritic to bathyal ?)	
NE-7	9690'	H PESAVIS TAGLUENSIS		MIDDLE EOCENE		----- 9500'	
NE-8	11,575'	K STRIADIPORITES		UPPER PALEOCENE	NO FAUNA		

* ALTERNATE ZONATION AND AGE BASED ON COMBINATION OF PALYNOLOGY AND LITHOLOGY

IMPERIAL NETSERK B-44SUMMARY OF MICROPALEONTOLOGICAL STUDYGENERAL REMARKS

Two hundred and fifty-seven (257) micropaleontological slides were submitted for study, yielding a well-preserved and in places very abundant microfauna. Recovery of microfossils throughout the borehole is nearly continuous, and unfossiliferous or sparsely fossiliferous intervals do not pose any major problem. Altogether, 20 species of ostracodes and 118 species of Foraminifera could be identified making Netserk B-44 one of the most fossiliferous sections so far encountered in our studies. It may serve, therefore, as a yardstick for correlation with other offshore wells.

MICROFAUNAL ASSEMBLAGES

Three (3) distinctive assemblages are recognizable on the basis of the influx of many species along faunal boundaries, and by their drastically differing faunal contents. Minor changes within Assemblage II allows recognition of two sub-assemblages: an upper and a lower one. The composition of the fauna is in part controlled by water depth and associated environmental factors, and in part by evolutionary changes. It is difficult, however, to establish with certainty which of these exerted a greater control on the distribution of the faunas at any given place or time interval.

Assemblage I

(230'-1,650')

A mixed foraminiferal and ostracode fauna constitutes Assemblage I. This fauna is probably the most widespread of all microfaunas in the Mackenzie Delta region, and it has been recognized to date in many wells examined.

The fauna contains two components: a few freshwater to brackish-water ostracodes that appear between 400 feet and 1,000 feet approximately, trailing-down to about 1500 feet, and a rich foraminiferal fauna with many calcareous forms, associated with a few shallow-water, marine ostracodes. Many of the species continue to about the 1650 foot level where the first forms of Assemblage II appear. The fauna is indicative of the middle neritic zone, as the miliolids and other near-shore indicators, so prevalent in this fauna in other boreholes, are relatively rare in the Netserk section. The freshwater ostracodes attest to either intercalation of some lacustrine deposits in the highest part of the section, or to transportation from the near-by land areas.

Assemblage I of Netserk resembles closely that recovered from Adgo F-28, a borehole due south of the B-44 location. The same is the case with respect to Assemblage II discussed below. The fauna occurs within sequences dated to be of Neogene age on basis of palynological evidence. It is the same fauna that Staplin and co-workers refer to as the "Sigmopollis-Ostracod-Elphidium Assemblage", and which is shown on their cross-section to occupy the highest part of the Neogene section and their T-4C Zone 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 ostracodes and chara--some of the elements of Assemblage I.

According to the palynological zonation established by Norris for Netserk B-44, he seems to have succeeded in dividing the Neogene section into 3 zones, the youngest representing the Quaternary, and the remaining two zones possibly the Upper Miocene to Pliocene. There is a minor change in microfauna at about the 300-foot level, the boundary approximately between Norris' NE-1 and NE-2 zones. A few additional species appear at approximately 600 feet, the boundary between his NE-2 and NE-3 zones of supposedly Pliocene to Upper Miocene age. Another microfaunal break occurs at about 1050 feet without corresponding break in the floral spectrum. There are possibilities, therefore, to divide Assemblage I, but in view that not enough is known about the ranges of the species involved, and in view that the faunal breaks are minor, the assemblage is left undivided for the time being.

Assemblage II

(1,650'-4,200')

The first few species of a richly diversified calcareous foraminiferal fauna appear at about 1,650 feet, the boundary between Norris' NE-3 and NE-4 zones. The main influx of species, however, occurs at about the 2,000-foot level. Another notable break in the faunal spectrum is evident at 2,500 feet, allowing discrimination of an upper and a lower sub-assemblage. Assemblage II is richly diversified and characterized by many and relatively small-sized specimens of various species of the foraminiferal genus Uvigerina, among many other calcareous forms and a few ostracodes. The boundary between the sub-assemblages is drawn where Trifarina 168 and Turrilina 166 appear, equally small-sized foraminiferal tests. These latter two species were found previously in Assemblage II of Adgo F-28, and with most of the Uvigerinas missing in this borehole, it may be suggested; in hindsight, that only the lower sub-assemblage is present at Adgo. It should be remembered, however, that the presence or absence of certain forms within Assemblage II (and other assemblages, for that matter) may not necessarily reflect evolutionary changes only, but changes rather in bathymetry.

The composition of Assemblage II suggests that the microfauna developed within the middle to outer neritic zone.

Assemblage II is equivalent to Staplin's and co-workers "Asterigerina-Fauna" which characterizes the upper part of their T-4A Zone or part of their lower Neogene section at Taglu C-42. At Netserk B-44, Assemblage II spans Norris' NE-4 Ericaceae (Alternate zonation - Tsuga-1) and about the upper half of his NE-5 (Lycopodiumsporites-1) zones of Oligocene (Alternate zonation - Miocene) and Upper Eocene-Lower Oligocene respectively. At Adgo F-28, the same microfaunal complex occurs within a floral sequence of supposedly Oligocene age (Ericaceae unit). Using Norris' age assignments, Assemblage II would characterize the Oligocene approximately, spanning part of his Lycopodiumsporites-1 and Ericaceae zones. The alternate zonation by Cumming would show the upper portion to be of Miocene (Tsuga) age. Using Staplin's yardstick, however, the fauna would have to be placed within the Miocene.

Without exhaustive and, for this reason, very time-consuming paleontologic-systematic studies, it is futile to argue ages in terms of the microfaunas recovered at this stage of our knowledge. Some species of Assemblage II could be readily identified or related to species described from Oligocene, Miocene and up to Recent assemblages, dependent on the preference or the bias of the investigator involved. The planktonic Foraminifera, commonly used in dating Late Cretaceous to Recent foraminiferal assemblages, are nearly or completely absent in such "cold-water" faunas we are dealing with, and the benthonic species present need far more careful attention with regard to discrimination and ranges of species as has been the case to date. An undifferentiated Oligocene to Miocene age is attached, therefore, to Assemblage II for the time being. This, by no means, impairs its usefulness in biostratigraphic studies, for the fauna is so richly diversified and so diagnostic that it cannot be overlooked or mistaken for another fauna. It is an excellent biostratigraphic marker!

Undiagnostic Interval

(4,200'-5,050')

Within this part of the borehole, the microfauna is distinctly impoverished and only a few species occur with some regularity and in greater numbers. There is the possibility that at least some, if not most, of these specimens are up-hole contaminants and that the interval would be essentially barren. However, in view that some of the species occur "regularly", the possibility that this undiagnostic fauna represents an impoverished Assemblage II, cannot be excluded either. Impoverishment would indicate that the environmental conditions deviated from those that provided the near ideal living conditions during the life span of the younger microfauna.

"Cyclammina" 7 and Alveophragmium 154 - 349 Assemblage
(5,050'-9,500')

At about 5,050 feet, the first few specimens of "Cyclammina" (Haplophragmoides) 7 and Alveophragmium 154 appear, with the main influx of specimens and the addition of Alveophragmium 349 a few hundred feet below. This fauna is characterized by the dominance of agglutinated forms and the relative large size of many foraminiferal tests, quite in contrast to Assemblage II where calcareous Foraminifera and small-sized specimens dominate. In Foraminifera, a greater species diversity and small size of the individual tests indicates ideal to near ideal living conditions with greatly accelerated reproductive cycles and fierce biological competition (Assemblage II). Such conditions are usually found in the open-marine waters of the middle to outer neritic zone. Large specimens and low species diversity, as is the case with the "Cyclammina" 7 - Alveophragmium 154-349 Assemblage indicate that certain "restrictions" were operative, slowing down the reproductive cycles considerably, the individuals would grow for a longer time, and biological competition is diminished. Such "restrictions" could have been present either in shallower or deeper water.

The mixture of "Cyclammina" 7 and other Alveophragmium species is the first encountered during our studies. Alveophragmium was recovered to date only from Nuktak C-22 and Ivik K-54, whereas "Cyclammina" 7 was known from Taglu C-42 and Umiak J-37. Important also is the addition of Alveophragmium 349 that may prove useful in this assemblage with other ones.

At Nuktak and Ivik, Alveophragmium 154 characterized sequences that were dated on palynological evidence to range from the Upper Eocene to Oligocene, or to span Norris' Tetrad-1, Osmundacidites-1, and part of the Lycopodiumsporites-1 zones. At the base, it may extend into the upper ranges of the Pesavis tagluensis zone. "Cyclammina" 7 was found at Taglu within Norris' Tetrad-1 zone and at Umiak from the Tetrad-1 well into the Pesavis tagluensis zone. At Netserk, the combined species span the lower third of the Lycopodiumsporites-1, the Osmundacidites-1 (alternate zonation), all of the Parviprojectus-1 and the major part of Norris' Pesavis tagluensis zones, ranging in age from the Middle Eocene into Upper Eocene to lower Oligocene sequences respectively, according to the palynological age interpretations.

There is a minor faunal break expressed at 6,780 feet, the boundary between Norris' NE-5 and NE-6 zones which may prove useful in future correlations. It is not used, however, for discrimination of a new assemblage or of sub-assemblages until its significance can be more fully assessed in future studies.

Undiagnostic Interval

Specimens of the "Cyclammina" 7-Alveophragmium 154-349 Assemblage occur nearly continuously to about 9,500 feet with only a few found trailing to total depth. The interval from 9,500 feet to 11,575 feet is considered, however, to be barren and not to contain any in situ microfossils.

APPENDIX

PALYNOLOGICAL

PHOTOGRAPHS

IMPERIAL NETSERK B-44

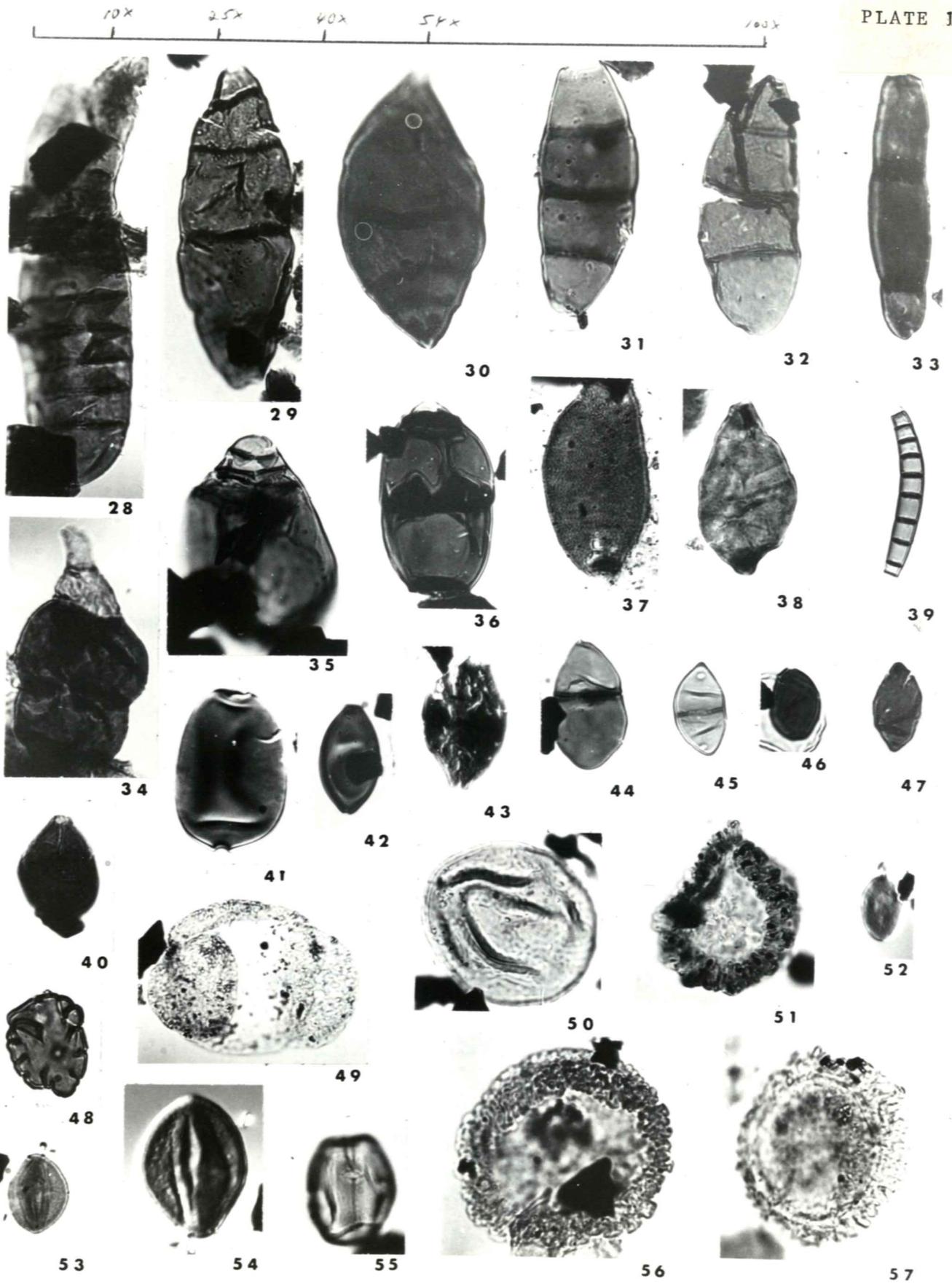
These photographs were taken using a variety of microscopic techniques. Magnifications are indicated in the scale at the top which represents 100 microns using respectively:

10x	bright field objective
25x	bright field objective
40x	interference contrast objective
54x	fluor-apo bright field objective
100x	interference contrast objective

The objectives used are indicated in parentheses in the plate explanations.

PLATE 1

28.	602	<i>Multicellaesporites</i> -2 (54x)
29-30.	610	<i>Multicellaesporites</i> -6 (54x)
31.	590	<i>Multicellaesporites</i> -5 (54x)
32.	585	<i>Multicellaesporites</i> -3 (54x)
33.	611	<i>Multicellaesporites</i> -7 (54x)
34.	606	<i>Tetracellaesporites</i> -1 (54x)
35.	585	<i>Multicellaesporites</i> -3 (54x)
36.	606	<i>Tetracellaesporites</i> -1 (54x)
37.	546	<i>Punctodiporites</i> -1 (54x)
38.	547	<i>Punctodiporites</i> -2 (54x)
39.	603	<i>Pluricellaesporites</i> -4 (54x)
40.	582	<i>Onagraceae</i> -1 (54x)
41.	598	<i>Diporisporites</i> -5 (100x)
42.	576	<i>Diporisporites</i> -1 (54x)
43.	605	<i>Dyadosporites</i> -2 (40x)
44.	583	<i>Dicellaesporites</i> -3 (54x)
45.	601	<i>Dyadosporites</i> -1 (54x)
46.	576	<i>Diporisporites</i> -1 (100x)
47.	608	<i>Fungididyma</i> -1 (54x)
48.	599	<i>microthyriaceous germling</i> (54x)
49.	326	<i>Pinus</i> -1 (54x)
50.	604	<i>Schizophacus</i> -1 (54x)
51.	597	<i>Tsuga igniculus</i> (54x)
52.	607	<i>Dicellaesporites</i> -6 (40x)
53-54.	387	<i>Tricolporopollenites</i> -6 (54x and 100x respectively)
55.	537	<i>Polygoniaceae</i> -1 (54x)
56.	371	<i>Tsuga</i> -1 (54x)
57.	597	<i>Tsuga igniculus</i> (54x)



IMPERIAL NETSERK B-44

These photographs were taken using a variety of microscopic techniques. Magnifications are indicated in the scale at the top which represents 100 microns using respectively:

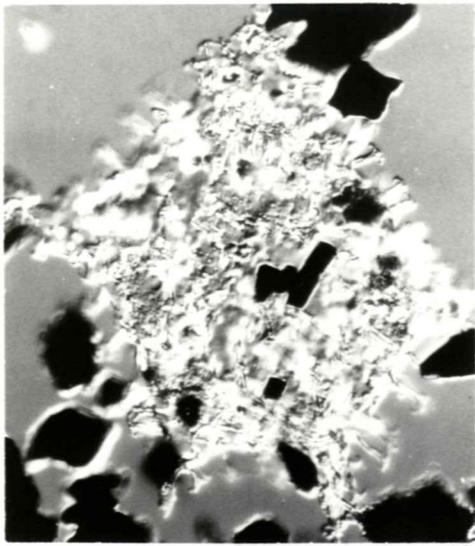
10x	bright field objective
25x	bright field objective
40x	interference contrast objective
54x	fluor-apo bright field objective
100x	interference contrast objective

The objectives used are indicated in parentheses in the plate explanations.

PLATE 2

- 110-112. M229 *Wetzeliella* cf. *hampdenensis* (40x)
113-117. M291 *Deflandrea* cf. *sagittula* (all 54x except #116
which is 40x)
118. M244 *Astrocysta*-1 (40x)

10x 25x 40x 54x 100x



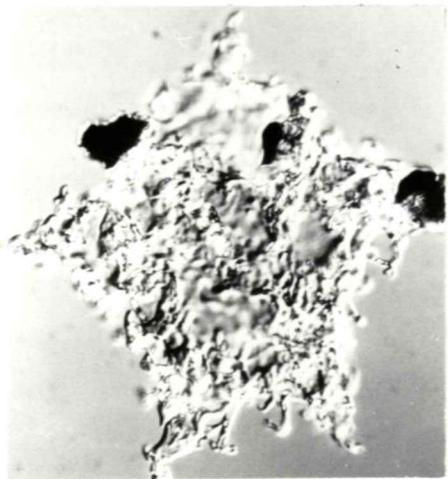
110



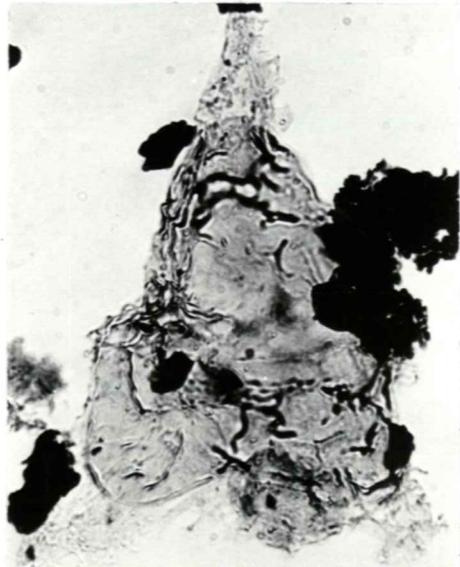
111



114



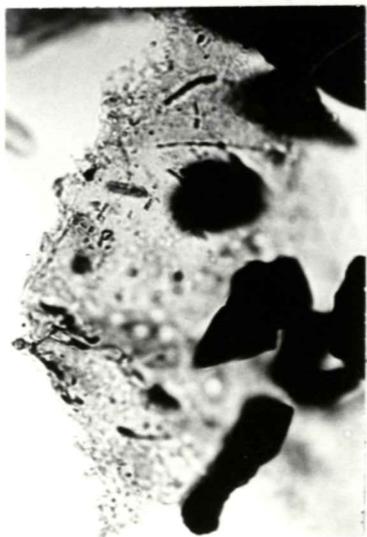
112



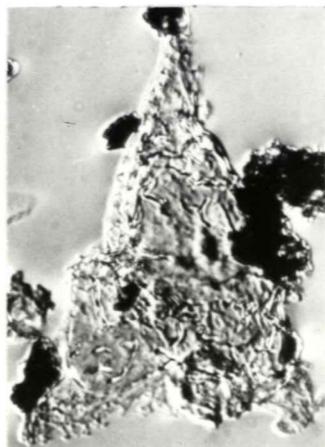
113



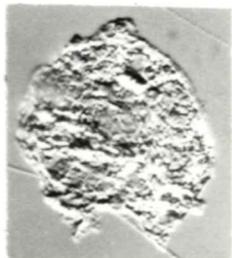
117



115



116



118

IMPERIAL NETSERK B-44

These photographs were taken using a variety of microscopic techniques. Magnifications are indicated in the scale at the top which represents 100 microns using respectively:

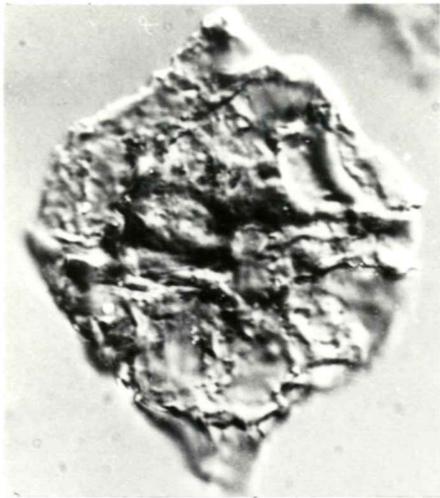
10x	bright field objective
25x	bright field objective
40x	interference contrast objective
54x	fluor-apo bright field objective
100x	interference contrast objective

The objectives used are indicated in parentheses in the plate explanations.

PLATE 3

- 119-120. M226 *Diconodinium*-6 (100x)
121-122. M220 *Lejeunia*-1 (54x and 40x)
123-124. M293 *Dinoflagellate* S-1 (40x)
125. M225 *Deflandrea*-3 (40x)
126. M290 *Chytroesphaeridia*-3 (100x)
127-129. M294 *Thalassiphora pelagica* (25x, 25x, and 40x respect.)

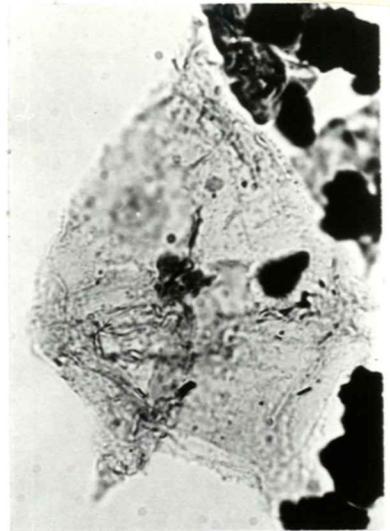
10x 25x 40x 54x 100x



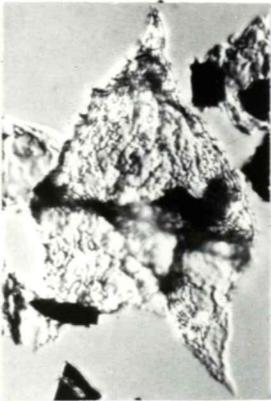
119



120



121



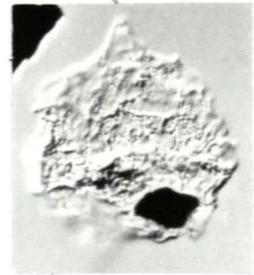
122



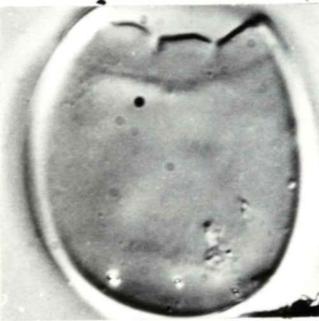
123



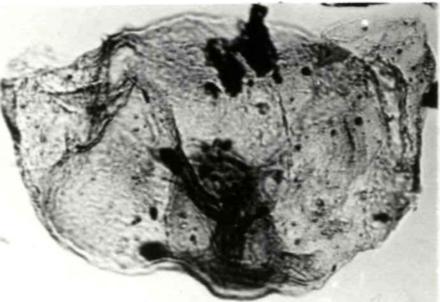
124



125



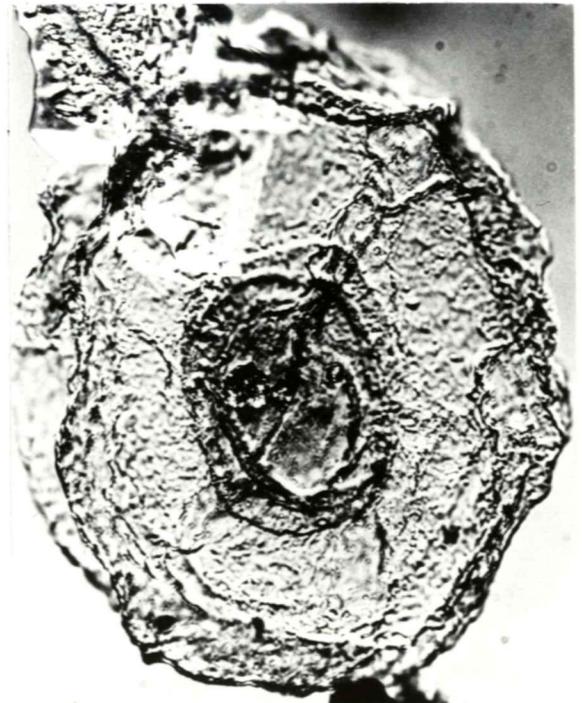
126



127



128



129