Geological Survey of Victoria

Subsurface stratigraphy of the Nepean Peninsula

by

G. R. Holdgate

NOT FOR LOAN

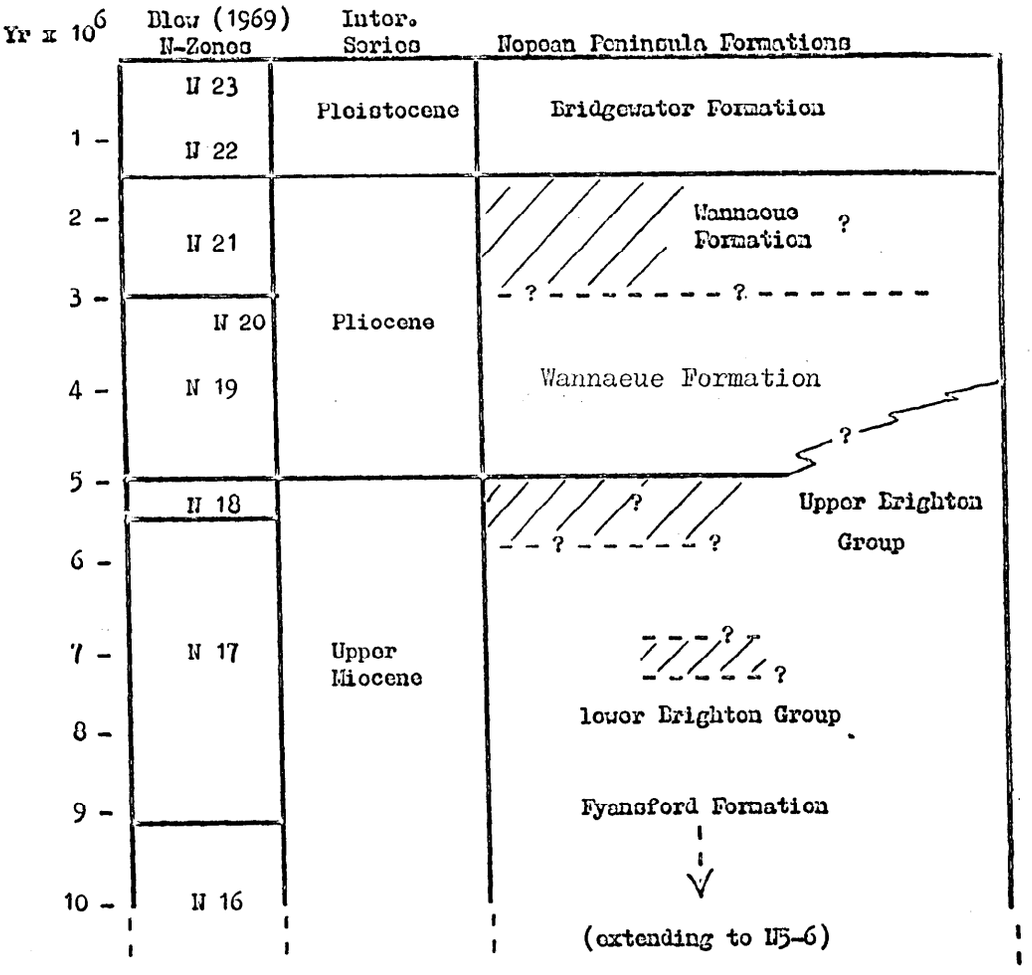
NOT FOR LOAN

Unpublished Report 1976/

June 1976/34

BIOSTRATIGRAPHY

The following table places the lithostratigraphic units of the Nopean Peninsula against the foraminiferal zone sequence of Blow (1969), and world time stratigraphic series and ages.



The following tables show foraminifera identified from selected bores on the Nopean Peninsula. All the samples were washed and floated in CCl_4, and the planktonic foraminifera picked and mounted onto faunal slides. Identifications were initially made by the author and subsequently checked and confirmed by C. Mallett (Holb. Univ. Geology Dept.) and C. Abele. The following identifications were kindly given by C. Mallett.

B= Bridgewater Formation   G = Brighton Group
W = Wannaeue Formation   F = Fyansford Formation

WANNAEUE 12 BORE

SAMPLE DEPTH	SPECIES Globigerina bradyi	bulloides	circularis	decoraperta	druryi	falconensis	foliata	juvenilis	nepenthes	praebulloides	quinqueloba	rubescens	Globigerinita glutinata	Globorotalia acostaensis	conomiozea	continuosa
20-40		x														
100-105		x										cf			x	
125-130																
195-200		x									x	x				x
W210-215		x														
W220-225		x				cf						x		x		x
240-245		x				x						x		x	x	
265-270	x	x					x				x	x				
280-285	x	x					x				x					
290-295				x	x		x		cf		x	x		x		
300-305		x														
325-330		x		x			x									
350-355																
F440-445	x	x		x	x		x	x		x	x			cf		x
F465-470		x	x	x	x						x		x	cf		x
F495-500		x		x	x	x			x	x	x			cf		x
F525-530		x		x	x	x			x	x	x			cf		x

SAMPLE DEPTH	crassaformis	crassula	crassula viola	hirsuta	inflata	mayeri	m'garitae	merotumida	miotumida	obesa	praehirsuta	scitula	subscitula	truncatulinoides	Globigerinoides elongatus	gomitulus	ruber	trilobus	Globoquadrina dehiscens	Orbulina suturalis	universa	Pulleniatina primalis	Sphaeroidinella sp.
20-40				x																			
100-105	x													x				x		x			
125-130																							
195-200				x	x	x								x				x					x
W210-215																		x					
W220-225																		x	x				
240-245	x							x			x							x	x	x	x		x
265-270	x		x		x	x							x					x	x				
280-285	x	x				x						x			x			x	x				
290-295			x			x											x	x	x	x	x		x
300-305					x													x		x			
325-330						x										x	x	x	x	x		cf	
350-355																		x					
F440-445						x			x									x	x	x			
F465-470						x			cf							x		x	x				
F495-500								x		x								x	x				
F525-530																		x	x	x	x		

WANNAEUE 13 BORE

SAMPLE DEPTH	SPECIES Globigerina bradyi	bulloides	circularis	decoraperta	druryi	falconensis	foliata	juvenilis	nepenthes	praebulloides	quinqueloba	rubescens	Globigerinita glutinata	Globorotalia acostaensis	conomiozea	continuosa
290-295				x	x		x					x				
315-320	x			x							x					
350-355		x		x										cf		
385-390		x									x					
475-480				x		x		x			x	cf				x
490-495		x			x		x				x	x				
520-525		x				x					x					x
525-530				x	x						x					
535		x			x						x					x

SAMPLE DEPTH	crassaformis	crassula	crassula viola	hirsuta	inflata	mayeri	m'garitae	merotumida	miotumida	obesa	praehirsuta	scitula	subscitula	truncatulinoides	Globigerinoides elongatus	gomitulus	ruber	trilobus	Globoquadrina dehiscens	Orbulina suturalis	universa	Pulleniatina primalis	Sphaeroidinella sp.
290-295		x			x	x			x				x			x		x	x	x	x		x
315-320		x								x								x	x	x	x		
350-355																		x	x	x			
385-390					x													x					
475-480													cf					x	x	x	x		
490-495										x			cf					x	x	x	x		
520-525																							
525-530																		x	x		x		
535																			x				

B = Bridgewater Formation G = Brighton Group
W = Wannaeue Formation F = Fyansford Formation

WANNAEUE 17 BORE

SAMPLE DEPTH	SPECIES Globigerina bulloides	circularis	decoraperta	druryi	falconensis	foliata	juvenilis	nepenthes	praebulloides	quinqueloba	rubescens	Globigerinita glutinata	Globorotalia acostaensis	conomiozea	continuosa	crassaformis	crassula	crassula viola
W 255-260				x						x	cf		x				x	
W 285-290			x		cf	cf							x			x	x	

SAMPLE DEPTH	hirsuta	inflata	mayeri	margaritae	merotumida	miotumida	obesa	praehirsuta	scitula	subscitula	truncatulinoides	Globigerinoides elongatus	gremitulus	ruber	trilobus	Globoquadrina dehiscens	Orbulina suturalis	universa	Pulleniatina primalis	Sphaeroidinella sp.
W 255-260		x	x	x	x										x	x		x		
W 285-290	x	x		x		x									x	x	x	x		x

NEPEAN 29 BORE

SAMPLE DEPTH	SPECIES Globigerina bulloides	circularis	decoraperta	druryi	falconensis	foliata	juvenilis	nepenthes	praebulloides	quinqueloba	rubescens	Globigerinita glutinata	Globorotalia acostaensis	conomiozea	continuosa	crassaformis	crassula	crassula viola
B 90-100																		
B 130-140																		
B/W 330-340																x		

SAMPLE DEPTH	hirsuta	inflata	mayeri	margaritae	merotumida	miotumida	obesa	praehirsuta	scitula	subscitula	truncatulinoides	Globigerinoides elongatus	gremitulus	ruber	trilobus	Globoquadrina dehiscens	Orbulina suturalis	universa	Pulleniatina primalis	Sphaeroidinella sp.
B 90-100											x									
B 130-140											x									
B/W 330-340		x									x									

The following molluscan species were kindly identified by T. Darragh (National Museum) from bores on the peninsula. Accompanying the identifications was the following note -

"The fauna as a whole is typical of shallow water and sandy to muddy bottoms with the exception of Wannaeue 12 (270-280') which has three species characteristic of rocky bottoms and three species characteristic of mud flats.

Overall the fauna consists entirely of species living on the Victorian coast with the single and important exception of Zenatiopsis ultima, which is known from late Pliocene to early Pleistocene. The genus is extinct. The only other species to warrant mention is Anadara trapezia which occurs with Zenatiopsis in Wannaeue 12 (280-290'). This genus is thought to have arrived in southern Australia during the last interglacial and I know of no record in the Pliocene or lower Pleistocene. The anomaly may be owing to contamination or lack of precise knowledge of the stratigraphic distribution of the species".

Wannaeue 11 (230 - 235') - Wannaeue Formation

Katelysia peronii
* Zeacumtus diemensis
Austrocochlea constricta
Austrocochlea adelaidensis
Cominella lineata
Parcanassa pauperata

Wannaeue 12 (240 - 260') - Wannaeue Formation

* Scaeoleda crassa
Glycymeris sp.
Mytilus sp.
Mactra sp.
Notocorbula stolata
* Bankivia fasciata
* Zeacumantus diemensis
Dialo pagodula
Cacozeliana granaria

Wannaeue 12 (270 - 280') - Wannaeue Formation

Ostrea sp.
Austrocochlea constricta
Bembicium melanostomum
* Zeacumantus diemensis
Velacumantus australis
Notocypraea angustata
Cominella lineolata
* Niotha pyrrhus

Wannaeue 12 (280 - 290') - Wannaeue Formation

* Scaeoleda crassa
Anadara trapezia
Barbatia pistachia
Ostrea sp.
Placamen sp.
Tawera sp.
Gemphina undulosa
Mactra pura
Mactra rufescens
Zenatiopsis sp.
Notospisula parva
Donacilla cerycinaea
* Bankivia fasciata
Ctenocolpus australis
Zeacrypta immersa

Wannaeue 12 (290 - 300') - Wannaeue Formation

* Scaeoleda crassa
Glycymeris striatularis (Lamarck)
Katelysia peronii (Lamarck)
Phacosoma cerulea
Mactra australis Lamarck
* Bankivia fasciata (Menke)
* Niotha pyrrhus

Wannaeue 12 (350 - 355') - Wannaeue Formation

Ostrea sp.
Notospisula parva
Donacilla cerycinaea
Zenatiopsis ultima
Sigapatella calyptraeformis
* Niotha pyrrhus

Wannaeue 14 (195 - 210') - Bridgewater Formation

Indeterminate

Fingal 26 (70 - 80') - Bridgewater Formation

Katelysia scalarina

Fingal 26 (88 - 90') - Bridgewater Formation

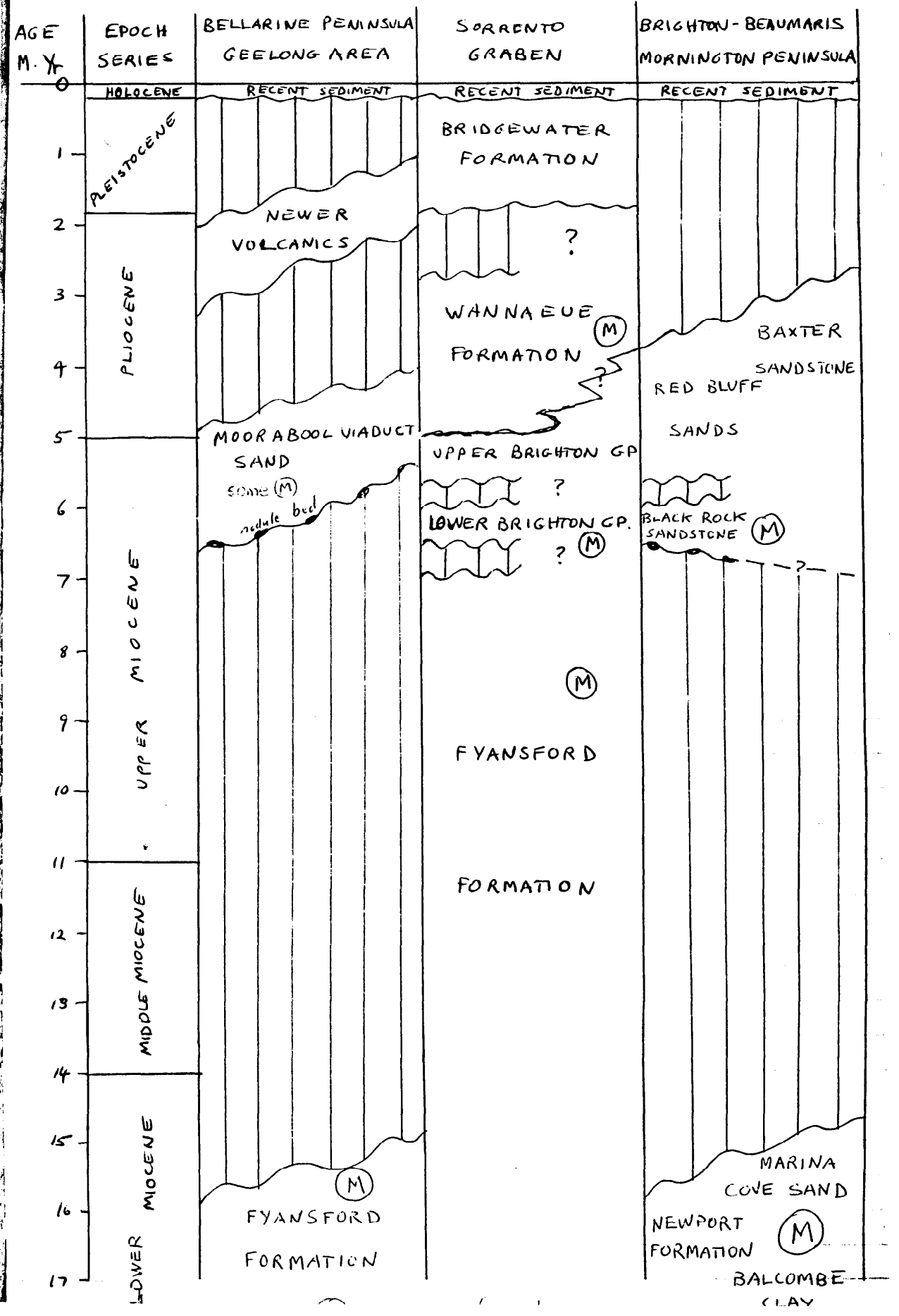
Fulvia tenuicostata
Pyrazus obininus
* Zeacumantus diemenensis

Note: Species common to the Whalers Bluff Formation at Portland (Singleton et al 1974) are asterisked.

Discussion - the ages of the Nepean Peninsula formations

(1) The Bridgewater Formation is dated by foraminifera to be Pleistocene in age by the occurrence of the Quaternary index fossil. Globorotalia truncatulinoides (N22 foraminiferal zone of Blow, 1969).

STRATIGRAPHIC AGES PORT PHILLIP BAY



Placing the Bridgewater Formation within any part of the Pleistocene is not possible at this stage, although it could well lie within the lower to middle Pleistocene age range attributed to the Warrnambool Aeolianite (McDougall and Gill, 1975). It contains some marine beds indicating there were marine transgressions over the top of the growing aeolianites which are probably the result of interglacial sea level rises. To determine the complex Pleistocene history recorded within this formation would be beyond the scope of this paper but would certainly make an interesting future study.

(2) The Wannaeue Formation is dated by foraminifera to be Pliocene in age by the occurrence of the Globorotalia crassaformis inflata complex in conjunction with Globorotalia hirsuta praehirsuta, and the absence of Globorotalia truncatulinoides (N 19 (20) foraminiferal zones of Blow, 1969). The absence of Globorotalia tosaensis suggests that N21 is absent in this area and there is a time break of approximately 1 x 10^6 years between the top of the Wannaeue Formation and the base of the Bridgewater Formation. Alternatively G. tosaensis may be absent due to some environmental reason and the Wannaeue Formation extends through to the Upper Pliocene. The gradational contact between the top of the Wannaeue Formation (Pliocene) and the base of the Bridgewater Formation (Pleistocene) in some bores favours this latter idea. The molluscan faunas from this formation contain mainly species still living with the exception of the now extinct species of Zenatiopsis ultima, thought to indicate a late Pliocene to early Pleistocene age. However its occurrence in the Whalers Bluff Formation at Portland (Singleton et al 1974) dated by foraminifera and confirmed by basalt dating to be N19 in age indicates its range extends down to the early Pliocene.

A number of the foraminifera recovered from the Wannaeue Formation are reworked species from older formations and reflect the relatively high energies prevailing at the time. In the bores examined the middle and upper sections of the formation contain the best foraminiferal assemblages, whilst the lower sections of the formation show only depleted forms, often dominated by the benthonic Ammonia beccarii which indicates very shallow water - low salinity conditions.

(3) The upper Brighton Group contains almost no foraminiferal or molluscan faunas and cannot be dated. However for lithostratigraphic reasons in some bores it could partly be a time equivalent to lower sections of the Wannaeue Formation. A study of its content of macro and micro flora could help elucidate this problem.

(4) The lower Brighton Group almost presents a similar problem to the upper Brighton Group as although it contains some faunas, in the samples examined so far nothing really diagnostic has been found. The microfauna recovered tends to resemble that found at the top of the Fyansford Formation than from the Wannacue Formation which could indicate a time break at the top of or within the Brighton Group. Species identified suggest the lower Brighton Group to range as high as low N17 (C. Mallett pers. comm.) i.e. Upper Miocene. Better sampling and coring in future bore holes may resolve this problem.

(5) The Fyansford Formation contains a well represented marine fauna throughout, which has been the subject of some attention by previous micro palaeontologists including Chapman (1928), Carter (1954), Nicholls (1968) and Abele (1976). Hence it is reliably dated, and ranges from Upper Miocene (N.16) down to at least N5 and 6 (Lower Miocene) which is as deep as the bores have gone on the peninsula.

Structure of southern Port Phillip and its effects on patterns of sedimentation

The Sorrento graben is bounded by two major faults - the Selwyn Fault on the east and the Bellarine Fault to the west. Movements in the graben relative to the Mornington and Bellarine horsts takes place along these fault planes. The variations between the stratigraphies on the horsts to that in the graben reflect these relative movements i.e. similar stratigraphies indicate periods of few movements, dissimilar stratigraphies reflect periods of pronounced movement.

The direction of movements are predominantly downwards in the Sorrento graben, whereas the horsts may remain static, or else have some small upward component.

Seismic evidence seawards of the Nepean Peninsula suggests that sedimentation and sinking rates are faster in the centre of the graben than at the edges, and that progressively older sediment markers show progressively greater amounts of downwarp. Sea floor profiles reflect this sinking pattern, with the deepest waters over the centre of the graben, indicating these factors are still operating today.

The rate of sinking appears to be roughly constant through geological time (controlled by isostacy of the crust beneath and sediment compaction), but can be effected from time to time by periodic movements taking place along the