Stratigraphy and Geology of the Noarlunga Basin. by B. Daily. B.Sc.

Table of Contents.

Daily B Honours thesis 1952
Supervisor: M F Glaessner

Abstract.

A Cainozoic sedimentary record from Eocene to Recent is known in the Noarlunga Basin. Mapping, description and correlation of the surface formations has been attempted and the subsurface geology interpreted from available bore logs. A discussion on tectonics and sedimentation together with facies changes is given.

Introduction.

a. The Location

The Noarlunga Basin is a roughly triangular area of about 50 odd square miles situated to the south of Adelaide. It embraces portions of the Hundreds of Noarlunga and Willunga and is outlined by the Noarna Fault Scarp on the east, St. Vincents Gulf on the west and by the Eden Fault on the north.

Pre-Cambrian rocks occupy most of the area north a line running from the Christies Beach sand quarry, north-east to beyond the Happy Valley Reservoir. A few isolated Tertiary deposits cover the Pre-Cambrian in this area.

b. Previous Work

Previous reconnaissance work was carried out by T.G.B. Sprawn, H. Raggedow (1904), W. Howchin (1904, 1918, 1923) and in more recent times by R.C. Sprigg (1942). The latter produced a map showing the various boundaries for all the recognisable units and formations for of the Eden-Noarna Fault Block.

c. Nature and Scope of Investigations

The main purpose of investigation was to map the surface formations and correlate them with the standard successions of Christies Beach and Marlin-Aldinga Bays. At the same time the subsurface geology, structure and facies changes were [expected to be] studied in conjunction with the mapping.

d Field Mapping.

Field work [began in October 1952 of last year] was continued early [this year 1953]. Difficulties experienced in mapp

the various formations because of thick alluvial cover were partly overcome though the generosity of the Mr. R.C. Sprigg who kindly supplied me with bore and well data which he had collected during the course of his investigations of the area in 1942.

(ii). Sampling.

Specimens of most of the Tertiary rocks exposed were collected, numbered and given the locations as on the map. All samples are lodged in the Palaeontology Dept. collection at the University of Adelaide.

Boundaries of the various units mapped are shown as broken or full line while inferred subsurface boundaries are shown as a dot-dash line.

The positions of relevent bores are shown together with well and bore data not published as yet.

Subsurface sections and a bore correlation chart have been drawn up.

II. Stratigraphy

1. Pre-Cambrian.

The orogenic succession of the Noarlunga Basin overlies unconformably the Pre-Cambrian rocks of the Adelaide System. Extensive outcrops of these Pre-Cambrian rocks are met with in the northern portion of the basin and have been fully described by Grigg (1942).

2. ? Permian.

? Permian rocks are known from Halletts Cove where they overlie unconformably Pre-Cambrian (Brachina) rocks. These ? Permian beds consist of till, glacial sands and varve beds and are unconformably overlain by a fossiliferous marine Pliocene sandy limestone.

3. Tertiary Sediments.

a. Formation :- North Maslin Sands.

Exposures : Good exposures of this formation are known from the Christie Beach sand quarry on the northern side of Witton's Bluff, at 1.11 one mile south of Moana; at the base of the Noarlunga cliff-section at 1.2; in a rail cutting 1.48, just north of Reynella; in the Happy Valley Reservoir drainage channel at 1.47; and in a shallow road cutting 1.52, just south of 1.49.

Lithology : The formation consists of hard, strongly cross-bedded and laminated pebbly to fine grained sands consisting chiefly of angular quartz grains with muscovite as a common accessory. Clay lenses containing plant remains occur within the formation at the Christie Beach sand quarry.

The sands vary from [a] yellowish-brown to [a] white in colour, but laminated red and white sands and clays are common, especially near the top of the formation [as evidenced] on the northern

wide at Wilton's Bluff, at L12, L2, L49 and L52. At L2, Moarunga, a red to yellow mottled sand containing numerous sponge spicules was found 10 feet below the ferruginised top of the formation.

Contacts: The base of the formation is exposed in and just south of the Christie's Beach sand quarry where fine white to yellow laminated sands rest unconformably on the ferruginised(?) surface of Pre-Cambrian weathered chocolate shales. In the road cutting L49, just south of Reynella the sands formation rests unconformably on weathered Pre-Cambrian shales. At the base are quartz grits which grade upwards into white quartz mica sands and white clays. Ten feet of beds constitute the thickness at this locality. Unconformably overlying them are 3 to 4 feet of ?Pliocene unfossiliferous ferruginous sands. At L52 a foot or so of white to red laminated micaceous clays overlie Pre-Cambrian weathered shale but at L49 a few hundred yards to the south about 12 feet of these clays are seen resting unconformably on the Cambrian shale. These clays grade upwards into richly glauconitic sands and clays. A feature of these beds is that unaltered glauconite occurs in pockets within the heavily ferruginised ledges giving the beds a characteristic appearance. No apparent unconformity could be seen between the lower laminated clays and the upper glauconitic bearing beds.

At the Christie's sand quarry the [60 feet of quarry sand is] overlain unconformably by Pliocene sands containing a well marked band of richly fossiliferous [Pliocene] limestone. Further south at Wilton's Bluff and at L2 Moarunga, the South Maslin sands rest unconformably on the ferruginised surface of the North Maslin sands. However at L12, south of Moana, the contact between the North and South Maslin sands can not be picked.

Remarks: It is noteworthy that [quite] extensive lignite deposits occur inland in the vicinity of Mambuga near the base of the formation. Although not outcropping the lignite has been encountered in [both] mines and in test bores [put down for the purpose of testing the deposits]. In a mine [at] the lignite comes to within 50 feet of the surface, and although the seam is not [so] thick here, it is of economic value owing to its high ash, sulphur and water content. The lignitic as can be seen from the bore correlation chart is only local in occurrence and is replaced north of bore 7 by lignitic clays as encountered in bores 10 and 11.

In view of the presence of both lignite, sponge spicule bearing sands [and glauconitic sands] within the formation, it seems probable that both terrestrial and marine conditions prevailed at different stages during the period of its deposition. [No suggestion of an unconformity or disconformity is present within the formation.]

2. South Maslin Sands.

Exposures:- Coastal exposures are known from the northern side of Wilton's Bluff and at L12, one mile south of Moana. Inland exposures can be seen at the following localities:-

(1) in a cliff section at Moanunga - L2.
(2) in a shallow cutting at the foot of a cliff east of Pt. Moanunga - L16.
(3). One mile south-east of Pt Moanunga - L19, L20.

Lithology.

The sands consist chiefly of angular grains of quartz and well rounded grains of limonite partly consolidated with a calcareous cement. The beds vary from a gravel to a fine sand, but chiefly a coarse sand, usually brown in colour but purple to green colored bands are not uncommon. The sands are strongly cross-bedded and contain numerous thin ochre colored bands of limonite. Greenish [colored] clays and chile Maslin lenses occur near the top of the formation at L2, L12, and L20.

Contacts.

On the north side of Wilton's Bluff and at L2 this formation overlies unconformably the ferruginised surface of the North Maslin Sands.

At L12, south of Moana, the contact between the North and South Maslin Sands is indistinct with the one formation grading imperceptibly into the other. Elsewhere the base of the formation is not seen.

The uppermost beds are overlain unconformably at L19, L20 and on the north side of Wilton's Bluff by a well consolidated brown fossiliferous calc-sandstone which marks the base of the Tortachilla Formation at these localities.

However at L2 and L16 the South Maslin sands are overlain unconformably by the glauconitic limestone

member of the Tortachilla Formation.

At L12 South of Moana, the greenish clays, with kaolinite lenses, and brown sands of this formation are overlain unconformably by the fossiliferous Blanche Point sanded Marls.

The maximum measured thickness of the formation, is 15 feet at L12 in contrast to about 5 feet at L12.

3. Tortachilla Limestone ~~Formation~~.

Member 1:- Polyzoal Limestone.

Exposures: The Polyzoal Limestone member as recognised by Reynolds (1953) in the coastal section at Maslin Bay is considered to be represented in the Noarlunga Basin by a hard brown calcareous sandstone ranging from 1 foot to 18 inches in thickness. Exposures of such can be seen at Witton's Bluff, and at L20, a mile or so south east of Port Noarlunga.

Lithology: A hard brown calcareous sandstone rich in limonite pebbles and casts of brachiopods, lamellibranchs and gastropods. The member appears to be completely lacking in polyzoa and seems to have been formed from reworked South Maslin Sand. What originally appears to have been glauconitic pockets within the sands now appear as light colored patches which give the rock a characteristic mottled appearance.

Contacts: At both Witton's Bluff and at L20 this member overlies unconformably the South Maslin sands. At L20 the plane of unconformity is a sinuous curve. In both instances the Glauconitic Limestone member conformably overlies this lower member.

Member 2:- Glauconitic Limestone Member.

Exposures:- This member is exposed at Noarlunga L2, at and between L19 and L20 a mile or so south-east of Port Noarlunga, at Witton's Bluff and at L16 approximately east of Pt. Noarlunga.

Lithology: A richly fossiliferous, well consolidated limestone containing pockets of green glauconite, and limonite pebbles derived from the reworking of the underlying South Maslin Sands. Other Arenaceous and argillaceous materials are almost lacking.

Fauna:- A very diverse and varied fauna is included in this formation, the echinoid, Australanthus longianus (Gregory) /

appears to be restricted to this member.

Contacts.

As stated previously this member overlies conformably the Polyzoal Limestone Member at both Witton's Bluff and L20, but elsewhere it overlies unconformably the South Maslin Sand Formation. In its upper limits it grades into the highly glauconitic marls of the Blanche Point Marls Formation except at L16 where no contact is seen because of soil cover. The maximum thickness is 3'6" at L20, but elsewhere it is 3' thick.

Formation :- Blanche Point Marls.

As pointed out by Reynolds (1953), this formation can be subdivided, on lithological grounds, into three distinct members :-

(1) Transitional Marls (at base)
(2) Banded Marls.
(3) Soft Marls.

Recognition of these three members can be made in the Noarlunga Basin wherever the formation outcrops.

Member 1 : Transitional Marls.

Exposures. This member outcrops at Wilton's Bluff, at Noarlunga at L2 and south east of Ft. Noarlunga at L19 and L20.

Lithology. A soft, grey, richly fossiliferous glauconitic marl grading upwards into a green sandy glauconite. At L19 and L20 the fossils in the greyish glauconitic marl are represented by ochre casts but elsewhere well preserved fossil remains are found.

Contacts.

At the four localities where this member can be seen it is underlain and overlain conformably by the Tortachilla limestone & Knuckle and Banded Marls respectively. The average thickness lies between 7 and 8½ ft.

Member 2 : Banded Marls.

Exposures: This member outcrops extensively over a very large area and has its southernmost exposure at L12, south of Noarlunga and its northernmost at L51, in a drainage channel south east of Reynella. At the Happy Valley Reservoir.

Intermediate exposures occur at the following localities.

(a) In cliff sections at Noarlunga - L2, L3, and Wilton's Bluff
(b) In road-cuttings On the main Hackham - Noarlunga road at L28, L29, L32, L34 and L35.
(c). In rail cuttings North-east and south-west of Hackham at L30 & L31.
(d). In shallow road cuttings, (i) a mile due north of Noarlunga at L22, L23 and L24, (ii) east of Ft. Noarlunga at L18, L25 and L36, and in two infilled wells 200 yards east of L20.

e. In cliff sections at Pt. Moarlunga at L15; south east of Pt. Moarlunga at L19 and L20; South of Pt. Moarlunga at L14, and in a quarry at L17, in creeks at L47 and L10, and in a channel at L51

Lithology

Essentially composed of alternate hard and soft grey fossiliferous bands of marl moderately rich in glauconite. Turritella aldingae Tate is abundant throughout the member occurring both as silicified casts or retaining its shell. Silicification of beds rich in sponge spicules and other siliceous material have resulted in the formation of the hard bands. Notocrea tatei Finlay, forms a prominent band about 10 ft above the base. At L14 white kaolin nodules occur 6 ft. below the base of the soft marls.
The maximum measured thickness is 86 feet, measured at L3 but the base was not exposed and so the true thickness would be slightly greater than 86 feet. The maximum thickness recorded from bores is 96 ft in bore number 7 about one mile west of Moarlunga.

Contacts.

At Wittons Bluff, L2, L3, L19, and L20 the member is underlain by the Transitional Marls; elsewhere the basal contact is not seen, except at Moana (L12 south of) where the marls rest with apparent unconformity on the South Marlin sands.
Conformably overlying the Banded Marls are the Soft Marls. This contact is seen at L12, L3, L19 and at Wittons Bluff.

Unconformable with the banded marls are Pliocene sands at L10, L12, L23, L29, L30, L32. Elsewhere Pleistocene to recent sediments form a covering over this member.

Member 3: Soft Marls.

Exposures: Good exposures of this member occur in the cliff sections at L3, L6, L12, L14, L33 and south of Wittons Bluff as well as along the Ruakapanga river between the foot-bridge and L14.

Lithology: Essentially a grey fossiliferous soft marl with occasional harder bands. In contrast with the underlying banded marls, this member is ~~absolutely~~ free of glauconite. Between the foot bridge and the mouth of the Onkaparinga the upper beds contain white kaolin nodules. *Limopsis* sp. and *Turritella aldingae* Tate are common throughout the member.

The maximum measurable thickness inland at L2 is at least 55 feet, but in bore No 7, 85 feet has been recorded.

Contacts. The base of this member is underlain at L3, L12, L14 and south of Witton Bluff by the top of the Banded Marl member.

At L12, Pliocene sands are unconformably above this member. Here about 10 feet of soft marl is ~~w~~ represented.

At L14, Pliocene & Recent sands and gravels rest unconformably on about 12 feet of white to yellowish soft Marl, whilst about 100 yards West of the foot bridge over the Onkaparinga River ~~white~~ Chinaman's Gully beds are unconformably above with them.

At L3, Recent boulder beds with boulders up to 2 ft in diameter can be seen unconformably overlying folded Pre-Cambrian chocolate shales. Although no contact between these boulder beds and the soft marls can be seen they are considered as overlying them.

At L33 in a shallow road cutting 3 feet of soft Marl is exposed. Overlying this member here is a hard ~~lime~~ calcareous sandstone of probable Pliocene age.

At L6, 15 feet of yellowish soft marl is overlain by yellowish sands and gravels of Pleistocene to Recent age. The latter are well exposed in a quarry at L5.

Formation 5: Whitaman's Gully Beds.

Exposure: The only known exposure of this formation occurs about 100 yards west of the foot-bridge across the Onkaparinga River. Here ferruginised grits are in contact with Soft Hard below and Pt. Willunga Beds above.

It is notable that ~~evidence of~~ this formation is not known inland in bores put down for lignite.

Formation 6: Port Willunga Beds.

Exposures: Beds of this formation form cliffs along the mouth of the Onkaparinga River and along the coast south to within half a mile of Moana.

Few inland exposures are known:

(a) In a shallow road cutting a mile north west of Noarlunga - L7.

(b). In a large rail cutting due west of Noarlunga - L9.

(c). From an old tank excavation 100 yards south of L9.

(d). In a shallow road cutting south-east of Moana - L13.

Lithology.

As exposed along the Onkaparinga River and coast this formation can be seen to be composed essentially of brown to yellow cross bedded polyzoal limestones among which Cellepora Sp. is most common. Unfossiliferous sands and clays together with silicified greyish rocks rich in polyzoa are also common especially near the base.

Inland the formation is represented by hard silicified grey to yellow rocks rich in polyzoa, interbedded with yellow sands and green clays.

Contacts: Inland the base of the formation is not exposed, but near the mouth of the Onkaparinga River the base of the formation rests unconformably on Whitaman's Gully Beds.

At L13 and L8 the beds are overlain by Recent kunkar and alluvium whilst at L9 approximately 25 feet of Pleistocene mottled clays are unconformable above them.

NB. An exposure of possible Pt. Willunga Beds occurs about 100 yards north of L12.

Pliocene sands and Pleistocene clays also cap the formation at the mouth of the Onkaparinga River and the coastal section, south, to where it dips below the surface of the beach.

1 Formation 7: Pliocene limestone.

Extent: Beds regarded as Pliocene in age occur at the following localities.

(a) Mt Hallets Cove, above ? Permian glacial sediments and on the 250 foot contour level ¾ mile south east of Black Cliff above Pre-cambrian rocks.

(b) From Kinsley Point south to the Christies Beach sand quarry.

(c) As a capping to the Pt Willunga beds at the mouth of the Onkaparinga River.

(d) At L12 south of Noarlunga, and in a road cutting at L39

Lithology: Essentially white to yellow sands made up of coarse angular quartz grains cemented by calcium carbonate. Pebble horizons also are a common feature. Fossiliferous arenaceous limestones occur at the Christies Beach sand quarry, in the cliffs at Hallets Cove and ¾ mile south east of Black Point

Contacts: In the vicinity of Hallets Cove the Pliocene limestone rests unconformably on ? Permian glacial sediments and is capped (above) by Pleistocene red clay. To the east, on the 250 foot contour, a richly fossiliferous limestone rests on Pre-cambrian rocks and is capped by a brownish calc sandstone which is lithologically identical with a calc sandstone as exposed in a cutting at L26, and on the ridge running between L26 and L33, and capping the pre-cambrian a ¼ mile south of L33.

From Kinsley Point south to Christies Beach sand quarry the Pliocene beds are seen to rest unconformably on both Pre-cambrian rocks and the ? Permian North Maslin sands. In the sand quarry the sands above the fossiliferous limestone are capped by

a laterite and are unconformably overlain by Pleistocene mottled clays. South of Moana at L12 coarse pink white and brown angular sands with well rounded pebble horizons, either flat or slightly dipping, rest with angular unconformity on the Lefr and banded marls and the North Maslin Sand formation, the top of which is laterised. The sands which are approximately 60 feet thick pass upwards into Pleistocene mottled clays.

? Pliocene to Recent deposits.

Sediments included under this heading embrace several distinctive lithological types.

(1). Unfossiliferous mottled white yellow to red sands often strongly ferruginised together with gravel and grit horizons confined to the eastern margin of the basin.

(2). Pleistocene mottled red to green clays confined mainly to the coastal cliffs and western portion of the basin.

(3). Pleistocene ~~mottled~~ and to Recent alluvial and boulda beds along the Onkaparinga River and creeks.

1. The mottled and ferruginous white, yellow to red sands form an extensive covering over the underlying Tertiary beds east of a line running from L33 south west of Hackham, north to Morphett Vale and then north-east to the Happy Valley Reservoir. Numerous exposures of the sands are met with in cuttings at L26 to L30, L32, L37, L41, L44 to L46, in outcrop near L11 a mile south east of Reynella; L48, L50 and in cuttings south west of Reynella.

The sands appear to be flat lying and probably have a thickness not exceeding 100 feet. As much as 20 feet of the sands occur in cuttings such as L41, L45 and L47. Generally the ferruginous sands are moderately consolidated, while gravels containing quartz pebbles up to 2 inches or more in diameter together with grits are quite common.

In the Hackham road and rail cuttings - L29 and L30 -

glauconitic sands occur in pockets in ferruginous mottled sands. The origin of these glauconitic sands is unknown, although the glauconite may have been derived from the reworking of the underlying Banded Sands which are quite rich in glauconite. Again they may possibly mark a transgression of a Pliocene sea and this seems quite likely as fossiliferous Pliocene beds reported by Sprigg (personal communication) occur at the same level capping Pre-Cambrian rocks south of 233. These fossiliferous beds are capped by a brown calcareous sandstone identical to that found above 233. Sprigg (1942) considers this calcareous sandstone as representing a Pleistocene raised sea-beach but in view of the underlying limestone being Pliocene in age it seems likely that it also would be Pliocene in age because of the conformable relation between the two. (which

The ferruginous mottled sands overlie these Pliocene beds and it would appear that their age is at least in part Pliocene if not wholly Pliocene. Root structures are the only fossils contained in the beds.

2. The Pliocene mottled clays, as previously stated, are confined to the coastal cliffs and the western parts of the basin. They are seen to rest unconformably on the Pliocene limestones at the Christie Beach sand quarry and near the mouth of the Onkaparinga River. At 112 south of Moana about 10 to 15 feet of these clays cap ferruginised sands considered to be Pliocene in age. Inland the clays are exposed at the rear of a brick factory at 19 where about 15 feet of clay is exposed, at 19 in a large rail cutting where 20 feet of clay is unconformable with the Willunga beds and at 121 the Noora Railway cutting where green mottled clays with a capping of limonitic sandstone are exposed.

3. Along the course of the Onkaparinga River from Noarlunga to its mouth an extensive flood plain terrace has been developed. Fine silty clays and sands together with boulder beds containing boulders of Pre-Cambrian quartzite and shale up to 2 feet in diameter together with gravels are seen to be exposed. In bores such as bore number 2 the thickness of these deposits reaches 70 feet.

Along the road adjacent to C3 boulder beds with quartzite and shale boulders together with sands, clays and gravels rest unconformably on highly folded Pre-Cambrian chocolate shales. These beds mark the position of a former flood plain and were deposited at an early stage of the river's history when it was cutting through the soft rocks which are most readily eroded.

Gravels, yellow sands and boulder beds may be seen

III. Subsurface Geology

Subsurface geological interpretations have been based on published and unpublished bore log reports recorded in the vicinity of Maslunga. The locations of the relevant bores are shown on the accompanying map and the published logs are recorded in the South Australian Department of Mines "Mining Review" publications nos. 6, 7, 8, 9, 37, 38. Information concerning unpublished bore and well data was kindly supplied by Mr. R.C. Sprigg and the South Australian Mines Department.

1. Bore Correlation.

The correlation of the bores has been based on lithology alone as given by the individual published and unpublished logs and the results obtained are shown in the accompanying bore correlation chart.

With the exception of the Chinaman's Gully beds all the formations recognised on the coast and elsewhere within the basin can be recognised in the bores.

Distinction between the North and South Maslin sands cannot be made with certainty and so the two have been correlated as a single unit.

The base of the Tortachilla Limestone is taken as the hard calcareous sandstone which appears in all the bores except number 5 where a brown sandstone is present. This brown or calcareous sandstone is regarded as the equivalent of the Polygoal Limestone member of the coastal section. In bore number 6 the dip on this calcareous sandstone is given as 17° but as the Tortachilla Limestone and unconformable with the underlying South Maslin sands then the recorded dip may possibly be the dip of the plane of unconformity.

The Tortachilla Limestone member is recorded in bores 6, 7, 10 and 11 but not in bores 5 and 8. It attains a thickness of 14 feet in 10 and 11 but in 7 and 8 a thickness of 10 and 13½ feet respectively is given. It seems likely that in the bores 7 and 8 the abnormal thickness are due to the addition of the Transitional Marls.

to the Tortachilla limestone member, but as no verification of this could be obtained the top of the formation has been drawn so as to include the grey to green fossiliferous limestone of bores 7 and 8. Whether the Tortachilla limestone member is present in bore number 6 cannot be told but a tentative boundary has been drawn in about 6 feet above the top of the calcareous sandstone to represent it's possible presence.

In bore number 5, 4½ feet of hard ironstone conglomerate was recorded between fossiliferous limestone (the Blanche Point Marls) and the brown sandstone correlated as the Polgoal limestone member of the Tortachilla limestone. This hard ironstone conglomerate has been correlated with the Tortachilla limestone member.

A good correlation for the Blanche Point Marls was obtained for every bore and only in bore number 5 is the complete succession missing.

The lithology as given by the logs is very variable for the Port Willunga beds but a correlation was obtained for all bores except number 5 where they were not present due to post lower Miocene erosion. This post lower Miocene erosion is also emphasized by the limited thickness as met with in bore number 8.

The sediments correlated as ? Pliocene to Recent probably date back only to the Pleistocene but in view of the presence of possible Pliocene elements on the coast their age has been placed back as ? Pliocene.

2. Structure.

The possible structure of the basin has been determined by taking into consideration the geological cross-sections A-B and C-D together with the measured surface dips of the various formations, together with any available well-bore data. Structurally the basin can be considered to be a south-westerly pitching syncline with the axis trending south-west — north-east quite near and roughly parallel to the Pre Cambrian scarp.

As illustrated by section C-D the syncline in the south-western portion of the basin is quite asymmetrical with rather steep dips on the southern limb, (up to 35°) and shallow dips on the northern limb generally of the order of 2°. North of Mophett Vale insufficient evidence is available to determine the possible structure but it seems likely that the structural picture is similar to that of the region to the south west.

A minor anticlinal flexure with axis trending north west - south east may be seen in the north eastern end of the Hawkhaw railway cutting, L30. Dips here are 3° to 4° to south-west, 1½° to north east.

III. Facies Changes.

Apart from the alternation of marine & non-marine facies no recognisable or significant facies changes occur except in the non-marine facies of the North Maslin sands.

Sands and clays with scanty plant remains from the Christies Beach sand grade progressively lignitic to the south for in bore 11 lignitic clays and sands occur. Still further to the south different environmental conditions favored the formation of lignite which occurs in bores 6, 7, 8 and 9.

Lignitic deposits may also be present a mile or so east of Reynella where "black foetid sands" were reported in a bore at 400 feet.

The Tortachilla Limestone exhibits no facies change for the area south of Mophett Vale. but to the north no outcrops are known to occur and although its presence has not been reported in well data it is reasonable to assume its presence. Present at Stone Rd.

The Blanche Point Marls are remarkably constant in facies over the whole area, there being no suggestion of the sandy facies as met with in bores and outcrop in the Willunga basin.

The Port Willunga beds may possibly exhibit marked facies changes as would be suggested by the bore correlation chart but

of the known variability of the centres of this formation it seems probable that the logs are not a true representation of the lithology of the beds. Again such variability in facies as indicated by the logs seems highly improbable over such short distances.

The various post Miocene sediments appear to be quite constant in facies except perhaps some of the Pliocene limestones which may possibly grade laterally into a sandy facies as is suggested in the vicinity of the Christies Beach sand quarry.

V. Tectonics and Sedimentation.

Prior to the commencement of Tertiary sedimentation, minor faulting along the old Eden and Moana fault lines with a complementary slight tilting of the block to the south together with a certain amount of folding of the pre-Cambrian rocks resulted in the formation of the Noarlunga Basin. Evidence of this pre-Tertiary faulting may be seen on the beach at or south of Moana where a well defined fault breccia outcrops. - dips 8° to S

With the advent of lacustrine sedimentation in ? Eocene times the North Maslin sands were deposited. Sands and clays with scanty plant remains were deposited in the high lying areas in the northern parts of the basin while not in the lower lying swampy areas adjacent to the scarp as in the vicinity of Noarlunga and possibly east of Reedy, lignites and lignitic sands and clays were deposited.

Following lacustrine sedimentation a marine transgression over part, if not the whole of the basin caused the formation of sponge spicule beds near Noarlunga and glauconitic sands near the Happy Valley Reservoir. A regression then followed and climatic conditions were such to allow the formation of a laterite on the eroded surface of the North Maslin Sands.

After a period of time another marine transgression took place which led to the formation of the South Maslin sands. Sedimentation must have been slow to allow the

formation of glauconite. Strongly crossbedded sands as at 12 Noanlunga, point to sediments deposited under shallow conditions. Following a regression of the sea and subsequent erosion a new transgression took place at the beginning of the upper Eocene. The marine conditions continued well into the Oligocene and during this period the Tortachilla limestones and Blanche Point Marls were deposited. The absence of the Tortachilla limestone at 1/2 south of Noana possibly means that the early upper Eocene transgression did not transgress the fault scarp at this point. Later when the Blanche Point Marls were being deposited the sea transgressed the scarp where possible, and was continuous with that of the Willunga Basin.

Following the regression of the lower Oligocene sea the Chinamans Gully beds were deposited. Lignites of this age have been recorded from bores in the Willunga Basin but no known lignitic deposits of this age occur in the Noanlunga Basin. In fact the only known Chinaman's Gully beds in the basin are just west of the foot bridge near the mouth of the Onkaparinga River.

At the beginning of the Miocene a renewed transgression of the sea occurred causing the deposition of the Port Willunga beds until middle Miocene time. How far north this Miocene sea reached cannot be known but it certainly must have transgressed much further north than the present day extent of outcrop of the beds. In fact it is not impossible that beds of this age covered the whole of the basin.

Following the deposition of these lower Miocene sediments gradual subsidence took place along the Noana fault line in the east, contemporaneous with elevation of the northern part of the basin along the Eden fault line. These movements culminated in a tilting of the block to the south, the angle of tilting being of the order of 1° or 2°. Complimentary to this tilting, folding of the Tertiary sediments adjacent to the fault occurred. Dips of 25°, 15-20°

and 35° have been measured. This tilting and folding of the sediments adjacent to the scarp has resulted in a south westerly pitching syncline with axis close to and parallel to the scarp.

If an apparent anomaly exists in the vicinity of Noradunga where at L3 the measured dip is 35°, but at L2, 4 miles away the dip on the beds is somewhere of the order of 1° or 2°. That slow subsidence occurred along an old fault plane seems beyond doubt at L3 because of the high dip. At L3 and L2 no faulted contact can be seen but at L3 "gash quartz" striking at 20° occurs. If this be taken to represent the strike on the fault then the fault will pass slightly to the west of L2. Nevertheless a much higher dip should be given by the beds at L2. If another fault is presumed between the Tertiary beds and Pre-Cambrian at L2 then compression of the dip caused by a fault to the west of L2 might be expected to give fairly flat lying sediments. Any suggestion that the beds at L2 were deposited adjacent to the scarp as we see them now, must be discredited, as boulder beds derived from the scarp would be included among the sediments, but this is not so.

Contemporaneous with and following these Miocene movements erosion of the more elevated portions of the basin began and continued until the transgression of the Pliocene sea. Erosion was severe and much of the Tertiary sediments was completely removed especially in the northern portions of the basin where erosion continued until the Pre-Cambrian rocks were laid bare. In Pliocene times a transgression occurred as far inland as the 300 foot contour. Limestones as well as sands (? fossiliferous) must have attained a thickness of at least 200 feet for Pliocene limestones occur at the Christie's Beach sand quarry at 50 ft. above sea level and also east of Hallett's Cove and south of L33 on the 250 foot (to 300 ft) contour level. Regression of the Pliocene sea to the 250 foot contour level

for a considerable time is substantiated by a raised sea-beach stretching from south of Hackham north to Sellicks Beach.

Contemporaneous with and following the regression of the Pliocene sea, mottled ferruginous sands of terrestrial origin were deposited on the higher regions on the eastern side of the basin. The beds are tentatively regarded as Pliocene (late) in age.

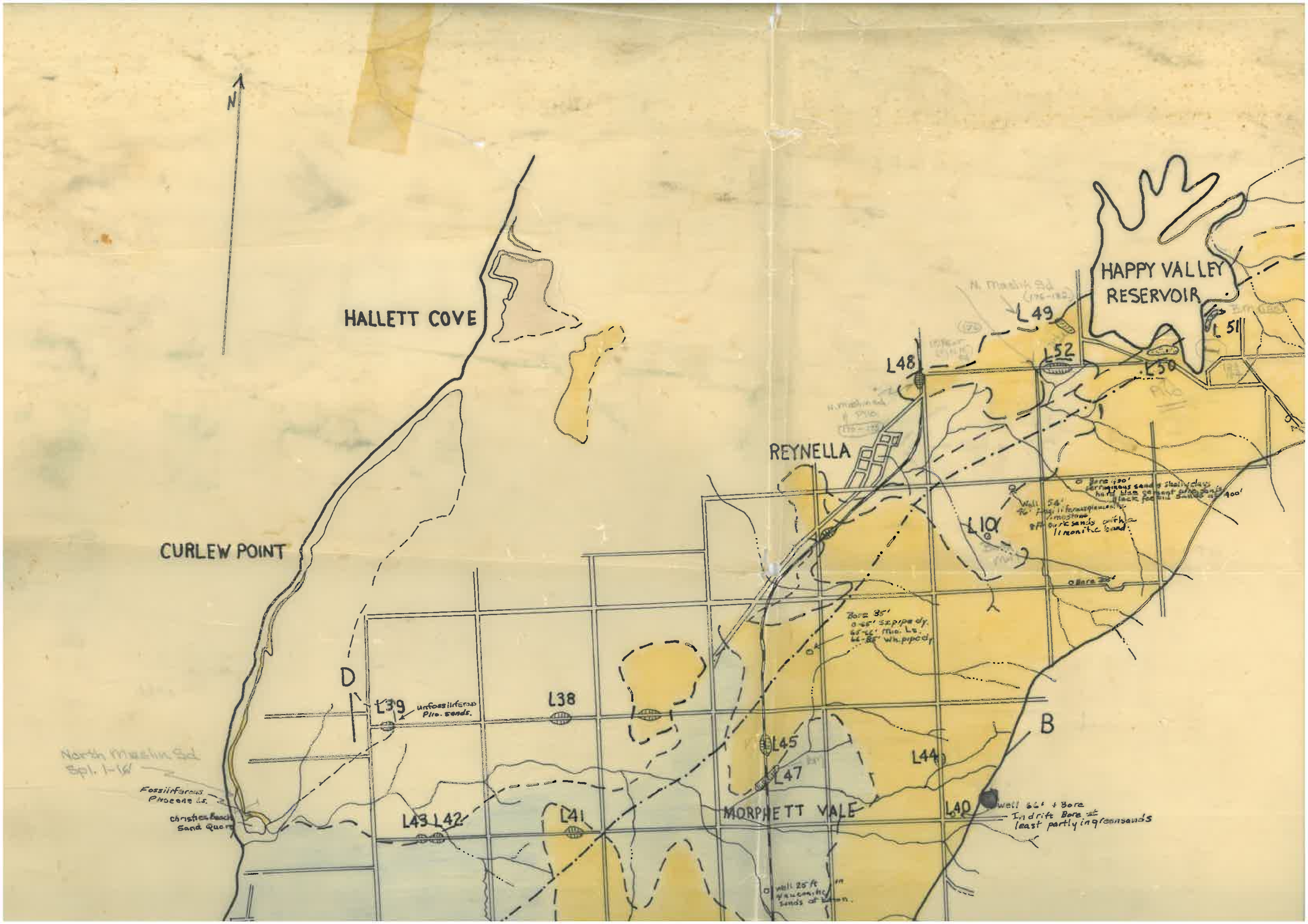
In post-Pliocene times erosion has removed most of the Pliocene sediments on the western side of the basin and only isolated patches remain. The only sediments of note deposited in Pleistocene to Recent times have been red and green mottled clays confined mainly to the western portion of the basin. Slight subsidence along the old fault lines has resulted in a very slight dip of the Pliocene. This is confirmed by slight differences in the level of the Pliocene.

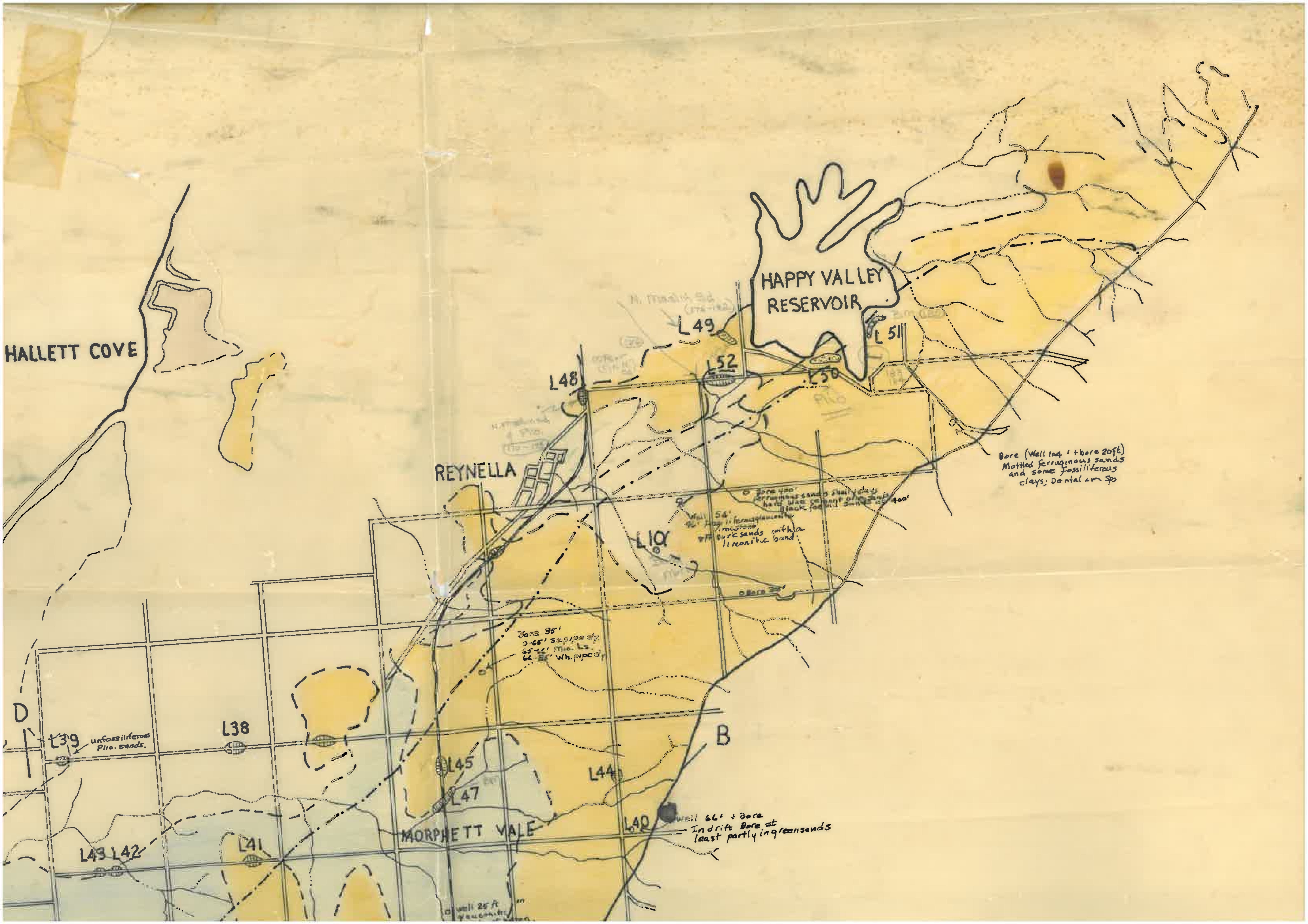
VI. Summary.

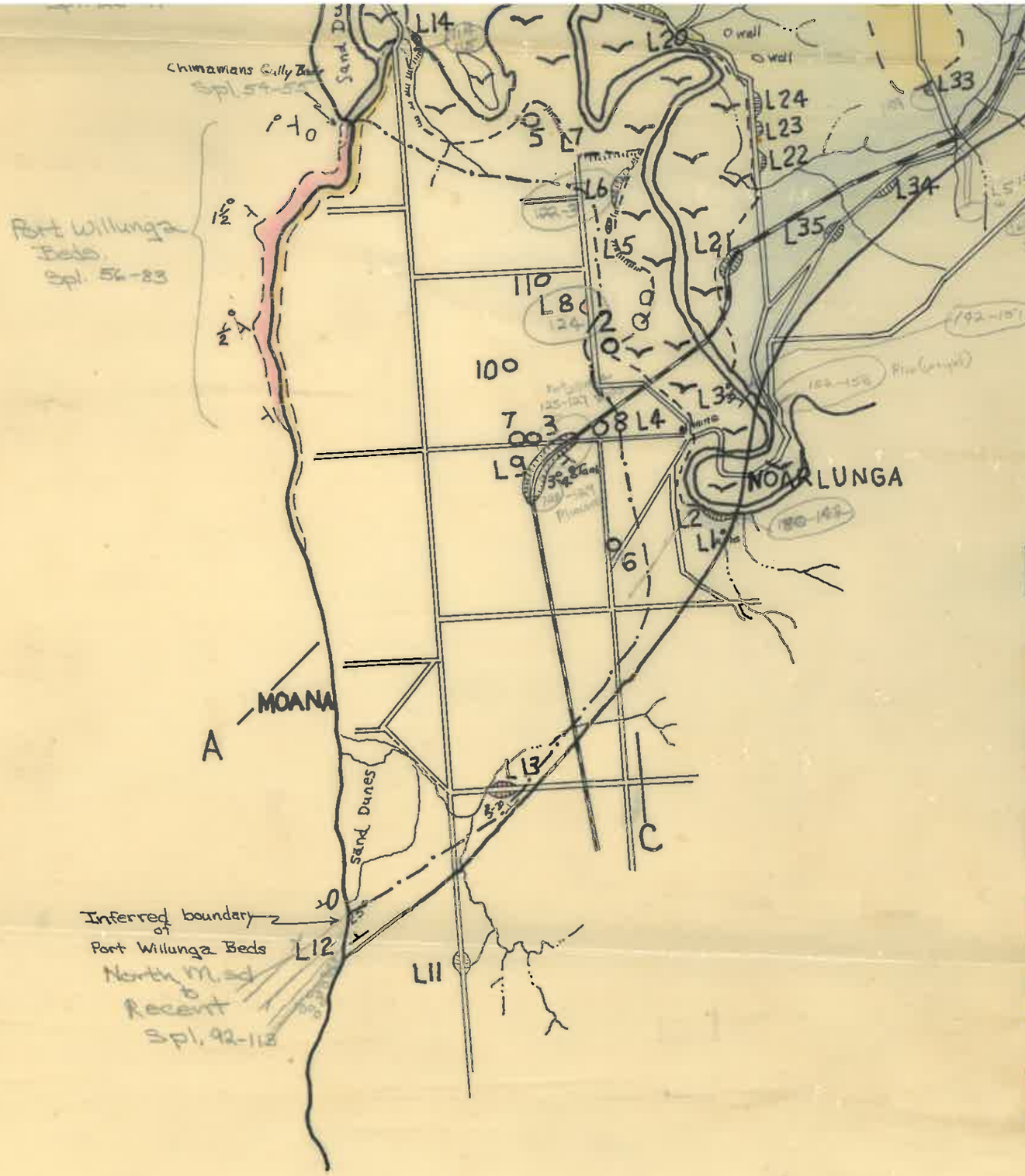
The geology of the Noarlunga Basin has been briefly sketched out. The location of the basin is given together with a few words on previous work and the nature and scope of investigations. The stratigraphy of the various formations has been discussed under the headings of exposure, lithology and contacts. Attention has been drawn to the subsurface geology with a view to correlation and possible structure. Significant facies changes together with tectonics and sedimentation are discussed. A map showing the locations of outcrops and boundaries together with bore correlations chart and subsurface sections are included in the report.

Acknowledgements.

I am deeply grateful to Dr. M.F. Glaessner, University of Adelaide, for the help he has given me during the course of my investigations. My thanks are also due to Mr. G.D. Woodard, Mr. R.C. Sprigg and the South Australian Mines Department for giving me access to unpublished information on the area.


N
HALLETT COVE
HAPPY VALLEY RESERVOIR
L49
L51
L48
L52
L50
REYNELLA
L1a
Wall 54'
limonitic band.
CURLEW POINT
Bore 35'
D
L39
Unfossiliferous Plio. sands.
L38
B
L45
L44
L47
North Maslin Sd
Fossiliferous Pliocene Ls.
Christies Beach Sand Quarry
L43
L42
L41
MORPHETT VALE
L40
well 66' + Bore
Indrift Bore at least partly in greensands


HAPPY VALLEY RESERVOIR
HALLETT COVE
REYNELLA
MORPHETT VALE
L49
L51
L52
L50
L48
L1α
L38
L39
unfossiliferous Plio. sands.
L45
L47
L44
L40
L41
L43 L42
D
B
Bore (Well 104' + bore 20ft) Mottled ferruginous sands and some fossiliferous clays; Dentalium Sps
Well 54'
sands with a limonitic band
Bore 85'
0-65' Sdy pipe cly.
66-85' Wh. pipe cly
Well 66' + Bore
Indrift Bore at least partly in greensands



LEGEND

- Pleistocene to Recent, alluvium, clays & sandstones
- Pliocene, gravels, sands, limestones, & clays
- Port Willunga Beds
- Chimamans Gully Beds
- Blanche Point Marls Tortachilla Limestone
- North & South Maslin Sands
- Inferred North & South Maslin sands plus Tortachilla Limestone under alluvial cover