ROBERTSON RESEARCH (NORTH AMERICA) LIMITED

EXPLORATION REPORT NO. 162

THE MICROPALAEONTOLOGY, PALYNOLOGY AND STRATIGRAPHY OF THE PANARCTIC, DOME, TENNECO ET AL. LOUISE O-25 WELL

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OF 571

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CONTENTS

		Page No.
I	INTRODUCTION	1
II	SUCCESSION	3
III	MATERIALS AND METHODS	4
IV	CRETACEOUS	5
V	JURASSIC	7
VI	TRIASSIC	15
VII	STRATIGRAPHICAL REMARKS	17
VIII	REFERENCES	19

ENCLOSURES: Biostratigraphical analysis charts, Nos. 1 and 2.

I

INTRODUCTION

This report comprises a summary of the micropalaeontological, palynological and stratigraphical analyses carried out under Project No. RRNA/767/405, on material received from the interval 60' - 7483' (T.D.) on the Louise O-25 well.

This well was drilled on Ellef Ringnes Island in the Sverdrup Basin, District of Franklin, Northwest Territories, at Latitude 78° 44' 57.17" N., Longitude 102° 41' 58.42" W..

The stratigraphical interval covered by this well section commences in strata of Early Cretaceous age, which are underlain by Jurassic sediments. These, in turn, pass down into strata of Late Triassic age within which the well terminated.

A similar lithological sequence is also penetrated in the Sutherland O-23 well. Correlation of the different foraminiferid assemblages recognised in both wells is illustrated on the enclosures accompanying this report. Reference to the foraminiferid zonation schemes in the Linckens Island P-46 and Dumbbells E-49 wells, as discussed by Souaya (1976) are also made to augment environmental and stratigraphical interpretations.

A tentative interpretation of the environment of deposition is indicated on the analysis charts. The interpretation of a probable environment is based on the use of a combination of factors, including the faunal and floral diversity and dominance, their stratigraphical distribution, the comparison of assemblages with analogous components

in the Recent and fossil record and the lithological characteristics of the intervals studied.

It should be realised that as the information is mainly derived from cuttings samples, only a generalised interpretation of the environment is feasible throughout the well section.

The terms Early and Late as used to describe geological systems in this report, are directly equated with the terms Lower and Upper as used in the Sutherland 0-23 report.

A summary of the sequence penetrated in this well may be seen overleaf in Table I.

II

SUCCESSION

TABLE I

INTERVAL	THICKNESS	STAGE/SERIES	SYSTEMS
60' - 860'	800'	Neocomian (Barremian-Berriasian)	Early Cretaceous
860' - 1160'	300'	?Tithonian-Kimmeridgian	Late Jurassic
1160' - 1510'	350'	Oxfordian	
1510' - 1800'	290'	Callovian-?Bathonian	Middle Jurassic
1800' - 2210'	410'	Bajocian	
2210' - 4520'	2310'	Liassic (Toarcian-?Hettangian)	Early Jurassic
4520' - 7483' T.D.	2963'	Rhaetian-?Norian	Late Triassic

N. B. The above figures are approximate only, since they are mainly based on information derived from cuttings samples.

III

MATERIALS AND METHODS

Under Project No. RRNA/767/405, cuttings samples were available from the interval 60' - 7483' (T.D.) together with samples from two cores from the intervals 5137' - 5155' and 7464' - 7483'. The examination comprised both detailed micropalaeontological and palynological studies. For specific information, reference should be made to the biostratigraphical analysis charts, enclosures 1 and 2.

The prepared samples and recorded information are now curated in the confidential files of the Calgary laboratory of Robertson Research (North America) Limited.

CRETACEOUS

INTERVAL 60' - 860': Early Cretaceous (Berriasian - Barremian)

General Lithology

This interval is comprised of an uninterupted sequence of dark grey-brown and black, micromicaceous shales with interbedded, thin dolomitic and calcitic horizons.

Micropalaeontology

The interval is characterised by the dominance of calcareous foraminifera. They are ascribed to the *Lenticulina turgidula* zone of Souaya (1976).

The occurrence of *Marginulina* cf. *cephalotes*, *Lenticulina turgidula* and *Saracenaria triangularis*, together with *Lingulina* cf. *hybrida*, *Marginulinopsis jonesi*, *Ammobaculites fragmentarius*, *Recurvoides obskiensis*, *Haplophragmoides topagorukensis* and *Uvigerinammina* cf. *manitobensis* is indicative of a Berriasian to Valanginian age.

However, toward the top of the interval, between 60' - 150', *Epistomina* sp., *Hoeglundina* cf. *chapmani* and *Cribrostomoides canui* are found. These forms are often recorded in younger strata, particularly the Barremian. Again, the presence of *Haplophragmoides goodenoughensis*, typical of the Barremian in the Mackenzie District (Chamney, 1969), was also found towards the base of this interval. Its range is extended into the Berriasian by Souaya (1976), within the Sverdrup Basin.

Nevertheless on foraminiferid assemblage evidence, only a Berriasian or Valanginian age can be assigned to this interval.

Palynology

Palynological assemblages from this interval are dominated by long-ranging or indeterminate species. An Early Cretaceous, Berriasian - Valanginian age is indicated by the presence of Cicatricosisporites spp., Oligosphaeridium pulcherrimum and Psaligonyaulax apatela. A specimen of the Barremian - Albian form Gonyaulacysta helicoidea in the 400' - 470' cuttings sample however, indicates that the upper part of this interval may be at least as young as Barremian.

Environment of Deposition

The diverse, calcareous foraminiferid fauna probably indicates shallow marine conditions of possible transgressive nature. Toward the top of the interval between 60' - 150', the presence of Epistomina sp. and Hoeglundina cf. chapmani further augments the evidence for unrestricted marine conditions. These genera are taken as shallow marine indicators in the Jurassic and Cretaceous of western Europe.

V

JURASSIC

INTERVAL 860' - 1160': Late Jurassic, Kimmeridgian - ?Tithonian

General Lithology

The dark grey-brown to black shales of the previous interval pass down at 1010' into dark grey and black micromicaceous shales with interbedded, thin dolomitic and calcitic horizons. Toward the base of the interval, the shales are slightly pyritic and minor ironstone horizons occur.

Micropalaeontology

The interval is characterised by the dominance of agglutinating foraminifera. They are ascribed to the *Haplophragmoides kingakensis* and *H. barrowensis* zone of Souaya (1976). The subzones of *Gaudryina leffingwelli* and *Gaudryina milleri* (Souaya, 1976) are also recognisable.

The sudden appearance and dominance of the above zonal index species is a characteristic feature of the change from the Early Cretaceous to Late Jurassic foraminiferid assemblages in the Linckens Island P-46 well, (Souaya, 1976). An identical development is found in this well.

The appearance of *Ammobaculites alaskensis* and *H. kingakensis* in large numbers is also a feature of the early Tithonian and late Kimmeridgian in the Linckens Island P-46 well (Souaya, 1976). However the absence of *Glomospira pattoni*, characteristic of the late Tithonian

in the Linckens Island P-46 well, may possibly indicate a non-sequence between the Jurassic and Cretaceous in this well with only ?Early Tithonian underlying Berriasian. However the palaeontological evidence alone is not conclusive.

Palynology

The dominantly Jurassic forms Corollina cf. meyerana and Classopollis classoides appear in the 890' and 990' cuttings samples respectively. Dinoflagellate species making their first appearance include Sirmiodinium grossi which ranges from Kimmeridgian to Barremian and the Middle Jurassic to Barremian form, Pareodinia ceratophora. Palynological recovery was too poor to date the interval precisely.

Environment of Deposition

The sudden appearance of agglutinating foraminifera contrast markedly with the calcareous fauna above. These contrasting faunas may suggest an hiatus and represent the change from open marine conditions in the overlying shales to restricted, shallow water marine conditions here. The abundance of Ammobaculites at this level, and in the Oxfordian, may indicate shoal, brackish and estuarine waters less than 100' deep (Bandy and Arnal, 1960).

INTERVAL 1160' - 1510': Late Jurassic, Oxfordian

General Lithology

The interval is a lithological continuation of that above. Dark grey and black micromicaceous shales are dominant with minor traces of calcite and pyrite with rare ironstone horizons.

Micropalaeontology

The interval is characterised by agglutinating foraminifera. It is ascribed to the *Ammodiscus thomsi* and *Ammobaculites cobbani* subzones of Souaya (1976). Chamney (1971) first recorded *A. thomsi* from the Callovian in the Mackenzie Delta Area although it commonly occurs in the Oxfordian of the Sverdrup Basin (Souaya, 1976).

The appearance of the above two species is indicative of the Oxfordian. However, *Arenoturrispirillina intermedia* appears with the above at 1160'. This species is indicative of the Kimmeridgian also, although its more common occurrence at this level is a feature of its development in the Oxfordian of the Linckens Island P-46 well. Chamney (1971) records *A. intermedia* as ranging from the late Oxfordian to Tithonian.

Palynology

The appearance of *Scriniodinium* cf. *crystallinum* together with *Endoscrinium* cf. *galeritum* and *E.* cf. *luridum* in the 1100' - 1180' cuttings sample indicates the presence of Oxfordian strata. Other important dinoflagellate species to appear in this interval include *Pareodinia* cf. *aphelia*, *Scriniodinium dictyotum* (especially abundant),

Gonyaulacysta dangeardi and Parcodinia aff. groenlandica. The presence of a specimen Wanea digitata in the 1400' - 1490' cuttings sample marks the transition to the Callovian.

Environment of Deposition

The continued abundance of agglutinating foraminifera particularly Ammobaculites and Arenoturrispirillina may indicate shallow, marine conditions. The latter is of environmental significance as it is often found in areas of shallowing or marine erosion. This may further suggest a thinning of the Late Jurassic sediments in this well.

INTERVAL 1510' - 1800': Middle Jurassic, ?Bathonian - Callovian

General Lithology

Dark grey and black, micromicaceous shales again characterise this interval, together with minor quartz and thin carbonaceous horizons. Pyrite and calcite occur rarely.

Micropalaeontology

The exact age of this interval is very difficult to define on foraminiferal evidence alone. Souaya (1976) records an increase in calcareous foraminifera at this level in the Linckens Island P-46 well. However the fauna in the Louise O-25 well continues to be dominated by agglutinating foraminifera. The rare occurrence of Lenticulina ?audax is the only indication of a Callovian age, whilst Nodosaria lirulata and Marginulinopsis phragmites, characteristic of this age, were absent.

Palynology

Assemblages from this interval are generally poor both in richness and diversity. The Aalenian - Kimmeridgian form Scriniodinium dictyotum, which appeared in the previous interval, continues to dominate the assemblages. The preservation of the palynomorphs deteriorates towards the base of the unit.

Environment of Deposition

The calcareous fauna of the Linckens Island P-46 well, and Dumbbells E-49 wells, as described by Souaya (1976), could not be recognised for this interval in the Louise O-25 well. Only rare Lenticulina ?audax were found.

The continued abundance of Ammobaculites may again indicate shallow marine conditions resulting from probable local epirogenic uplift. This is in contrast to the nearby Dumbbells E-49 well that probably experienced continuous deeper marine conditions from the Callovian to Kimmeridgian, as shown by the dominant calcareous fauna over this interval.

INTERVAL 1800' - 2210': Middle Jurassic, Bajocian

General Lithology

This interval is a lithological continuation of that above with dark grey and black, micromicaceous shales with thin carbonaceous horizons. Pyrite and calcite are also present in small quantities.

Micropalaeontology

The base of this interval is assigned to the Ammodiscus cf. baticus

zone of Souaya (1976).

The diversity and abundance of the Ammodiscids within the Bajocian, as also recorded in the Sutherland O-23 well, characterise this interval. Ammodiscus cf. baticus, A. orbis and A. cf. limitatus are found toward the base of the interval.

Palynology

The appearance of Nanoceratopsis gracilis in the 1800' - 1890' cuttings sample is used to define the top of the Bajocian. Other important taxa to appear in these otherwise poor assemblages include Nannoceratopsis cf. pellucida and Netrelytron sp.. The deterioration in preservation noted in the previous interval persists through this unit.

Environment of Deposition

It is of note that the Late Jurassic and Early Cretaceous foraminiferid faunas in the Sutherland O-23, Louise O-25, Linckens Island P-46 and Dumbbells E-49 show great similarity. However in the underlying Middle and Early Jurassic, variations in assemblages occur which must reflect the local development of sedimentary facies and environmental niches.

In the Louise O-25 well, agglutinating foraminifera particularly Ammobaculites and Ammodiscus dominate this interval. They probably indicate shallow marine conditions reflecting local epirogenic uplift.

INTERVAL 2210' - 4520': Early Jurassic, ?Hettangian - Toarcian

General Lithology

The dark grey and black shales of the previous interval persist to 2910'. From 2910' to the base of the unit the lithologies are a series of interbedded siltstones, sandstones and shales with numerous diorite and gabbro intrusions. The more prominent intrusions occur at 2590' - 2710' and 2940' - 3140'.

Micropalaeontology

The numerous igneous intrusions have severely effected the occurrence of foraminifera at certain horizons.

The A. cf. baticus subzone of the interval above continues down to 2390'. The appearance of Ammobaculites imlayi, Ammodiscus rugosus, Reophax homoagglutinans and Lenticulina toarcensis toward the top of this interval are all indicative of the late Liassic in this area. The sudden and common appearance of Frondicularia cf. lustrata, first recorded from the Toarcian by Tappan (1955), together with Vaginulinopsis enodis suggests a Toarcian age.

Between 2590' - 2800', the interval is barren of microfauna and only very rare, indeterminate rotaliids are found. They are probably caved from above, as this interval has a diorite intrusion.

From 2810' - 3050', the fauna typical of the topmost unit is badly preserved and may only be ascribed to the Liassic sensu lato.

The interval 3060' - 4050' is probably barren of microfauna except

LOUISE 0-25

Plates 1 - 3

All Magnifications X500

PLATE 1

1.	Cingutriletes clavus	600'
2.	Psaligonyaulax apatela	600'
3.	Oligosphaeridium pulcherrimum	600'
4.	Lycopodiumsporites sp.	700'
5.	Gonyaulacysta helicoidea	910'
6.	Sirmiodinium grossi	910'
7.	Corollina sp.	800'
8.	Cicatricosisporites	1000'
9.	Cyclonephelium	1000'
10.	Pareodinia ceratophora	1000'
11.	Endoscrinium cf. luridum	1100'
12.	Pareodinia cf. aphelia	1100'
13.	Psaligonyaulax sp.	1200'

PLATE 2

1.	?*Scriniodinium* sp.	1200'
2.	*Sriniodinium dictyotum*	1200'
3.	*Pareodinia groenlandica*	1300'
4.	*Gonyaulacysta dangeardi*	1300'
5.	*Veryhachium* sp.	1400'
6.	*Wanea digitata*	1400'
7.	*Gonyaulacysta* cf. *dangeardi*	1400'
8.	*Psaligónyaulax apatela*	1400'
9.	*Nannoceratopsis pellucida*	1800'
10.	*Nannoceratopsis gracilis*	1800'
11.	*Pareodinia* cf. *ceratophora*	1900'
12.	*Netrelytron* sp.	2000'

PLATE 3

1.	?Dinoflagellate cyst	4300'
2.	*Alisporites* sp.	4300'
3.	*Corollina tetrad*	4900'
4.	*Minutosaccus* sp.	4200'
5.	*Zebrasporites* sp.	5500'
6.	*Classopollis* cf. *torosus*	5600'
7.	?Dinoflagellate cyst	5100'
8.	cf. *Kyrtomisporites* sp.	5600'
9.	cf. *Semiretisporis* sp.	5600'
10.	*Kyrtomisporites laevigatus*	6200'
11.	?Dinoflagellate cyst	6500'
12.	*Zebrasporites interscriptus*	6500'
13.	?Dinoflagellate cyst	6600'

PLATE 1

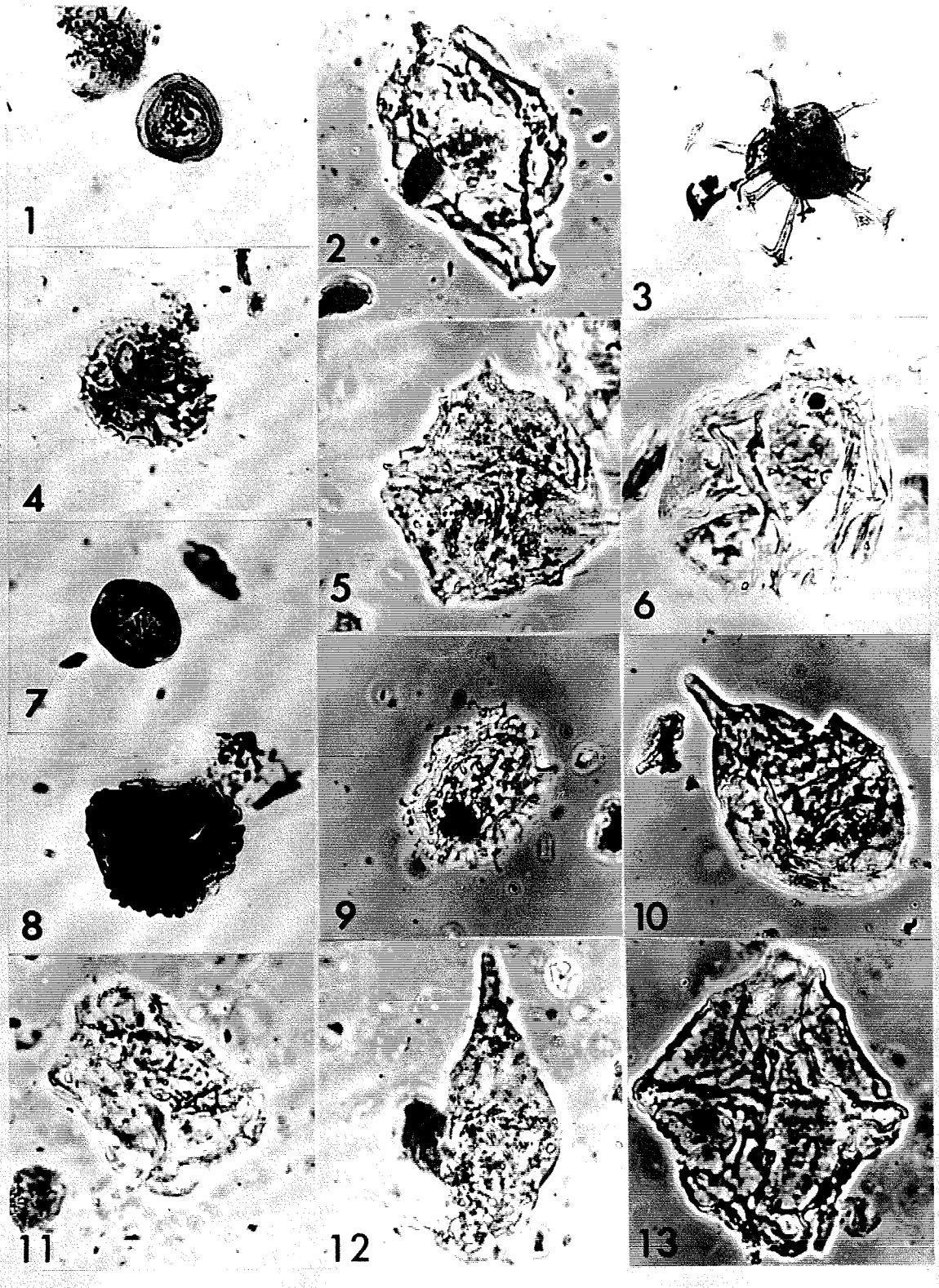

PLATE 2

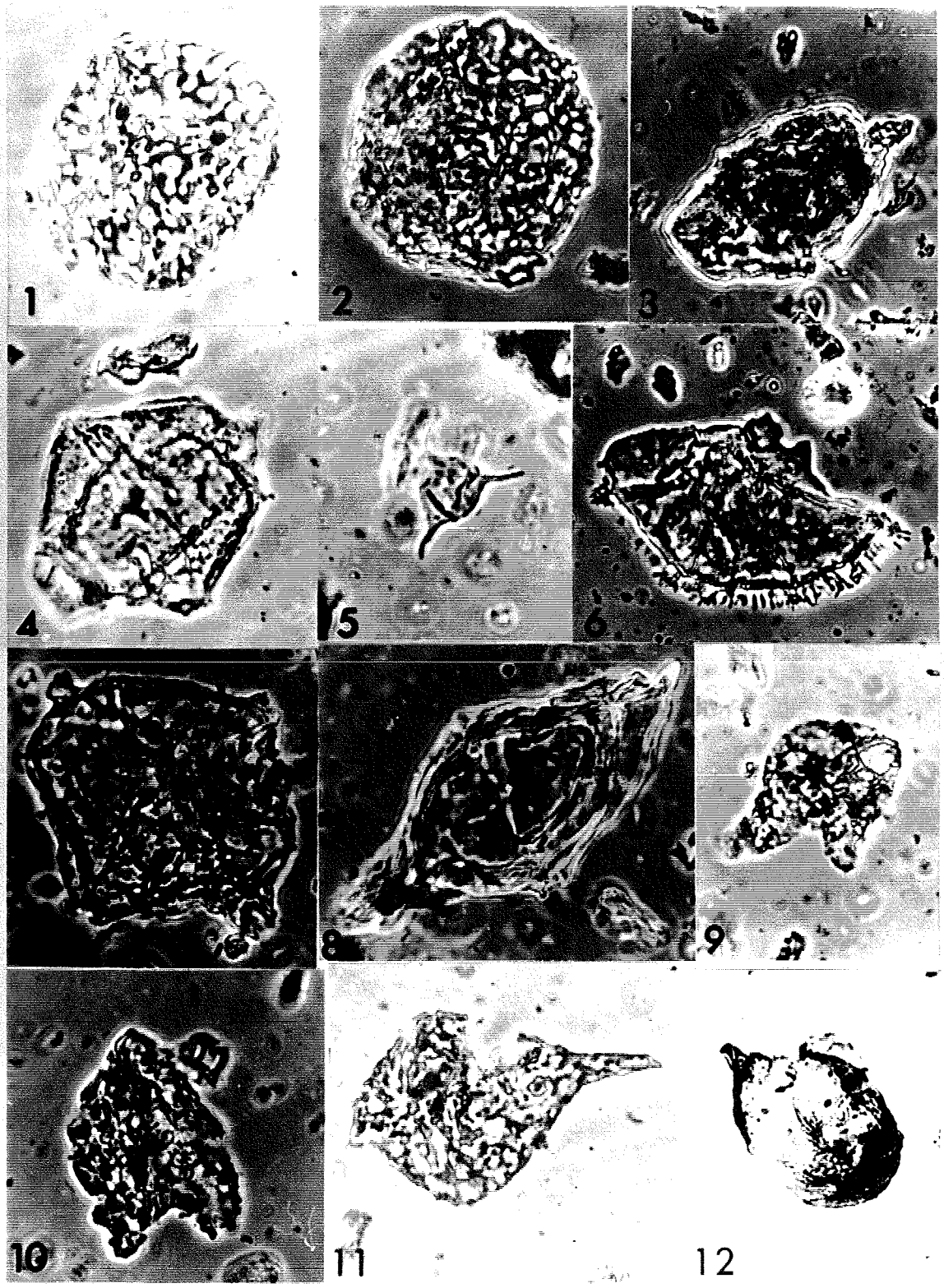
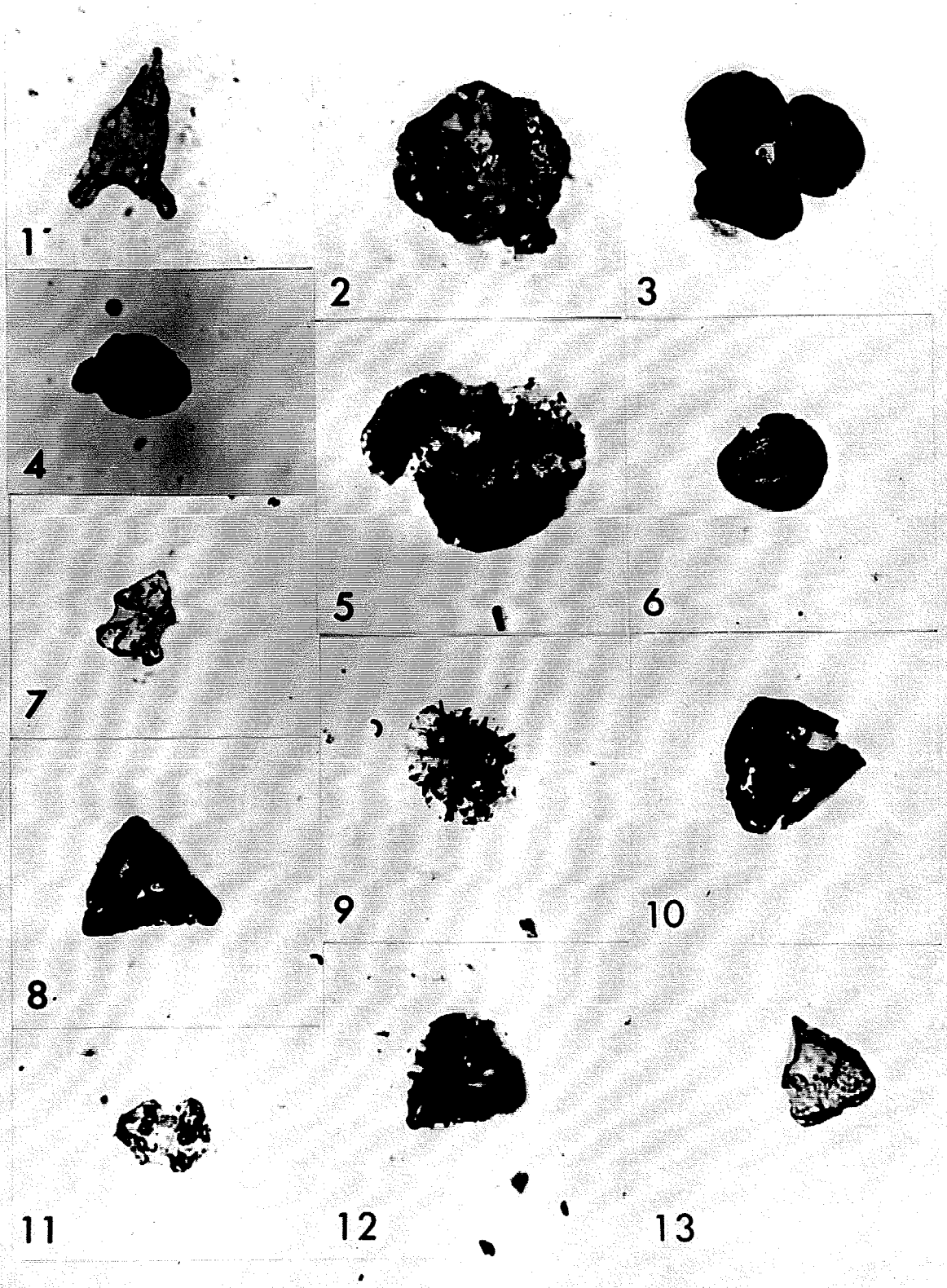
PLATE 3