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THE STRATIGRAPHY AND PALAEONTOLOGY OF THE SUBSURFACE DEPOSITS OF THE ADELAIDE PLAINS

by

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THE STRATIGRAPHY AND PALAEONTOLOGY OF THE SUBSURFACE DEPOSITS OF THE ADELAIDE PLAINS

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and

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I. INTRODUCTION.

The material submitted for examination came from 35 bores which were drilled in the Adelaide Plains by the South Australian Department of Mines during 1945 and 1946. For comparative purposes, material has also been examined from several bores previously drilled in the area.

The bores were sunk for water for agricultural uses and for implementing the Adelaide water supply. The area drilled extended from Bore No. 69 at Royal Park northwest of Adelaide, eleven miles south to Ivimey's Bore at Warrndale, Hundred of Noarlunga, with a maximum width of four miles from Bore No. 80 at the entrance to the Torrens Viaduct east to Nathan Brewery Bore on the Torrens River.

The shallowest bore was Ackland's near Black Forest which reached the depth of 160 feet and the deepest was Bore No. 65, Wolseley Plantation which was drilled to 620 feet. The bores passed through sediments of Recent, Pleistocene, Pliocene and Miocene ages. The sediments consisted of yellowish unfossiliferous and fossiliferous sands, yellowish calcareous sandstone, grey fossiliferous sandstones, cream to ochreous bryozoal sandstones and limestone, grey marls and greenish grey glauconitic sandstone.

The fragmentary nature of the majority of the fossils especially the molluscs in the Pliocene ("Adelaidean") frequently made specific determinations difficult. This was partially overcome by comparison with material from other bores.

II. STRATIGRAPHIC SEQUENCE.

No bore was drilled to bedrock, and no complete suite of

samples was collected from the surface down to the base of the Pleistocene or to the top of the Pliocene. Consequently the exact thickness of deposits representing Recent, Pleistocene, Pliocene and Miocene can only be estimated.

A. Recent.

The only bore which showed material definitely referable to Recent was Weymouth's, the sample 0 to 15 feet containing minute shallow water foraminifera and mollusca, the dominant mollusca being the common sand-cockle Katelysia scalarina (Lam.). From information derived from earlier bores, the Recent deposits covering the area may be up to 100 feet thick.

B. Pleistocene.

The highest samples submitted from all bores other than Weymouth's belong to the Pleistocene. On information derived from the bore samples it is difficult to give any definite thickness of these deposits, but it is estimated that they are possibly about 250 feet. The samples available consisted of yellowish sands which were mainly unfossiliferous. Minute shallow water foraminifera were recognised in Bore No. 41 at 340 feet and Pleistocene mollusca were noted in Bore No. 20 at 345-362 feet. Outcrops of Pleistocene rocks occur in the old Adelaide Quarry in the University grounds, and occurred near the surface in many excavations in the central city area.

C. Pliocene.

Deposits of Pliocene age are extensively developed under the Adelaide Plains. Outcrops are not known in the Adelaide Basin but they occur at localities further to the south at Hallett's Cove and in the upper portion of the Christie's Beach, Port Noarlunga and Aldinga sections. The beds contain a characteristic assemblage of foraminifera and mollusca and in 1929 Howchin created the name "Adelaidean" for the horizon.

The "Adelaidean" is represented by two beds in the bores -

(1) an upper one consisting of a few typical foraminifera and

molluscs, and

(2) a lower one consisting of grey sandstone containing a rich assemblage of foraminifera and molluscs, together with an incidental associated fauna.

In the southern portion of the Basin this lower bed is represented by a coarse grey, hard to friable, calcareous sandstone containing numerous foraminifera and molluscs indicative of a shoreline deposit. To the north in the vicinity of Salisbury, deeper water conditions prevailed and the sediment is a very fine sandstone extremely rich in the foraminifer Marginopora vertebralis and well preserved molluscs. Samples from this bore have been examined and the results are included in this report.

There is a slight variation in the depths at which the "Adelaidean" was first met with in bores in the northern part of the area, but the average is about 350 feet. In this northern part the shallowest depth was 301 feet in Bore No. 69, the most northerly bore to be examined in detail and the deepest at 426 feet in Bore No. 188. The greatest thickness was in Bore No. 65, Wolseley Plantation, where 183 feet of "Adelaidean" beds were determined, before the bore passed into the Miocene. The only other bore in which the thickness of this deposit could be estimated was in Nathan Brewery Bore where the Miocene was not encountered until 150 feet of richly fossiliferous beds had been passed through.

Evidence derived from the fossil fauna gives every indication of deposition under tropical, marine, clear, shallow water bay conditions. The absence of currents is supported by the fact that there is an almost complete lack of bryozoa, which only thrive in circulating waters. The fossil fauna will be discussed in Section III.

D. Miocene.

The lithology of the Miocene deposits in the bores varies from cream to grey bryozoal limestones and sandstones in Bores Nos. 36 and 65 and in Nathan Brewery Bore in grey marl and dark

green glauconitic sandstone at the base of Ivimey's Bore.

Miocene sediments occurred in two deep bores in the northern half of the area, in Bore No. 65 at 568 feet and in Nathan Brewery Bore at 500 feet, and in eight in the southern part at depths varying from 100 feet in Bore No. 47 to 271 feet in Amber's Bore. Based on the occurrence of certain zonal foraminifera the actual thickness of Miocene rocks passed through in the bores, amounted to approximately 330 feet.

It has been possible to divide the Miocene deposits into three zones determined by the foraminifera. These will be discussed when dealing with the Miocene fossil assemblage in Section V.

III. THE FOSSIL FAUNA OF THE "ADELAIDEAN".

The calcareous sandstones which comprise the "Adelaidean" contain assemblages of foraminifera and molluscs which are distinct as far as the Tertiary deposits of southeastern Australia are concerned. There is every indication that these assemblages will be found in rocks west of Adelaide. The age of the "Adelaidean" will be discussed in Section IV.

A. Microfossils.

Although microfossils such as the calcareous alga *Lithothamnium ramosissimum* and a few ostracods are recorded in the "Adelaidean" sandstones, the main group is the foraminifera which will be discussed in some detail.

Foraminifera.

Eighty-one species of foraminifera were determined in the "Adelaidean" sediments. Of these, fifty-one have a stratigraphic range from Miocene to Recent in the Australian region, fifteen range from Adelaidean to Recent, five are typical of the Kalimnan (Lower Pliocene) of Victoria and two are restricted to the "Adelaidean".

A characteristic assemblage of species is always present. The majority of these were described by Howchin and Parr (1938) in their paper on the foraminifera in the Abattoirs Bore.

Species included in this "Adelaidean" assemblage are:-

Quinqueloculina adelaidensis Howchin and Parr
Quinqueloculina sumophila Parr
Flintina triquetra (Brady)
Massilina lapidigera (Howchin and Parr)
Clavulina multicamerata Chapman
Valvulina fusca Williamson
Valvulina cf. triangularis d'Orb.
Cribrobulimina polystoma (Parker and Jones)
Tubecularia lucifuga de France var. lapidea Wiesner
Marginopora vertebrelis Blainville
Soritos marginalis (Lam.)
Sorosphaera planatum (F.& M.)
Planispirella polystomelloides (Parker and Jones)
Discorbis cycloclypeus Howchin and Parr
Discorbis acervulinoides Parr
Discorbis dimidiatus (Parker and Jones)
Rotalia beccarii (Linne)
Elphidium adelaidense Howchin and Parr
Elphidium rotatum Howchin and Parr

Frequently associated with this distinct assemblage are numerous Miliolida such as Quinqueloculina lamarckiana, Q.seminulum, Q. polygona, Q. disparilis, Triloculina tricarinata, T. trigonula, and Spiroloculina antillarum together with Sigmoidella kagaensis, S. elegantissima, Notorotalia clathrata and Elphidium crispum.

An analysis of the range of the more important species in the "Adelaidean" is as follows:-

Species restricted to the Adelaidean.

Quinqueloculina adelaidensis
Valvulina cf. triangularis

Species ranging from Miocene (Middle Miocene and Upper Miocene) to Adelaidean.

Guttulina regina var. crassicostata
Discorbis cycloclypeus
Pseudopolymorphina dosnei
Lobatonion australe
Elphidium adelaidense
Elphidium chapmani

Species characteristic of the Kalimnan and Adelaidean.

Flintina intermedia
Massilina lapidigera
Quinqueloculina sumophila
Guttulina regina var. crassicostata
Baggina philippinensis

Species previously restricted to the Kalimnan.

Flintina intermedia

Species ranging from Kalimnan to Recent.

Quinqueloculina costata
Clavulina multicamerata
Discorbis dimidiatus
Discorbis acervulinoides
Notorotalia clathrata
Elphidium advenum

Species ranging from Adelaidean to Recent.

Quinqueloculina disparilis
Quinqueloculina limbata
Quinqueloculina bosciana
Miliolina australis
Flintina triquetra
Spiroloculina excavata
Spiroloculina circularis
Valvulina fusca
Cribrobulimina polystoma
Lamarckina lucifuga
Lamarckina lucifuga var. lapidea
Cancroplia planatus
Borites marginalis
Elphidium rotatum
Elphidium argenteum

Species listed from Adelaidean - 80

Range.	No. of Species.
Miocene to Recent in Australia -	50
Miocene to Adelaidean -	6
Restricted to Kalimnan -	1
Kalimnan to Recent -	6
Adelaidean to Recent -	15
Restricted to Adelaidean -	2
Total	80

All the species ranging from Miocene to Recent, are widely distributed in Recent deposits.

B. Macrofossils.

1. Mollusca.

This report deals only with the Mollusca obtained from bores submitted for examination by the Department of Mines and covers 147 species, most of them characteristic of the Adelaidean. Much of the material is fragmentary. In order to verify identifications and to prepare for future studies, material from rich bores such as the Abattoirs Bore and Salisbury Bore have been examined and many new and remarkable species found in them, may be described later.

The total number of species recorded from the Adelaidean, including all bores so far examined, is 309, comprising Pelecypoda 113, Scaphopoda 5, Crepipoda 6 and Gastropoda 185 species.

Species restricted to the Adelaidean.

Arca sp. nov.		Astele fanaticum	
Barbatia sp. nov.	a	Pulchrastele planiconicum	
Barbatia sp. nov.	b	Ethminolia perglobosa	
Tucetilla sp. nov.		Cana sp. nov.	
Tucetona sp. nov.		Sequenzia sp. nov.	

Velatucosta subradians
Brachyodontes pappenkeana
Atrina semicostata
Equichlamys consobrinus
Amusium lucens
Spondylus spondyloides
Neotrigonia sp. nov.
Cuna sp. nov.
Hallucina simulans
Miltheidea grandis
Divalucina sp. nov.
Kellia planiusculum
Anticona pernitida
Anapella variabilis
Notocorbula equivalvis
Myadora sp. nov.
Paradentalium howchini
Zoplax adelaidae
Tugalia sp. nov.
Tugalia infortunata
Isoclanculus quadricingulatus
Isoclanculus eucarinatus
Phasianotrochus subsimplex
Calthalotia fictilis

Herpetopoma pliocenica
Partubiola depressispira
Bellastraea sp. nov.
Nina sp. nov.
Phenacolepas tila
Gazameda adelaidensis
Gazameda subcricula
Maoricolpus subrudis
Ctenocolpus trilix
Glyptozaria sp. nov.
Terebralia adelaidensis
Terebralia fallax
Glyphaomorus bivaricatus
Manulona lirasuturalis
Heraldia incommoda
Turbonilla subfusca
Sabia sp. nov.
Capulus sp. nov.
Uber balteatella
Uber sp. nov.
Ellatrivia cirrata
Cymatiella adelaidensis
Adamitrella insolentior
Zemitrella muscula
Cominella subfilicea
Austromitra angusticostata
Austroharpa tatei
Veratuaria bisculptus
Tomopleura ludbrookae
Maoritomella cutana

Species ranging from Miocene to Adelaidean.

Versinella beaumariensis
Versinella maccoyi
Mimachlamys peroni
Mimachlamys antiaustralis
Hinnites corioensis
Ctenamusium atkinsoni
Monia tatei
Cardita compta
Cardita kalimnae
Venericardia dennanti
Pratulum hemimeris
Dosinia johnstoni
Placamen cainozoica
Placamen subroboratum
Psammobia hamiltonensis
Solecurtus dennanti
Notocorbula ephamilla
Myadora tenuilirata
Verticordia pectinata
Cuspidaria vellicata
Cosmetalepas malleata
Entomella delicatissima
Entomella dennanti
Heliacus wannonensis
Neodiastoma provisi
Uber subsolidum
Tonna hamiltonensis
Ellatrivia minima

Hypocassis textilis
Hypocassis exigua
Mayrina ornatum
Chicoreus biconicus
Cyphonochilus rugucostatus
Fetiquassa tatei
Cupidoliva nymphalis
Baryspira pseudaustralis
Baryspira tatei
Ossavira tatei
Marginella micula
Conus hamiltonensis
Acteon scrobiculatus
Semiacteon microplocus
Adamnestia angustata
Colus dictyotis
Typhis maccoyi
Typhis laciniatus
Fasciolaria cryptoploca

Characteristic Kalimnan species in the Adelaidean.

Nunucula kalimnae
Scaeoleda woodsii
Cucullaea praelonga

Austromactra hamiltonensis
Austromactra axiniformis
Zenatiopsis angustata

Verginella affinitilis
Trichomya hamiltonensis
Pinctada crassicardia
Ostrea arenicola
Emarginatella camura
Venericardia trigonalis
Striacallista submultistriata
Callanaitis paucirugata
Proxichione cognata
Bankivia howitti
Subninella grangensis
Phasianella dennanti
Gazameda multiangulatus
Propesinum crassum
Marginella hordacea
Temnoplaura dilectoides

Species ranging from Kalimnan to Recent.

Chionerya cardioides

Species ranging from Adelaidean to Recent.

Scaeoleda verconis
Lissarca rubricata
Regozara cygnorum
Miernatrea rutidoloma
Gazameda iredalei
Siliquaria australis
Vermicularia sipho
Zescumantus diemenensis
Cacozeliana granaria
Hypotrochus monachus
Hypotrochus penetricinctus
Syrnola bifasciata
Leucrypta immersa.

Range of Species.

Miocene to Recent	0	0
Miocene to Adelaidean	47	32%
Characteristic Kalimnan species in the Adelaidean	22	14%
Kalimnan to Recent	1	1%
Adelaidean to Recent	13	9%
Restricted to Adelaidean	64	44%
	147	100

Analysis of Species.

Almost half the molluscs identified from the bores (44%) are restricted to the Adelaidean. From a preliminary survey, it seems probable that an examination of long series may prove certain Miocene and Recent molluscs listed, to be different from the Adelaidean species and so the predominant proportion of Adelaidean species may be further increased. About one third of the species (32%) range from the Miocene to Adelaidean. Those ranging from Kalimnan to Adelaidean represent about one seventh (14%) of the fauna, while only one ranges from the Kalimnan to Recent. About one tenth (9%) are Recent species found in the Adelaidean. These latter are comparatively common kinds in which differences between Adelaidean and Recent series would be difficult to detect without intensive study. But here again, further examination may reduce this proportion and add to those species restricted to the Adelaidean.

The conclusion to be drawn from these facts would be that the Adelaidean Mollusca represent a distinct fauna readily separable from the Recent and from the Miocene.

Analysis of Genera.

Essentially tropical and warm sea genera of Indo-Pacific facies represented in the bores are Arca, Amusium, Pinctada (Pearl Oyster) Nina, Terebralia, Clypeomorus all of which are not found living in Recent Southern Australian Seas, so that the Adelaidean may be described as a tropical Indo-Pacific fauna.

The presence of the genus Terebralia suggests tropical mud-flat of mangrove swamp conditions, but the bulk of the fauna is of the clear, sandy bay type. Weed living species such as Phasianella and Phasianotrochus are present and there are few reef shells such as Tugalia, Subninella and Cominella. There is no suggestion of a coral reef fauna.

Deep Water Mollusca.

The remarkably rich fauna from the depth of 330 feet in the Salisbury Bore is a deeper water community with well preserved species such as Pratulum hemimeris, Ctenamusium atkinsoni, Scaeoleda woodsii, Ennucula kalimnae, Cyphonochelus rugicostatus and Austroharpa tatei. Most of the smaller species recorded from the Adelaidean are represented, and some of them in quantity. There are no tropical mud-flat types nor are there any coral reef communities.

Species Dominant in the Aquifers.

The maximum water supply in the Pliocene is found in the rich shelly bed, but in bores such as Nathan Brewery Bore, it occurs in the top zone of the Miocene which is distinguished from the Pliocene by the abundance of bryozoa and the foraminiferal assemblage.

The dominant species in the Pliocene aquifer are:

1. Mollusca.

The pelecypoda, Ostrea arenicola, is present in most bores, if only as small fragments. In Bore No.19, at the depth of 486-490 feet, it is particularly abundant. The gasteropod, Neodiastoma provisi is also well represented in most bores and is usually common

at the same depths as O.arenicola, for example, in Bore No.19 at 486-490 feet.

2. Echinodermata.

Goniocidaris mortenseni (Kalimnan species)

3. Brachiopoda.

Magadinella woodsiana (Balcombian species)

4. Vermes.

Ditrupa wombetiensis (Upper Middle Miocene to Kalimnan species)

5. Cirripedia.

Balanus (Chirona) zelandicus
Balanus amphitrite acutus

(Kalimnan species recorded from Abbatoirs Bore)

6. Pisces.

Odontaspis contortidens
Carcharias (Prionodon) aculeatus
Myliobatis moorabbinensis
Lamna sp.

(Kalimnan species recorded from Abbatoirs Bore)

IV. AGE OF THE "ADELAIDEAN".

Since Howchin instituted the term "Adelaidean" in 1928, various opinions as to its position in the Pliocene have been put forward. At that time Howchin thought the deposit to be Upper Pliocene. Later, Hall and Pritchard and Chapman considered the Adelaidean to be equivalent of the Kalimnan of Victoria, and Lower Pliocene in age. Howchin in 1936 placed it in the Upper Pliocene and later Chapman agreed with Howchin that the beds were younger than Kalimnan but did not commit himself further. Howchin and Parr in 1938 considered them to be Upper Pliocene, basing their views on the Recent aspect of the foraminiferal assemblage. In 1937 Mrs. Ludbrook on evidence of the mollusca, was inclined to the view that the Adelaidean was Lower Pliocene. In 1941 she placed them in the Lower-Middle Pliocene.

The conclusion drawn by us after examination of material from 28 bores which passed through the beds is that the "Adelaidean" is Lower Pliocene in age. The fossiliferous sandstones were most probably deposited contemporaneously with the Lower Pliocene (Kalimnan) beds of Victoria, the change in faunal assemblages being

due to facies, not to age. The foraminiferal assemblage of Marginopora, Borites, Peneroplis and Miliolidae, which is a feature of the Adelaidean is common in the Indo-Pacific region and is found in limestones which range in age from the top of the Miocene to Recent, and the exact age of the rocks containing this assemblage can only be determined by known zonal species. Consequently, the percentage of Kalimnan species of foraminifera and mollusca in the Adelaidean assemblage is of considerable importance and gives the only basis upon which correlation with a deposit of known position in the Pliocene can be made.

V. THE FAUNA OF THE MIOCENE.

The most important group of microfossils in the Miocene deposits in the Adelaide Bores is the foraminifera. Bryozoa, which are not listed in detail, were very common in the limestones in the upper part of the Miocene section and were typical of Middle Miocene deposits in southeastern South Australia and Victoria. The few corals, brachipods and mollusca present were all known Middle Miocene species. As the fossils other than the foraminifera are of little importance in zoning the Miocene beds, they are not listed in detail.

Foraminifera.

One hundred and twenty six species of foraminifera were recognised in the beds and of these thirty-five ranged up to the Adelaidean. Species which have been described from the Middle Miocene in southeastern Australia and from earlier bores in the Adelaide Basin are listed below.

Austrotrillina howchini (Schlumberger)
Calcarina verrieulata (Howchin & Parr)
Cresaniella umbonifera (Howchin & Parr)
Operculina victoriensis Chapman & Parr
Carpenteria rotaliformis Chapman & Crespin
Planorbulinella plana (Heron-Allen & Earland)
Planorbulinella inaequilateralis (H-A. & E.)
Gypsina howchini Chapman
Rhonides scabriculus (Chapman)
Notorotalia howchini (Chapman, Parr & Collins)
Elphidium howchini Cushman
Elphidium parri Cushman
Elphidium pseudoinflatum Cushman
Frondicularia lorifera Chapman
Sigmoidella subregularis Howchin & Parr
Guttulina (Sigmoidina) silvestrii Cush & Ozawa
Pseudopolymorphina rutila Cush. var. parri C. & O.

Cibicides victoriensis Chapman, Parr & Collins.
Cancris ovatus Cushman
Candrvina (Pseudogaudryina) crespinae Cushman
Dorothia parri Cushman
Clavulinoides szaboi (Hantken) var. victoriensis Cush.
Sherbornina atkinsoni Chapman
Massilina torquayensis (Chapman)
Sigmilina victoriensis Cushman

The Middle Miocene section as compiled from the bores, can be divided into three zones based on the foraminifera.

1. Topmost zone or zone of Austrotrillina howchini. Associated species: Crespinella umbonifera, Marginopora vertebralis, Cycsina howchini, Calcarina verriculata, Planorbulinella plana, P. inaequilateralis, Cnorculina victoriensis, Amphistegina lessonii.

This assemblage is found at the top of the Miocene section immediately underlying the "Adelaidean" in Bore No.65 and Nathan Brewery Bore and at the first samples submitted for examination in Bore No.58, No.36, and Amber's Bore. So far no rocks containing the Zone 1 assemblage have been found in outcrop in the cliff sections south of Adelaide. It occurs in the Mallee Bore in Northwestern Victoria and in limestones west of Adelaide and as far north as Northwest Cape in Western Australia.

2. Middle zone or zone of Sherbornina atkinsoni. Associated species Calcarina verriculata, Planorbulinella plana, Cycsina howchini but less commonly than in Zone 1.

This assemblage occurs in Bores Nos. 29, 25, 36 and 47. It can be correlated with beds in the Aldinga section in which S.atkinsoni is a common species.

3. Lowest zone or zone of Massilina torquayensis. Associated species: Sherbornina atkinsoni (at top of zone) and several species of Miliolidae and Polymorphinidae.

This assemblage is present in Ivimey's bore (the most southerly bore to be examined), Ackland's Bore, Bore No.25 and Bore No.47. The zone can be correlated with the Janjukian deposits in Victoria.

VI. THE AGE OF THE MIOCENE BEDS.

The presence of the zonal foraminifera Austrotrillina howchini is of considerable importance in determining the age of the Miocene deposits in the Adelaide bores. A.howchini was described from

Clifton Bank, near Hamilton, Western Victoria where it was associated with abundant Lepidocyclinae, the species of which all belong to the subgenus Tryblioleniding. This subgenus is recognised throughout the Indo-Pacific region as the zone fossil for the topmost beds of the Miocene. The majority of the foraminiferal species found with A. howchini in the Adelaide Bores, such as Planorbulinella plana, P. inaequilateralis, Cyasina howchini and Calcarina verriculata, belong to the assemblage which characterises the Lepidocyclina (Tryblioleniding) horizon in Victoria which is now recognised as of Upper Middle Miocene age. The same assemblage has been found in the Northwest Australia.

The beds represented in Zone 3 in which Massilina tornueyensis is the zonal foraminifer most probably belongs to the middle part of the Middle Miocene, Zone 2 being a passage bed between Zones 1 and 3.

VII. STRUCTURE OF THE ADELAIDE BASIN.

A subsurface countour map of the area under discussion has been constructed with the key microfossil horizons as the basis. The key horison in the Lower Pliocene (Adelaidean) is the top of the grey calcareous sandstone which contains a typical assemblage of foraminifera and molluscs. The three zones which have been recognised in the Middle Miocene beds are also based on distinct foraminifera.

The bores in which the main aquifer occurs in the Adelaidean beds, are situated along the banks and chiefly north of the Torrens River which flows in a more or less westerly direction from Nathan Brewery Bore to St. Vincent's Gulf.

The conclusion drawn from this contour map is that this part of the Adelaide Basin has been subjected to Stepfaulting- the fault lines trending northeast-southwest. The northern line runs south of the Nathan Brewery Bore and Bore No. 83, and the south line, north of Bores Nos. 25 and 47 and Ackland's Bore.

The contours in the northern part of the map which are based on the key fossiliferous bed in the "Adelaidean" give the indication of a broard synclinal structure passing in a southwesterly direction

from Bore 69 to St. Vincent's Gulf. Shallow rolls within the syncline are indicated in Bores Nos. 41 and 21.

In the vicinity of Bore No.80, which is situated at the entrance to the Viaduct which gives the Torrens an outlet to the Gulf, there is an indication of a depression, Adelaidean beds being penetrated at a much greater depth than in the surrounding bores. Two other slight depressions occur in the vicinity of Bores No.19 along the Torrens Valley, and of Bore No.67 a mile and a half to the north.

Unfortunately samples from only 7 bores were available for examination on the south side of the fault and these bores are situated at distances varying from half a mile to two miles from each other. The contour used is taken as zero and is based on the lowest horizon in the Miocene which was recorded in Ivimey's Bore. The stratigraphical difference between the rich fossiliferous horison in the Pliocene and the foraminiferal horizon taken in the Miocene, is between 300 and 400 feet, the Miocene being the lower. The Pliocene in the main area contoured had been preserved through its being down faulted to the northwest.

The faulting probably took place during the Pleistocene.

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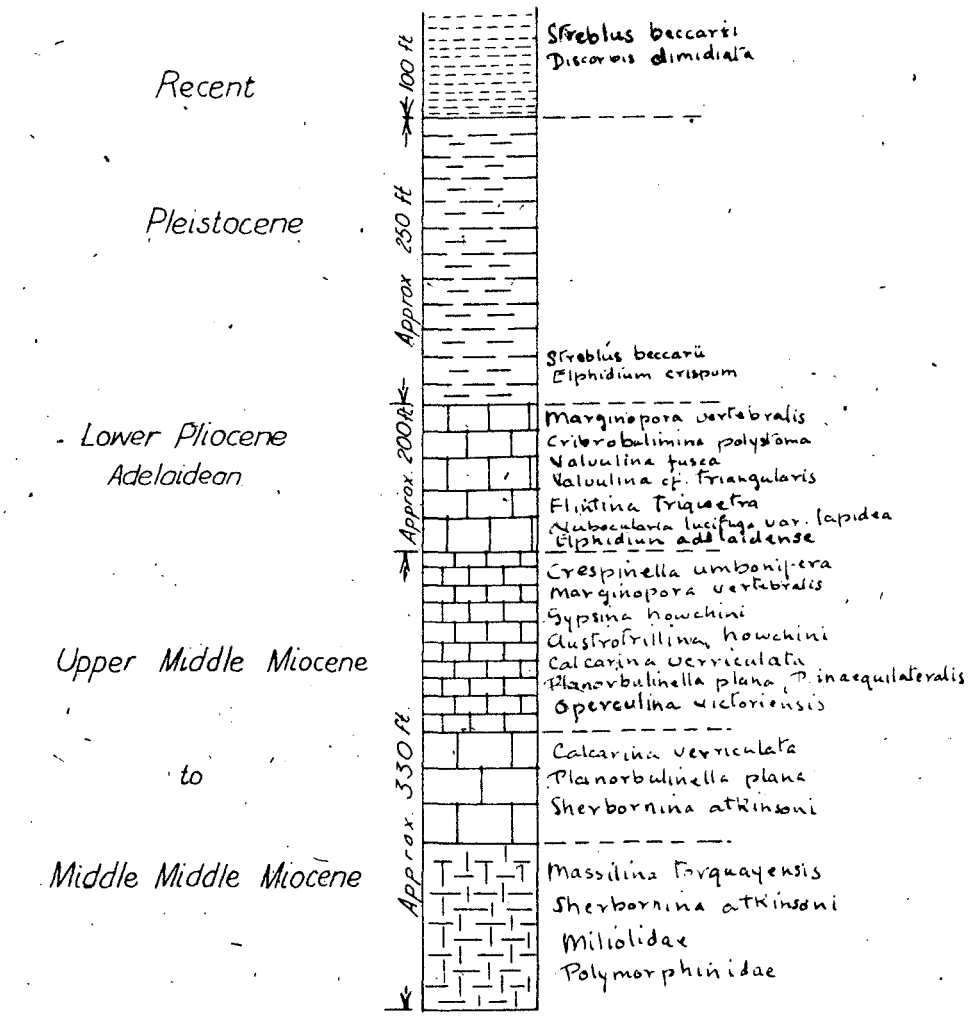
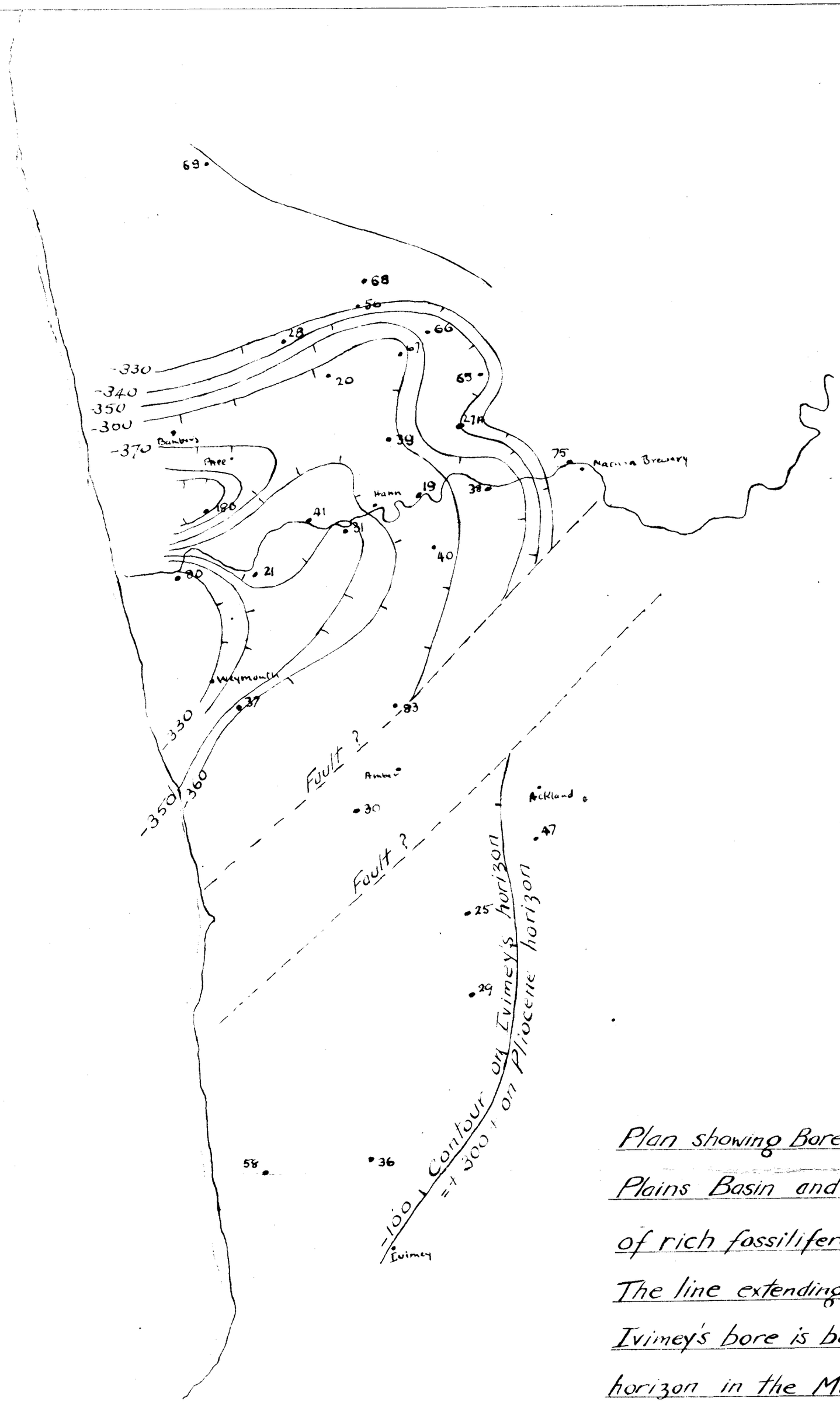
Diagrammatic Section showing

STRATIGRAPHIC SEQUENCE IN ADELAIDE BORES

WITH ZONAL FORAMINIFERAL ASSEMBLAGES.





Plan showing Bores in part of the Adelaide Plains Basin and Structural Contours on Top of rich fossiliferous horizon ("Adelaidean").

The line extending from near Ackland's bore to Ivimey's bore is based on the lowest foraminiferal horizon in the Miocene.

Datum for Structural Contours Sea Level (approx.)

Scale 1 inch = 1 mile. Plan prepared by I Crespin.