North Stradbroke island Geohistory Tour

1. Cleveland Ferry Terminal; 2-Coochiemudlo Island 3. MacLeay Island
4.Peel Island; 5. Dunwich terminal and sandspits; 6. Ebb and Flow Tidal Delta
7. Myora Springs; 8. Amity Point; 9. Flinders Beach; 10. Adder Rock;
11. Point Lookout 12 Brown lake 13. Blue Lake

SUMMARY

North and South Stradbroke Islands were initially joined and separated in 1895 after a violent storm to give the passage known as Jumpinpin or The Jumpinpin Bar.

There is also evidence that the former Stradbroke Island joined the Spit at Southport, as neither Cook (in 1770) nor Flinders in 1799 recorded the passage now known as The Southport Bar. It also may be possible that Moreton Island was also joined to Stradbroke Island in recent times, as Cook in 1770 did not note separation between Moreton and North Stradbroke Island. However Flinders in 1799 was first to record the South Passage Bar. Erosion of the southern end of Moreton Island is still gradually widening the gap between the two islands.

North Stradbroke Island comprises mainly sand dunes and ridges, with rocky outcrops at Point Lookout and environs, Adder Rock and small outcrops of sandstone at Dunwich. The sands which make up the dunes originated in the granitic highlands of north-eastern New South Wales and southern Queensland. As these highlands eroded, sands were transported seawards. These sands were then carried northwards by ocean currents including the east Australian current until blocked by the flow-banded rhyolitic remnants of old volcanoes at Point Lookout which acted as a natural groyne. Sands accumulated behind these outcrops over the past several hundred thousand years.

Periodic sea levels changes in the Pleistocene due to glacial and interglacial periods and wind action have resulted in massive quantities of sand blowing inland to form the complex dune systems which form today's North Stradbroke Island.

The evolution of North Stradbroke Island through geological time and its history of occupation by indigenous inhabitants form the basis of this tour experience. The tour outlines the formation of the island its coverage of plants and animals and the way the island has been utilised by humans from its inception to the present day.

Geological units include bedrock (Rocksberg Greenstone; Rhyolite; Woogaroo Subgroup), but the majority of the island comprises unconsolidated Cainozoic deposits in the form of transgressive aeolian dune forms. The younger frontal dunes are quartzose sand, and marked variations in topography, soils and vegetation occur between older Pleistocene and newer Holocene dunes.

Transgressive dunes development produces deflation hollows within the dune system locally tapping the groundwater producing 'window lakes' (e.g. Blue Lake) or indurated remnants of these lakes. Several periods of transgressive dunes created multiple indurated layers. The layers locally trap rain water and generate 'perched lakes'. Pleistocene dunes are characterised by the development of giant podsol soils, products of prolonged weathering and leaching down the sand profiles. Typically, such dune sands are yellow in colour, as revealed in exposures in road cuttings and in the eastern scarp slopes in the south of the island.

Major changes (over 200m) in global sea-levels have occurred throughout the latter part of the Quaternary period, essentially the last one million years; these changes in the relative levels of the sea and the land have been associated with both climatic and tectonic causes. The last interglacial period saw global sea-level up to 5m above

present mean sea-level (PMSL) marine transgression - whilst the sea-level fall during the last glaciation- marine regression was possibly in the order of 130-150m below PMSL, thus exposing extensive areas of the continental shelf fringing major land masses like Australia. Geological mapping shows that there is a fairly complex sequence of transgressive dune units on the northern part.

Groundwater is the body of subterranean water derived from the percolation of water, under the influence of gravity, down through the soil and regolith (weathered material) and underlain by impermeable material or rock. The upper surface of the saturated zone is termed the ' groundwater table. This table tends to have a broadly convex form, subject to, geological factors such as localised bedrock structures and weathering profiles. The height of the table will rise after recharge during especially wet periods and fall during periods of abnormally low rainfall when recharge is reduced. This may also reduce discharge into springs, streams and swamps fed by groundwater. In coastal zones and on islands, the saturated zone of freshwater ' typically takes on the form of a broad lens with convex curvature; the lower surface, in contact ' with saltwater, bulges deeply downwards. Major natural lakes are Brwn Lake and Blue Lake.

Heavy minerals (zircon, rutile and ilmenite) that have been mined on the island are within the siliceous coastal sediments of northern New South Wales and southern Queensland. The main sources of this material are the New England granites and Mesozoic sandstones.

Plants and animals on the island have evolved from the Low sea level stands of the Pleistocene when the land became emergent and the system if dunes were formed and a series of ground water. There is considerable diversity of plants and animals and significant effort is being made to conserve their habitats.

The island has a rich history and is being developed for diversify to expand the current tourism industry in terms of

- education and training opportunities
- stimulate local business development and growth.
- preferred location/s, including current mining sites, for boutique eco-tourism development
- feasibility and identification of boutique ecotourism development, including size, scale, location and private sector interest
- strategies related to the staged transfer of expired mining leases or expansion of national parks and other protected areas

Contents

INTRODUCTION

The tour is has three components-

1. The Geological and ecological history of the island as understood by Geologists and ecologists with comments on the plants and animals
2. The occupation of the island by the Quandamooka indigenous group and their legends about the island
3. The human history of the island from the time of colonisation to the present day with some examples within the places of interest visited on the tour and illustrated photos within the brochure

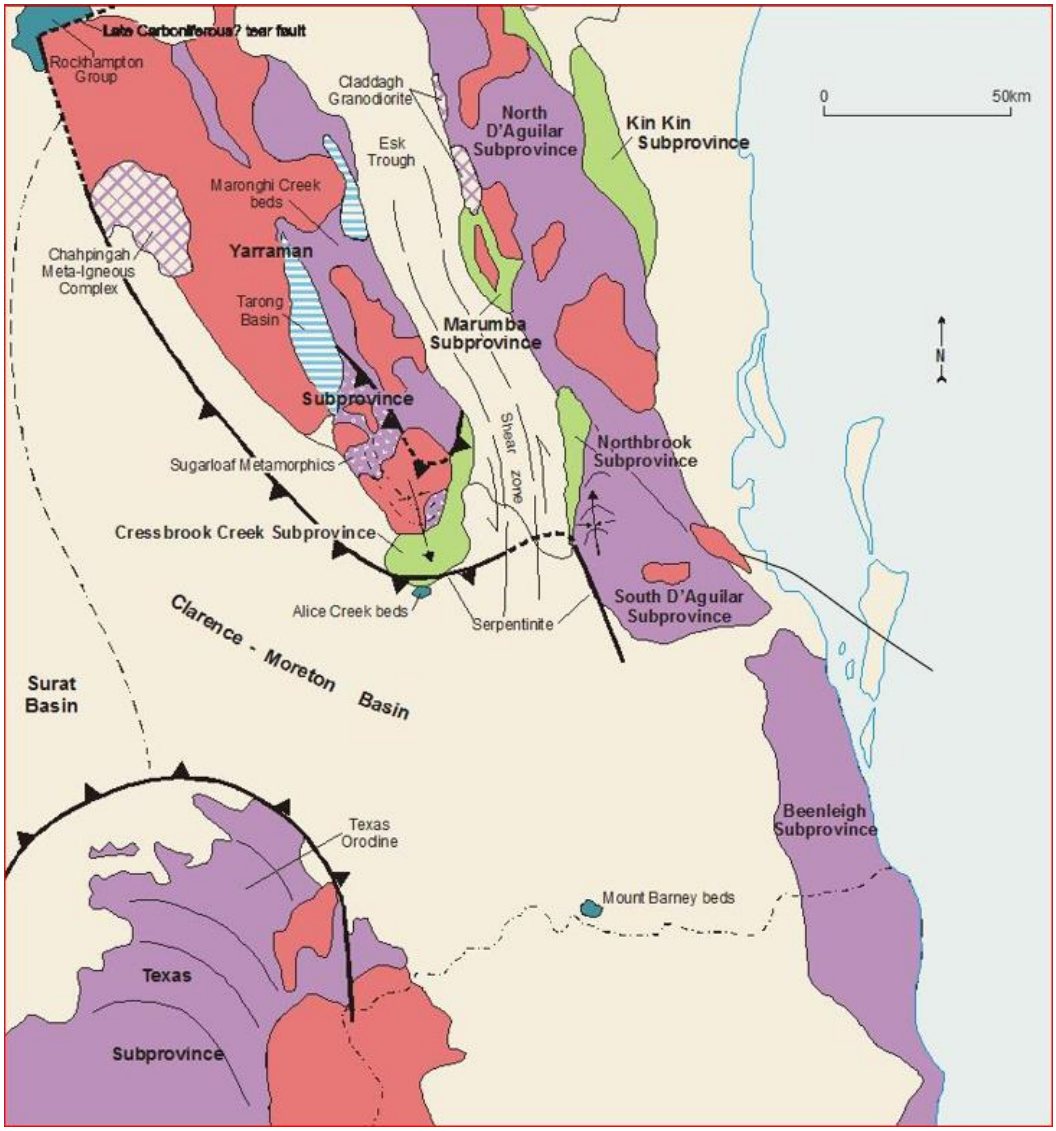
GEOLOGICAL AND ECOLOGICAL HISTORY

The rocks sand, mud and swamps of North Stradbroke Island and environs covers a period of more than 300 Million years from the Late Devonian period to the present and by geologists subdivided into: -

1. **Deformed deep sea sediments more than 350 million years ago that were accreted to the continent (best represented in the Brisbane city area and north along the D'Aguilar Range)**
2. **Sediments of about 180 – 201 million years ago (Mesozoic) that accumulated as sands muds and coals in basins on the margin of the continent**
3. **Sediments and volcanic rocks that formed in shallow coastal basins about 30-35 million years ago (Tertiary) during a time of extension of the crust**
4. **Sand hills, swamps and muds formed from about 120,000 years to the Present (Pleistocene and Holocene, Cainozoic morphostratigraphic units). These developed from movement of material along the continental shelf and deposition against hard rock bars forming North Stradbroke Island**

Palaeozoic tectonic units of accretionary wedge

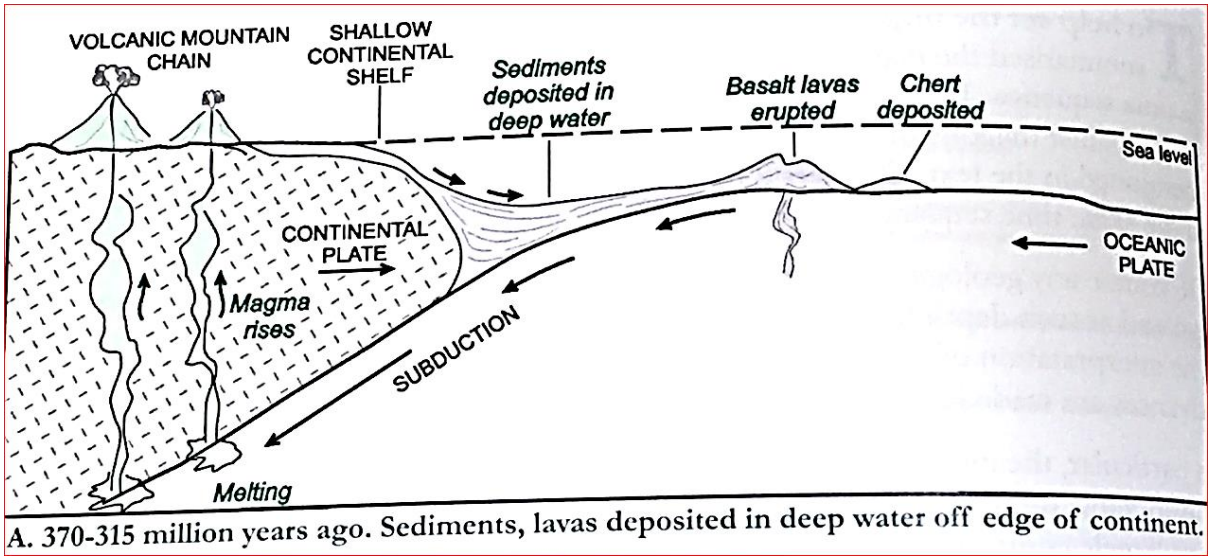
A belt of deformed continental margin rocks extending along the eastern Australian craton from Newcastle in the south to Bowen in the north represents the deformed and metamorphosed remnants of an accretionary complex formed during **Late Devonian to Middle Carboniferous** (About 300-370 Million years ago) Andean-style subduction at the eastern margin of the Australian continent (Figure A,1A). This belt forms an entity known as the **New England Orogen** (NEO). Ocean floor mafic rocks and deep marine sediments were deposited to the east of the westward-dipping subduction zone. As subduction proceeded, these deposits were progressively deformed uplifted and accreted against the convergent margin, forming thrust wedges within an evolving accretionary complex. There are different components of the accretionary complex that have been juxtaposed by later faults. These oldest rocks form part of the North D'aguilar subprovince.



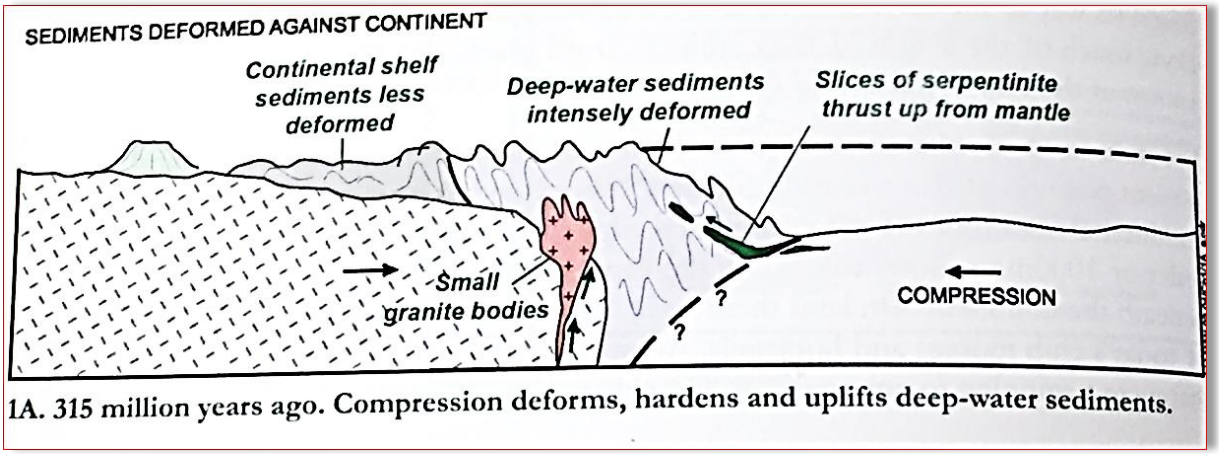
Oldest Rocks of South-east Queensland (in purple).

There have been periods of collision between deep sea sediments and island arc sediments interspersed by extension and relaxation of the crust locally forming basins and volcanics.

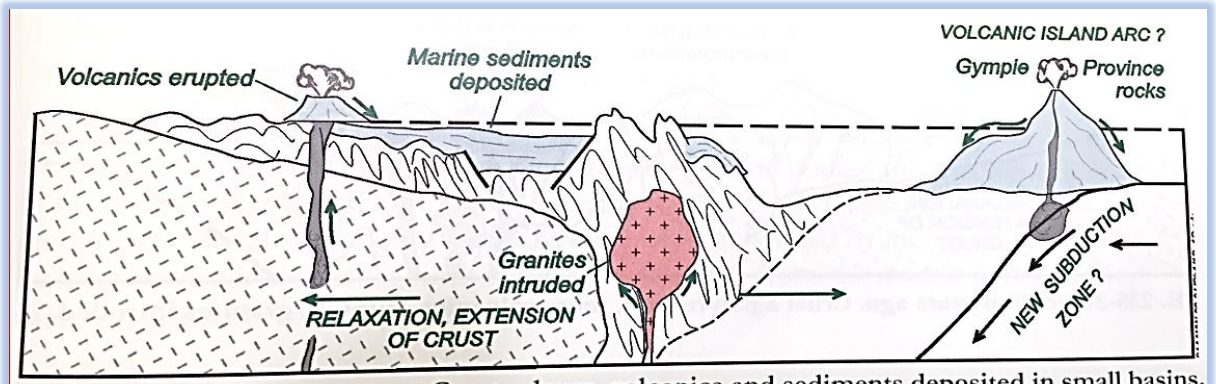
This processes that affected the formation of the bedrock are shown below. The theoretical reconstructions of events that formed the different bedrock units are shown in time sequesnce.



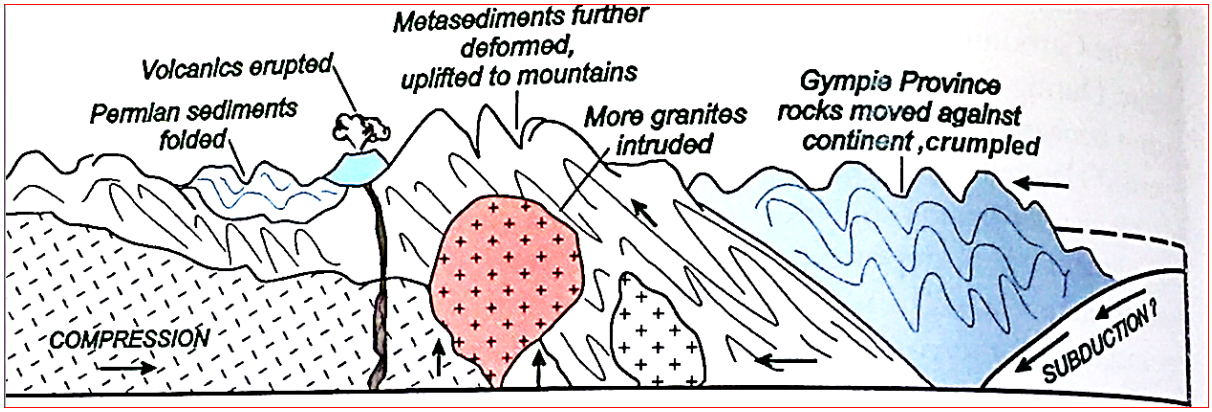
A. 370-315 million years ago. Sediments, lavas deposited in deep water off edge of continent.



1A. 315 million years ago. Compression deforms, hardens and uplifts deep-water sediments.



1B. 290 -235 million years ago. Crust relaxes, volcanics and sediments deposited in small basins.
1C. Subduction zone moves east, rocks of Gympie Province deposited.



1D: Hunter Bowen Orogeny collision of the Gympie Province with the continent and deformation of Permian to Early Triassic sediments and volcanics

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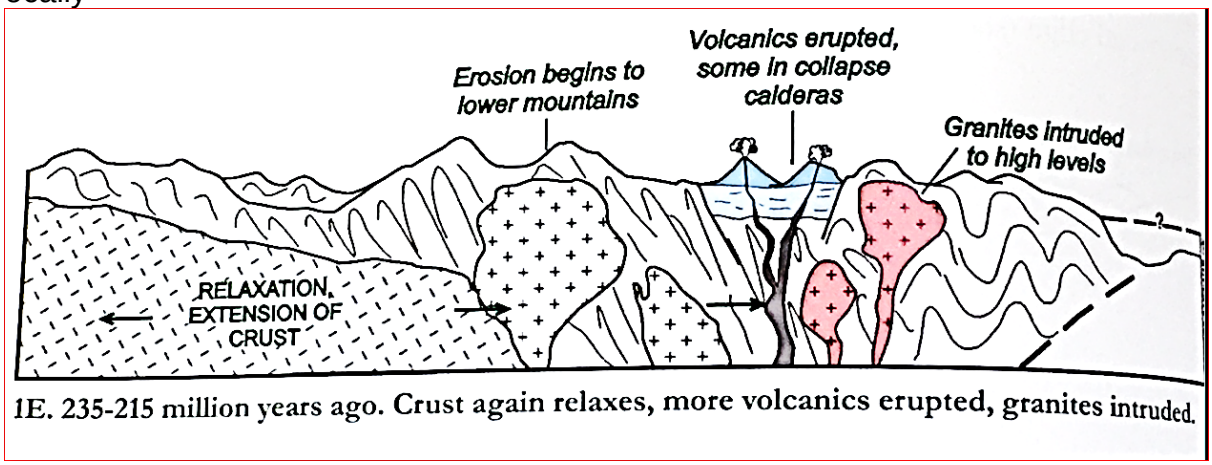

This relaxation formed the Ipswich Basin locally with its coal measures and volcanic rocks

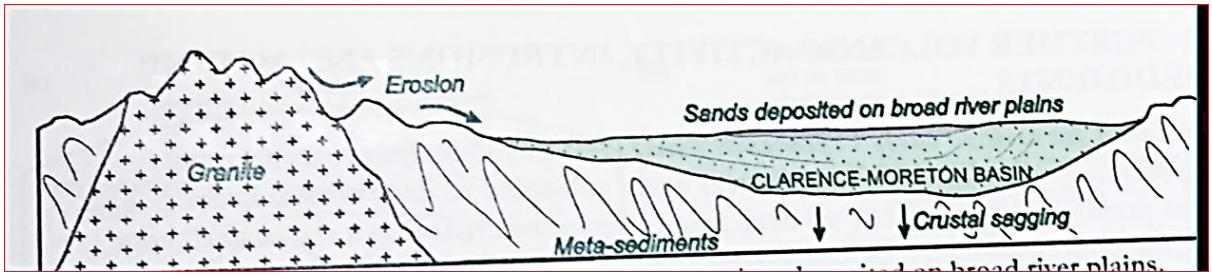

Figure 1F: Development of deeper basin following crustal relaxation and extension

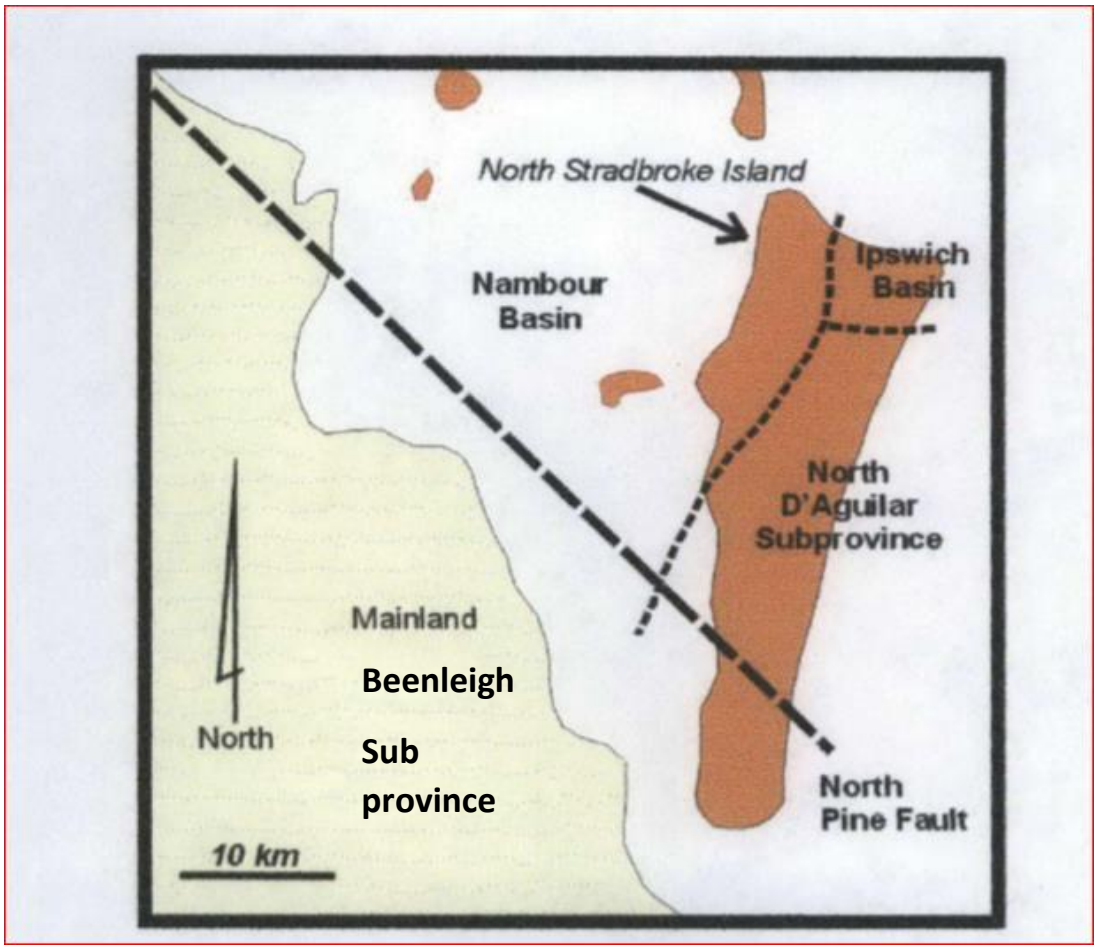

Figure 2: Structural Elements of the bedrock

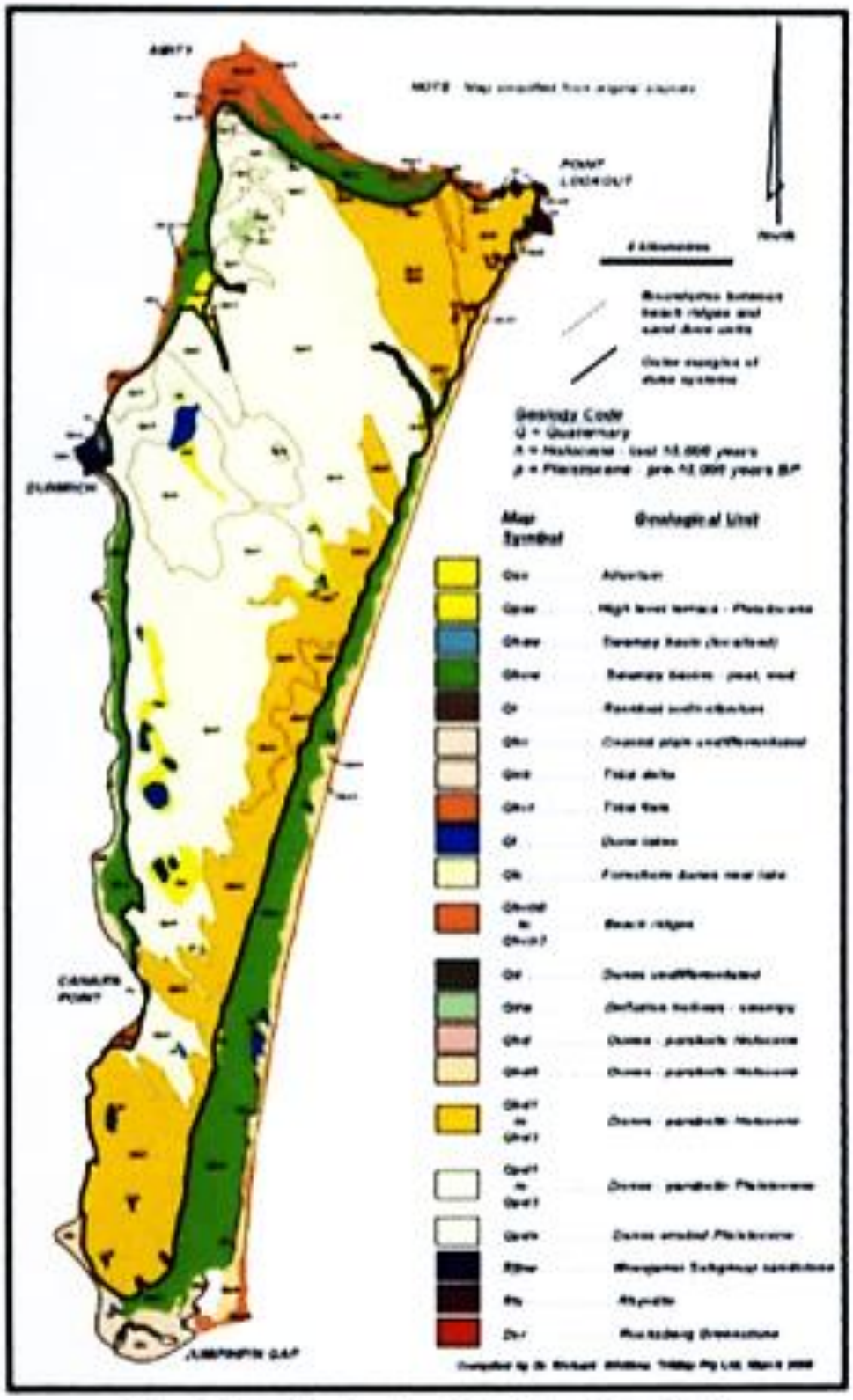

Figure 2.5 : Surface Geology of North Stradbroke Island

Remnants of this accretionary complex are represented in this region by rocks of the **North D'Aguilar Sub Province. (see Figure 2 above)**

North D'Aguilar Sub province

The accretionary wedge contains deposits consistent with an origin in a continental slope and deep-sea basin environment. A major, similarly oriented structure, the Bracalba Fault, terminates the North D'Aguilar Sub Province against the Nambour Basin to the east

The North D'Aguilar Sub Province is faulted to the south-east against correlative accretionary complexes rocks of the Beenleigh Sub province along the north-northwest trending North Pine Fault. The North Pine Fault represents the southern extension of a major north-northwest trending suture - the Perry Fault**.**

Middle to Late Triassic felsic volcanics

The first cover sequences postdating the Hunter-Bowen orogeny (1D) are a series of extension-related felsic volcanics and associated high level granite plutons (1E). **The Late Triassic volcanic units occur at the base of the Nambour and Ipswich Basins and are correlatives with the rhyolite near Point Lookout.**

Mesozoic Basins

The close of the Late Triassic volcanic episode was followed by a sag phase that continued with the development of local intermontane basins (1F). In southeast Queensland these sediments are represented by the Nambour Formation. Movement is known to have occurred along the large north-northwest trending fault systems (including the Bracalba and North Pine Faults) after the Late Triassic when episodic dip slip and strike slip movements took place. Rocks of the Woogaroo Sub Group occur in the surface at Dunwich and in the subsurface of Moreton Bay. They have been affected by Tertiary laterisation processes

Tertiary Basins

Latest Cretaceous to Early Tertiary movement is associated with extension of the crust, the opening of the Coral Sea and the formation of the small oil-shale-bearing grabens along the east coast of Queensland. Most Tertiary Basins in southeast Queensland are of Late Paleocene to Eocene age and are essentially half grabens bounded by faulting to the west. Carbonaceous oil shale is known from the Petrie In the Petrie Basin basalt flows that occur along the Redcliffe Peninsular, at Bald Hills and along the coastline at Redland Bay are deeply weathered with pisolitic iron-rich gravels and have not been dated.

Typical laterite weathering in rocks of the Petrie basin

These flows overlie carbonaceous mudstones that contain fish scales of Paleocene to Eocene age.

Cainozoic Morphostratigraphic Units

The Cainozoic units on North Stradbroke Island form part of a unique coastal system in eastern Australia. This system includes Fraser Island in the north, Rainbow Beach, Colocolo sand mass, Noosa-Coolum and Moreton and Stradbroke islands.

On the oldest Pleistocene dunes (‘ancient dunes’) occurred in the northern part of the island east and immediately south of Dunwich., and that these dunes form the western part north of Canapé Point and there is a onlap of successively younger dune deposits from west to east in the direction of the prevailing wind. The formation of parabolic dunes with trailing arms in the direction of the prevailing south-easterly wind and there is redistribution of heavy minerals from the original beach deposits to the transgressive dunes.

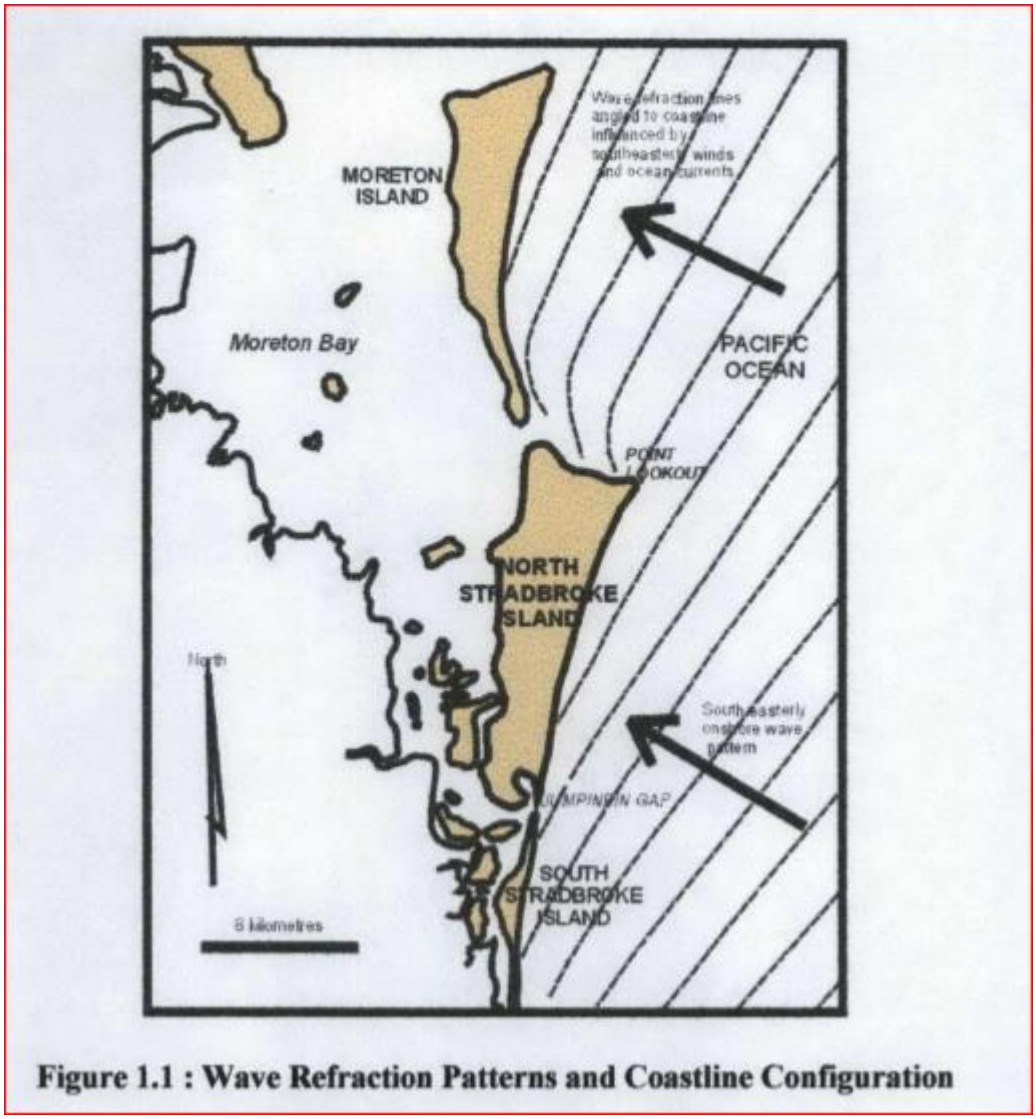

Figure 1.1 : Wave Refraction Patterns and Coastline Configuration

The **Pleistocene to Holocene** history of southeast Queensland is dominated by the glacial low sea level stands and interglacial high sea level stands. These variations produced a range of unconsolidated to poorly consolidated units that had distinctive geomorphological expressions. These units comprise marine sands, silts, and muds, coastal dunes and beach ridges and alluvial and colluvial deposits.

The coastal evolution of the area is dominated by fluctuations in sea levels in the Pleistocene. These fluctuations produced a series of dunes (Quds and Qpd units) and beach ridges (Qhcb, Qhb and Qpcb units) parallel to the coastline, and coastal swamps (Qcw, Qhcw) inland. A sequence of distinctive soils is associated with the different ages of quartzose sand dunes and beachridges. The soils are mainly podsols and groundwater podsols. The age of individual units is related to the depth of the subsurface B horizon, and there is a progressive deepening of soils with increasing age. Comparisons between dune soils and beach ridges are only valid for the Holocene because in older beach ridges the depth of soil development is restricted by shallow water tables. Pleistocene dunes are characterised by the development of giant podsols. Ages for these dune deposits are constrained by thermo-luminesence and radiocarbon dating. The oldest unit (Qpd_3) was termed a Kabali landscape

comprising giant humus podzols was dated by thermoluminesence at 730^{+}- 70 Ka). Unit Qhd_2 or Qhd_3 comprising giant podzols and giant humus podzols had a 90 $^{+/}$- 10 ka thermoluminesence age. Unit Qhd_1 had thermoluminesence age dates of 19+/- 2 and 11+/- 2 Ka at Kings Bore.

In some cases, the coastal swamps were very large and formed large bodies of fresh to brackish water (unit Ql). Two types of lakes have been produced – water table lakes and perched lakes. In larger water bodies the wind-blown sand produced a series of sand ridges and water movement produced large-scale ripples. In the offshore marine area and inshore estuaries tidal changes produced complex geometries in quartz bodies of the tidal delta. The present tidal delta produced quartz-rich sandbars. Lake deposits are designated by symbols that indicate their morphology or lithology. The coastal swamps (Qcw) are also Holocene in age with small coastal swamps (Qhcw) between the existing Holocene beach ridge and older Pleistocene dunes. Coastal swamps with peat and fresh water sedges (**unit Qhcw**) occur long the western coast of NSI and grade seawards into intertidal mangrove (**Qhct**) units. The coastal swamps also contain low beach ridges (probable originally off shore spits - unitQhcb1) within Qhcw south of Amity.

The major area of coastal swamp occurs along the eastern side is Eighteen Mile Swamp. This swamp separates the current Holocene surf beach (**$Qhcb_0$**) and foredune system (**unit Qhd)** with blowouts (**Qhd_0**) from the transgressive dune systems to the west at a prominent scarp developed during the last interglacial period.

View looking south from Point Lookout, showing the Holocene surf beach, the foredune system and the scarp with the transgressive high dunes in the background

Along the northern margin of from Amity to near Adder Rock is a zone of coastal fresh water swamp with beach ridges (**$Qhcb_0$ to $Qhcb_3$**) and a foredune system. This

youngest system (**Qhcb$_0$**) system is locally up to 4 m above the base of the current beach. (Photo of higher dune at Amity).

PLANT AND ANIMAL HABITATS

North Stradbroke Island exhibits a wide range of habitats, each supporting its own assortment of plants and animals. The most important habitats along the eastern, or ocean, side of the Island consist of open beaches, frontal dunes and the 18 Mile Swamp, together with a small area of rocky headland at Point Lookout. The western, or Moreton Bay, side of the Island is characterized by mangroves and tidal swamps. The bulk of the Island consists of sand dunes - some low and rounded, others up to 100m in height, with steep sides. A series of lakes and lagoons occurs between the dunes, the most notable being Blue and Brown Lakes and Blaksley, Black Snake, Ibis and Native Companion Lagoons. These waters are generally acidic and support little animal life. The sand dunes are mostly covered with mixed forests, usually dominated by eucalypts. Extensive areas dominated by smaller banksias and acacias, ranging down to low heathlands, also occur. Inland swamps are usually dominated by paper-barks. A small patch of dry rainforest or vine scrub occurs at Myora . Large areas of sand and muddy sand flats occur on the Moreton Bay side of the Island and these support communities of seagrass.

Plants of North Stradbroke Island

Frontal Dunes

Plants on the exposed frontal dunes need to be salt tolerant and they generally hug the ground as a reaction to the incessant winds. The dominant plant is the grey, creeping grass *(Spinifex hirsutus).* Other creepers include the guinea flower *(Hibbertia scandens)* with showy bright yellow flowers; goat's foot *(Ipomoea pescaprae)* with mauve flowers; and pigface *(Carpobrotus glaucescens)* with purple daisy-like flowers. The Pandanus or screw-pine *(Pandanus pedunculatus)* and coast she-oak *(Casuarina equisetifolia)* grow on some exposed dunes and at Point Lookout. The coast banksia *(Banksia integrifolia)* grows in some exposed areas in a stunted form, deformed by the winds, in marked contrast with the upright tree which it becomes in more sheltered areas.

The High Dunes

Most nutrients have leached from the high dunes by rain waters and the soils are thus infertile in the agricultural sense. These dunes, however, generally support tall open forests, dominated by eucalypts, with a well- developed understory of grasses and shrubs. The more common species of eucalypts include blue gum *(Eucalyptus tereticornis);* scribbly gum *(E. signata);* pink and red bloodwoods *(E. intermedia and*

E. gummifera) and blackbutt *(E. pilularis).* Other trees of the open forests include the smooth-barked apple *(Angophora costata);* the she-oaks *(Casuarina littoralis and C. torulosa);* the cypress-pines *(Callitris columellaris* and *C. rhomboidea).* Smaller trees and shrubs include several wattles or acacias such as the black wattle *(Acacia cunninghamii);* sweet wattle *(A. suaveolens),* prickly moses *(A. ulicofolia)* and the wallum and coastal banksias *(Banksia aemula and B. integrifolia).* These banksias and some of the eucalypts attract many nectar eating birds and insects when flowering.

Shrubs of the understory include May-bushes or Tea-trees *(Leptospernum)* and baeckea species with masses of small white flowers; geebungs *(Persoonia)* species with yellow or cream flowers; wedding bush *(Ricinocarpus pinifolius)* which can provide a spectacular spring show with masses of white flowers; grass-trees or blackboys *(Zanthorrhoea Johnsonii)* with striking spear-like flowering spikes which are attractive to nectar-eating birds and insects, and the blueberry ashes *(Elaeocarpus obovatus and E. reticulatus).*

Many smaller flowering shrubs and creepers also occur, including the pink flowering boronia *(Boronia rosmarinifolia);* eggs & bacon *(Dillwynia floribunda);* the yellow pea *(Phyllota phylicoides)* and false sarsparilla *(Hardenbergia violacea).* The well known bracken fern *(Pteridium esculentum)* is widespread, as is the matrush *(Lomandra longifolia).*

Mangroves conspicuously occupy the inter-tidal zone along the western side of the island, ranging from isolated trees to extensive forests in the south and in Swan Bay. The common and dominant species is the grey mangrove *(Avicennia marina),* but stilted mangrove *(Rhizophora stylosa),*large-leafed mangrove *(Bruguiera gymnorrhiza),* spurred mangrove *(Ceriops tagal),* river mangrove *(Aegiceras corniculatum),* and the milky- sapped blind-your-eye *(Exoecaria agallocha)* are all well distributed. Areas of muddy sand adjacent to the mangroves support several species of seagrass, of which Zostera capricornia) the most abundant.

Animals of North Stradbroke Island

The island is home to native land mammals including wallabies, kangaroos, echidnas, koalas and bandicoots. Reptiles include turtles, tortoise and lizards, and it also has amazing birdlife.

The Department of Environment & Heritage Protection has identified 450 native animals ; most of which are intrantional and 43 of which are either rare or a threatened species

Land Mammals

About 18 species of native land mammals occur on the Island. These include three macropods; the swamp wallaby *(Wallabia bicolor),* the grey kangaroo *(Macropus giganteus)* and the relict agile wallaby *(Macropus agilis)* which is rare. The echidna *(Tachyglossus aculeatus);* bridled bandicoot *(Isodon macrourus);* brush-tailed possum *(Trichosurus vulpecula)* and koala *(Phascolarctos cirereus)* are widely

distributed but are uncommon, while the grey-headed flying fox *(Pteropus poliocephalus)* seasonally concentrates on flowering trees and fruit.

Marine Mammals
Since the closure of the whaling station on Moreton Island in 1962, the population of the humpback whale *(Megaptera novae-angliae)* has increased slowly and they can now be seen annually from vantage points at Point Lookout during the north-bound migration in June and July and during the south-bound migration in September and October. Dolphins are common, both offshore and in Moreton Bay. The bottle-nosed dolphin *(Tursiops aduncus)* is the most plentiful, but the spotted dolphin *(Sousa lentiginosa)* also occurs. Dugong *(Dugong dugon)* feed on the seagrasses of Moreton Bay and may occasionally be seen as they come up to breathe.

Birds
Almost all visitors to North Stradbroke Island arrive by ferry and a good variety of birds can be seen on Moreton Bay during the crossing. These include the pied cormorant *(Phalacrocorax varius)* and the smaller little pied cormorant *(P. melanoleucos)* which can be seen perched on the navigation guides or fishing. Pelicans *(Pelecanus conspicillatus);* black swan *(Cygnus atratus)* which often occurs in a large loose flock of 200 or more out from Cleveland; the well known silver gull *(Larus novae- hollandiae)* with red legs and bill; crested tern *(Sterna bergii)* which is about the same size as a silver gull but with black cap and yellow bill; little tern *(Sterna albifrons)* which is much smaller than the crested tern, and perhaps the caspian tern *(Hydroprogne caspia),* the largest of our terns, with a large red bill and black cap.

Four raptors may often be seen on Moreton Bay or along the edges of Stradbroke Island. These are the brahminy kite *(Haliastur indus),* with rich reddish-brown back and wings and contrasting white head; white- bellied sea-eagle *(Haliaeetus leucogaster),* grey above, white below and often seen soaring with broad upswept wings; whistling kite *(Haliastur sphenurus),* rather dingy looking and characterized by a loud whistling call Òpee-oar-wh-wh-wh-wh-wh-wh-whÓ; and the osprey *(Pandion haliaetus),* with white head, dark eyestripe and brown back and tail, perhaps diving into the water to capture a fish or maybe eating a fish whilst perched.

At low tide mixed flocks of waders feed on the sand and mud banks north of Dunwich and at high tide they congregate on exposed sand spits. Migratory waders are usually seen in their drab brown and grey non- breeding plumages during our summer months. The largest of these is the eastern curlew *(Numenius madagascariensis)* with a very long down- curved bill. The whimbrel *(N. phaeopus)* is smaller than the curlew and its down-curved bill is proportionally shorter. The bar-tailed godwit *(Limosa Lapponica)* is similar in size to the whimbrel but has an almost straight bill which is slightly up-turned. Smaller waders include the lesser golden plover *(Pluvialis dominica),* plumpish, with a short bill, grey-brown with yellowish speckles; greenshank *(Tringa nebularia)* greyish above, white under, greenish legs and a long, thin bill; and the black and white black- winged stilt *(Himantopus himantopus)* with very long, thin, pink legs.

Several species of birds are usually found only in mangroves or in adjacent areas. These include the striated or mangrove heron *(Butorides striatus),* a squat-crouching

grey or brown heron; mangrove kingfisher *(Halicyon chloris),* blue-green on back with a white breast and heavy black bill; mangrove warbler or gerygone *(Gerygone levigaster),* a very small bird with a brown back, white underpants, white eyebrow and red eye, *(its mournful call is heard more often than the bird is seen);* and the mangrove honeyeater *(Lichenostomus versicolor),* a medium-sized honeyeater with a series of strong melodious calls.

Larger species which are likely to be seen on the beaches, in swamps or in open grass-lands include the familiar masked plover or lapwing *(Vanellus miles)* with black cap, yellow face wattles and a raucous call; sacred or white ibis *(Threskiornis aethiopica),* a white ibis with a black head; straw-necked ibis *(Threskiornis spinicollis),* a black and white ibis with yellow plumes; Royal spoonbill *(Platalea regia),* white, with black spatulate bill; and white-faced heron *(Andea novae-hollandiae),* a blue- grey heron with a white face.

The familiar gannet *(Morus serrator)* can usually be seen from Point Lookout, especially in winter, while the wedge-tailed shearwater or muttonbird *(Puffinus pacificus),* which has a small breeding colony at Point Lookout, can be seen during the summer banking and gliding close to the waves. Many other sea-birds have been recorded off Point Lookout, including albatrosses, petrels, shearwaters, frigatebirds, boobies, skuas and terns.

Nectar-eating species are a conspicuous part of the avifauna of North Stradbroke Island. Most conspicuous are the well-known rainbow lorikeet *(Trichoglossus haematodus)* and the scaly-breasted lorikeet *(T. chlorolepidotus)* which congregate in noisy, colourful flocks when the banksias and eucalypts are in flower. Many honeyeaters are conspicuous in the forests and heaths, including the noisy friarbird or leatherhead *(Philemon corniculatus),* which is characterized by a bare black head and upright knob on bill and is made conspicuous by its loud, harsh but pleasant calls; little wattlebird *(Anthochaera chrysoptera),* with an untidy streaked appearance and a raucous, chuckling series of calls, is often found in banksias; the familiar noisy miner or mickey *(Manorina melanocephala),* a grey-brown and yellow honeyeater forming sociable, aggressive flocks; white-cheeked honeyeater *(Phylidonyris nigra),* a distinctive-black and white bird often found in the banksia heathlands; brown honeyeater *(Lichmera indistincta),* a small olive-brown bird without distinctive markings but with a rich, varied call; and the scarlet honeyeater *(Myzomela sarguinolenta),* a tiny bird, dull brown if female, but having a brilliant scarlet head and back if male.

Other well distributed and common birds are the kookaburra *(Dacelo novaeguineae);* rainbow bee-eater *(Merops ornatus),* a beautiful iridescent blue-green and bronze bird which nests in a tunnel dug in the ground; dollar-bird *(Eurystomus orientalis) (summer),* a dumpy, dark blue-green bird with white, round patches on the wings seen in flight; the familiar black-faced cuckoo-shrike or blue jay *(Coracina novaehollandiae),* a blue- grey bird with black face and throat and a characteristic habit of shuffling its wings on alighting; rufous whistler *(Pachycephala rufiventris),* the male easily recognized by grey back, and black breast band separating the white throat from the rufous breast and belly; figbird *(Sphecotheres viridis),* a stocky species, brown above and streaked below if female, and with red skin around the eye if male, often found in sociable flocks

feeding on figs or other fruiting trees; spangled drongo *(Dicrurus hottentotus),* glossy black with a characteristic fish tail and red eye.

Finally mention should be made of the familiar black and white birds which are so common throughout much of eastern Australia; willie wagtail *(Rhipidura leucophrys);* magpie-lark or pee-wee *(Grallina cyanoleuca);* pied butcher bird *(Cracticus nigrogularis);* Australian magpie *(Gymnorhina tibicen);* pied currawong *(Strepera graculina);* and the all- black torresian crow *(Corvius orru).*

The birds listed are but a small fraction of the 260 species which have been recorded for North Stradbroke Island but some species are vagrants and are unlikely to be seen.

Reptiles
About 16 species of snakes occur on North Stradbroke Island. Species most likely to be encountered include the carpet python *(Python spilotes);* green tree-snake *(Dendralaphis punctulatus);* and the red-bellied black snake *(Pseudechis porphyriacus).* The death adder *(Acanthophis antarcticus)*is well distributed but is uncommon. Several species of sea snakes also occur.

Larger lizards which may be encountered include the sand monitor *(Vanarus gouldii);* lace monitor *(V. varius)* and bearded dragon *(Amphibolurus barbatus),* but many species of skinks are also present.

The long-necked tortoise *(Chelodina longicollis)* frequents permanent swamps and lakes and is the only land tortoise present. Green turtles *(Chelonia mydas);* and loggerhead turtles *(Caretta caretta)* can sometimes be seen in Moreton Bay or in the off-shore waters near Point Lookout.

HUMAN HISTORY TIMELINE

The Quandamooka story

Minjerribah (now North Stradbroke Island) is the traditional home of the Noonuccal and Gorenpul people. The Noonuccal people lived around what is now Amity Point and the Gorenpul around what is now Dunwich.

The Quandamooka People's native title consent determinations cover most of North Stradbroke Island, Peel Island, Goat Island, Bird Island, Stingaree Island, Crab Island and the surrounding waters of Moreton Bay. There are a series of festivals undertaken by Quandamooka group (REF)

Early contacts

Point Lookout was named by Lieutenant James Cook in 1770 but it wasn't until 1803 that the Redlands' first recorded contact between Europeans and Aborigines occurred when Matthew Flinders was on his way to Sydney to organise a rescue of shipwrecked passengers from the Porpoise. Flinders and his small crew stopped near Point Lookout where the Noonuccal people helped the sailors to find fresh water.

The next prolonged contact occurred when three timber-getters, Pamphlett, Finnegan and Parsons, were blown off course in their small boat near Sydney and landed on Moreton Island in 1823. They crossed to Minjerribah and spent about six weeks with the Noonuccal tribe.

That same year, more officials were sent to look at Moreton Bay, this time as a potential convict settlement. By sheer coincidence, the Surveyor General, John Oxley, ran into Pamphlett and Finnegan. On their information, he explored the Brisbane River and elsewhere. He later recommended to the authorities that Moreton Bay would be an ideal convict settlement.

Colonial naming of the island

The island was named Stradbroke in 1827 by Captain Henry John Rous, after his father, the Earl of Stradbroke. Back then, today's North and South Stradbroke Islands were one land mass.

In 1894, a ship called the Cambus Wallace was wrecked on the ocean side of a very narrow part of Stradbroke Island. In 1896, a southerly gale led to the breakthrough of the strip.

From this time on, North and South Stradbroke have been two separate islands. It is believed that the breakthrough was partly caused by earlier efforts to rescue the Cambus Wallace's cargo. Explosives it had been carrying were blown up, creating huge holes in the sand dunes.

The Amity Point area was called Bulan or Pulan, meaning narrow place. It was renamed Amity in the 1820s after John Oxley's ship of the same name.

The Dunwich area was called Goompee or Coompee, from a word meaning pearl oyster. It was also renamed in 1827 by Captain Rous, this time after his older brother, Viscount Dunwich. Rous commanded the Rainbow, hence the Rainbow Channel which runs along the island.

The convicts

Brisbane began life as the Moreton Bay Penal Settlement, which was originally set up in 1824 at Redcliffe before moving some months later to what is now Brisbane.

Ships travelled to and from the penal settlement through the South Passage between Moreton and North Stradbroke Islands. A pilot station was established at Amity Point in 1825 and a depot for unloading stores was set up at Dunwich in 1827. This was the beginning of permanent contact between Europeans and Aborigines in the Redlands.

The convicts were brought to Stradbroke Island partly to collect timber and partly to see whether farming would be successful.

After the convicts

Once the Moreton Bay convict settlement closed in 1842, the entire Moreton Bay area was opened to free settlers. In 1850, a quarantine station was set up at Dunwich for the settlers who flocked to the new colony. They had a stay at the quarantine station if they were sick so that they didn't infect people in Brisbane and elsewhere.

In 1866, the quarantine station was closed and the buildings converted into the Dunwich Benevolent Asylum, Queensland's first dedicated home for the old and infirm. Some buildings in Dunwich today date from this period but most buildings were removed when the asylum moved to Sandgate in 1946.

During this time, fishing was an important industry for Aborigines and European residents. Amity Point and Dunwich have been home to fishing communities until the present day.

Sand mining began on North Stradbroke Island in the early 1950s, playing a significant role in the community. It is currently being phased out.

Stradbroke Island's first car ferry service began in 1947. Before then, only passenger ferries travelled to the Island. They landed at Amity Point and at Dunwich. The car ferry allowed many more people to visit the island, which had long been recognised as a potential holiday spot.

In 1935, the first land sales took place at Point Lookout and, in the 1950s, planning began for the Point Lookout township with residential land sold in stages over the following years.

The island's historical records show that many of the early facilities were set up on the Island for the convict settlement, the quarantine station or the benevolent asylum.

Dunwich

A stone causeway was built in the mid-1820s at Dunwich for the boats that brought people and cargo to the island. This causeway defines the northern wall of the car and passenger ferry terminal at Dunwich.

The first school opened in Dunwich in 1889 for children of staff at the asylum. This school moved to Bribie Island and back to Stradbroke in 1893, when the Myora Aboriginal Mission opened at Moongalba. The school continued operating at Moongalba until 1941, when it closed. The mission closed in 1943. A new school, the Dunwich State School, was opened in 1904, again for the children of asylum staff. An Anglican church, St Mark's, was built in Dunwich in 1909 for the asylum.

When the asylum closed in 1946, many of the buildings were taken off the island. New houses and other buildings were erected after the sand mining companies arrived in the 1950s.

Amity Point

A fishing community was established at Amity Point in the 1880s. The first school opened in 1919 but it did not last long. Another school opened in 1951 but it closed in 1961 because there were no longer enough children living there.

Point Lookout

For many years Point Lookout was part of a large cattle run operated by Billy North. Permanent residents began living at Point Lookout from about the 1930s. Bert Clayton built Point Lookout's first holiday accommodation in the 1930s. In 1932, the Point Lookout Lighthouse was built. From the 1950s, land was increasingly sold at Point Lookout for housing, creating the popular township that is there today.

APPENDIX DESCRIPTION OF UNITS AT SITES

1. Cleveland Boat Harbour

   Red pisolitic material of the Petrie Basin at Cleveland Boat Harbour and the intertidal zone derived from lateritisation of rocks of the Petrie Basin

Typical laterite deposit of the Petrie Basin

2. Coochiemudlo Island (see Description below)

Coochiemudlo Island

Coochiemudlo Island in the middle to part of Moreton Bay is the closest of the bay island to the coastline at Victoria Point. The island is composed of basaltic and sandstone rocks ranging in age from Late Triassic (~210Ma) to early Tertiary (~45 Ma). A process of deep weathering affects both these rock types in the mid-Tertiary. The island also contains unconsolidated deposits - a series of beach ridges and a sandy beach (Holocene in age) and clayey swamp deposits.

Geological Units

***Marine intertidal sands* (Qhm)**

This surrounding part of the island is intertidal and subtidal sand deposits of Moreton Bay.

Coastal Swamp (Qhcw)

The eastern part of the island is contains a coastal swamp The Green area on the map is a coastal swampy area dominated by Tea-tree (Melaleuca quinqinerva), which is formed on mainly clayey soil. The northeast part of the island also contains areas of peat that are visible at low tide. The map here depicts both surface and sub tidal units. The northern orange coloured area is of marine sands and muds that are below low tide

Present Beach Qhb

A beach composed dominantly of coarse quartz grains and shell material surrounds the island and is about 100m wide at the widest point. The beach forms between high and low tide

Beach ridges (Qhb)

The golf course on the western margin of the island is composed of alternations of low sandy mounds that are interpreted as a series of low beach ridges formed on a tide dominated coast. These ridges are commonly between 0.5 and 1.0m in elevation and may have been degraded over time by the action of water and wind to their present elevation. No datable material has been extracted to confirm the age of these ridges, which may be Holocene or Pleistocene in age.

Petrie Formation (TPb(w))

The basaltic rocks of the Petrie Formation forming the highest western parts of Coochiemudlo Island contain clay-filled altered amygdales (probably originally zeolites) in a typically deeply weathered red clay profile on. These basaltic rocks were affected by a period of deep weathering in the mid-Tertiary (~20Ma) that converted the amygdaloidal basalt to red clay.

Woogaroo Subgroup.(RJbw)

The oldest rocks on the island (forming the eastern ¾ of the island) are of Late Triassic age. These consist mainly of iron-stained, mottled quartz-rich sandstone, which generally gives sandy soils or podzols. Outcrop of the sandstone is generally poor, but is best along the eastern coastline of the island where it is overlain by beach sands. The quartz-rich sands were most likely derived from the granites of the Stanthorpe region based on palaeocurrent information by Wells & O'Brien, (1994) which indicates a southerly source for sandstones of the Woogaroo Subgroup.

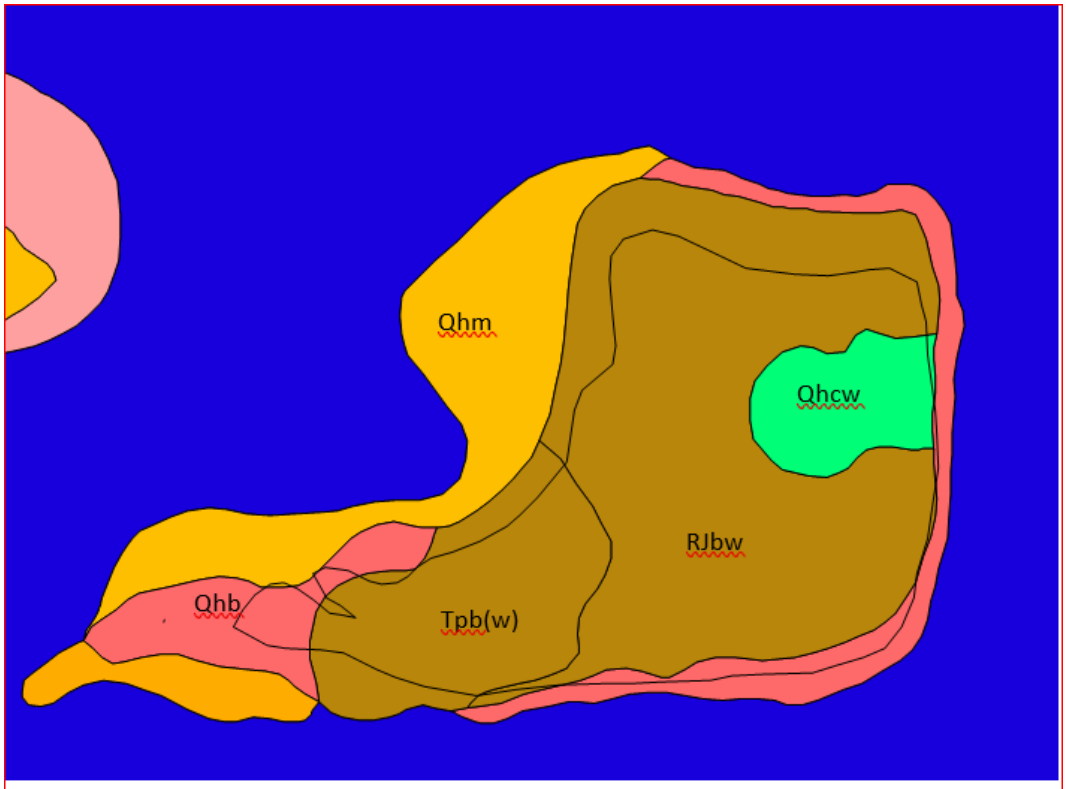

Figure 1: Geological Map Of Coochiemudlo Island (updated from Cranfield and Schwarzbok, 1973)

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CRANFIELD, L.C. and SCHWARZBOCK. H., 1973: Brisbane 1:250 000 Geological map. Department of Mines, Queensland

3.Macleay Island

MACLEAY ISLAND GEOLOGY

Source of Textual Information: Cultural Heritage Report – Ann Wallin and Associates (1998), et al. Prepared by Lindsay Hackett.

Macleay Island, similar to Russell, Lamb and Karragarra Islands, is a "bedrock" island. It is composed of Palaeozoic metamorphic rocks (Bunya Phyllite) which were deposited approximately 300 Ma before the present.

Mesozoic (Jurassic) sandstones (Woogaroo Sub-Group) - deposited in the period 220 - 180 Ma before present, and Cainozoic (Tertiary) basalt - deposited approximately 45 -35 Ma before present. The bedrock of the Moreton Bay Islands and adjacent mainland was subjected to a period of deep weathering during the Late Eocence to Early Miocene. This weathering event produced a laterite profile consisting of iron-rich material in the topmost part of the bedrock of the island and adjacent mainland.

According to the theory of continental drift, the supercontinent of Pangaea is believed to have existed between about 300 to 180 Ma. The geology of Macleay Island was created largely during its time as part of Pangaea and, consequently, when it was located at about 60^0 of south latitude, close to the South Pole. Subsequently, at about 180 Ma, the process of plate tectonics separated Pangaea into Gondwana and Laurasia.

The oldest rocks on Macleay Island are the phyliitic metasediments of the Bunya Phyllite. These rocks consist of slate, phyllite, arenite, metabasalt. These were originally deep-water marine deposits which were deposited in an ocean trench to the east of the Australian continent. In mid to late Carboniferous these rocks were metamorphosed by pressure and heat into low-grade metamorphic rocks that were folded and faulted to form a series of local and regional scale synclines and anticlines. These and other metamorphic rocks formed a mountain range at the eastern margin of the evolving Australian continent. The main exposure of

metamorphic rock of the Bunya Phyllite on Macleay and the adjacent Perulpa Island is a phyllite (see Perulpa 4.pdf). Phyllite is a metamorphosed shaly rock that contains quartz veins and erosion of these rocks produced large cobbles of quartz. The metamorphic rocks were eroded over time and eventually in the late Triassic to Early Jurassic sedimentary rocks of the Woogaroo Sub-Group (described as "quartzose sandstone, siltstone, shale, conglomerate and minor coal"), but mainly sandstone and conglomerate on Macleay Island were deposited between hills of the metamorphic rocks and on Macleay island to the west of the metamorphic rocks. The exposure at the end of Jan Street (jan8-11.pdf and Jan Street Rock Shelf Location.pdf) probably represents the unconformity between the metamorphic rocks and the over lying rocks of the Nambour basin. The rock is a sedimentary breccia that was deposited as a debris flow eroded from the hills of the Bunya Phyllite. The phyllitic rock is composed of narrow layers of phyllite with quartz veins. Erosion of this rock would create blocks of quartz that would move down slope under gravity. The rock at Jan Street consists of angular quartz cobbles to granules in a dark clay-rich matrix. The present nature of this rock is probably due to two processes – the erosion of phyllite at the commencement of the Nambour Basin causing the liberation of cobbles of quartz from the quartz veins and the conversion of phyllite to clay/mud. The deposit would probably have originally contained quartz grains in a light coloured to grey matrix. The tertiary weathering event would have coloured the matrix to a dark grey to black colour. This unit from its position on the map and its composition probably represents the initial deposits of the Woogaroo Sub Group.

This sub-group was deposited at the earliest time of the dinosaurs who reached their zenith of development in the Cretaceous Period.

The break up of Gondwana and the splitting off of New Zealand and the opening of the Coral Sea took place in the Cretaceous, and by the Tertiary period, Australia had separated from Antarctica, had moved northwards to about 40^0 of south latitude, and was warm and humid. During the Tertiary period (Eocene to Oligocene epoch, 55-24 Ma), large scale regional volcanism occurred to produce numerous basalt flows around the southeast Queensland region, in particular the Redland Bay area, Archerfield, and Redcliffe areas (Green & Stevens, 1975). The volcanism in the Redland Bay area was probably associated with the creation of a deep but narrow graben which formed as part of the regional tectonic activity associated with this period of volcanism (FRIEDERICH, 1978). The graben in the Redland Bay area is bounded to the east by the western margin of Macleay Island where a small area of basalt has been mapped (Warner *et. al.:* 1980). The western boundary is located on the mainland. The graben widens and deepens to the north and includes St. Helena and Green Islands. The eastern bounding fault of the graben lies somewhere between Peel Island and Wellington Point.

** Graben: A depression in the earth's surface between faults.

The warm and wet climate of the Tertiary period, from about 24 Ma, deeply weathered all rock on Macleay island to form the lateritic*** soil profiles present today. In the south of the Island, this weathering of Palaeozoic rock has produced red soil. At Pott's Point, in the north of the Island, is seen Jurassic sandstone. On the

shore at the eastern end of Jan Street is seen Palaeozoic metamorphic rock that has developed nodular ironstone concretions.

*** Lateritic: A red or yellow ferruginous clay (containing the element “iron”).

About 1.6 Ma ago, Australia reached its present position of about 25^0 of south latitude, but continues its northward drift.

Source of Textual Information:

Cultural Heritage Report – Ann Wallin and Associates (1998), et al. Prepared by Lindsay Hackett

4.Peel Island;

PEEL ISLAND GEOLOGY (Q AND A)

(Document supplied by LC CRANFIELD to GSAQ, 27 February 2016 and minor amendments made by DL TREZISE)

Q: What has caused the island to form the way it has e.g. repeated emptying and filling of Moreton Bay?

A: By sea-level rise ~ 120 000 years ago to the present sea level. There is some example of higher sea level than present during the Holocene (i.e. last 10 000 years) to about 2-3 m above present seal level. Peel Island would have been higher than the rest of the local bay area due to the resistant exposures of quartz-rich sandstone.

Q: When it was formed (how old)?

A: The Island was formed in the past 120 000 years. Prior to that, the area would have been sandstone outcrop. There is a beach area around the island with localised exposures of shelly beach rock and local occurrences of mangroves. In the period of drowning of the coastline and the formation of beaches, a coastal swamp was formed on the southern side of the island and a brackish lagoon and a fresh water was formed over this period.

The sandstones were formed in the Latest Triassic to Early Jurassic (about 210M years before present) as part of the Nambour Basin (an offshoot of the Great Australian Basin) that occurs to the east of the Beenleigh Block.

Q: What types of sandstone are present?

A. Quartz-rich sandstones of the Woogaroo Sub Group of the Nambour Basin. These have a deep weathering profile at the surface weathering at the top that occurred during mid-tertiary times (about 20M years before present).

Q: What is the bedrock?

A.: Sandstone

Q: What soil types are on Peel Island?

A: Sandy soils developed on bedrock, fine sands and clays developed as Holocene deposits adjacent to the island and peaty clays in the swampy regions.

Q. Information about the aquifers on the island.

A. Sandstone - porous bedrock of the Woogaroo Sub Group (Late Triassic to Early Jurassic age)

Q: Is this water saline or suitable for consumption?

A. Yes it is fit for human consumption – this water was used for the leper colony on the island in the 1940s-1950s.

Q: How shallow/deep are this/these aquifers below ground?

A: The deepest well (in 1949) was 32 ft 6ins (well B) in sandstone which gave a 700 gallons per hour of water suitable for human consumption (Pearce, G.W., 1949). Two wells - 23ft 6ins (water depth 8ft 6ins) and 32ft 6ins (water depth 4ft 0ins) have been drilled and water from both wells was pumped from tanks for human consumption. The chemical analysis of this water was 13.2 grains per gallon total solids, 9.2 grains per gallon NaCl, 1.0 grains per gallon CaCo3, 1.7 grains per gallon Ca So4, 5.0 grains per gallon hardness and a PH value of 6. These wells are in recent sands overlying lateritised sandstone of the Woogaroo Sub Group. Pearce (1949) suggested a deeper well through the sandstones to search for water, but these have not been drilled. Comparisons from other Moreton Bay Islands (Warner & others, 1976) has shown that water in the sandstone occurs at depths ranging from 10 m to 27 m (in drill holes in other Moreton Bay Islands) (Warner & others, 1976).

References.

PEARCE, G.W., 1949: Report on water resources of Peel Island. Queensland Irrigation and Water Supply Commission. Water resources investigations

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5. Dunwich terminal

Crossbedded quartzose to sublabile sandstone and pebble conglomerate of the Woogaroo Subgroup crops out as a low headland at Dunwich on North Stradbroke Island. Palaeocurrent data from the North Stradbroke island indicates a southerly provenance for the sandstone. The unit has been penetrated in the subsurface in Gillman's Bore, Dunwich (0- 35.5 m.)Dark red to black coarse-grained feldspathic sublabile to quartzose sandstone covered in places by Tertiary laterite occurs at Mud, Peel, Coochiemudlo, Macleay, Russell, Bird, and Goat Islands. The Outcrop of sandstone is coastal and immediately south of the Dunwich Ferry Terminal. In addition rocks of the overlying Marburg Subgroup occur in the subsurface of Moreton Bay and the Islands., AAO St Helena 1 (357-479 m), WPL Wellington Point 1 (610-976 m).

6.Ebb and Flow Tidal Delta

The ebb and flow tidal delta between Moreton and North Stradbroke has redistributed the present movement of sand from northern New South Wales streams due to the tidal flow between these islands. This makes the crossing of this area dangerous for boating.

7.Myora Springs;

(https://www.tripadvisor.com.au/LocationPhotoDirectLink-g495004-d9789138-i215976224-Myora_Springs_Conservation_Area-North_Stradbroke_Island_Redland_City_Bri.html)

Myora Springs Conservation Area, also known as Capembah Creek by the local Quandamooka people, was once a sacred meeting place. Myora Springs is a natural flow from the main Ground water table on the western side of the island it is the only area of rain forest on the island.

This site in the mangroves, the site provided the people with fresh water and food. The area has been conserved and can be visited via the short boardwalk. On entering the conservation area looking to the right you will see a rapid fresh water stream flowing from under the road, as the signage states 2.4 million litres flows out of the stream daily. Myora Springs is located on the main road between Dunwich and Point Lookout, a visit here only takes five to ten minutes to enjoying the tranquillity of the creek. Here it is possible to view the mangroves on the western side of the island.

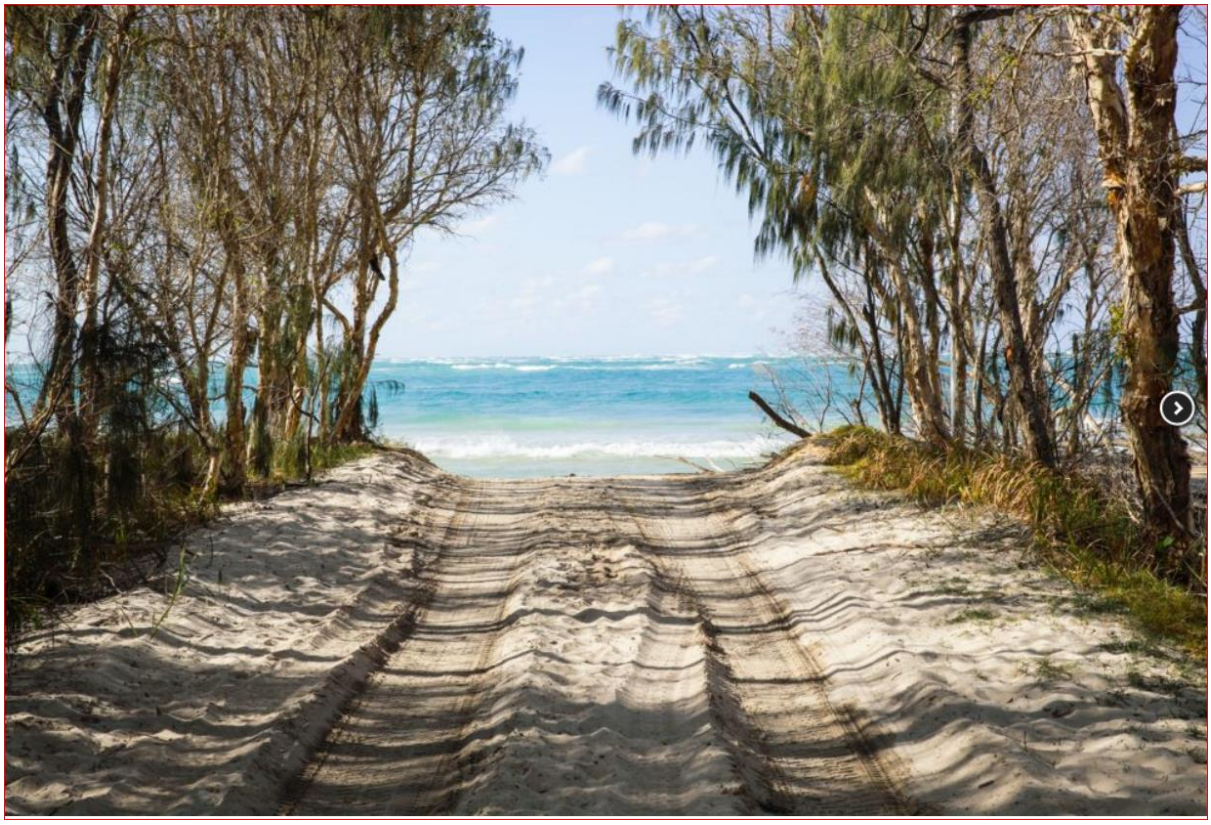
Mangrove forest on western edge of the island

Along the boardwalk are signs on the local flora and fauna.

8. Amity Point and Flinders Beach;

Amity Point is a popular fishing village on the north-western tip of the island and has access to a wide beach area with low frontal dunes of Flinders Beach on the north-western tip of the island that afford a view to Moreton Island.

Amity Point Looking north to Moreton Island



Flinders Beach track north of Amity Point

Flinders Beach looking east to Point Lookout

9-10. Adder Rock; Cylinder Headland and Point Lookout

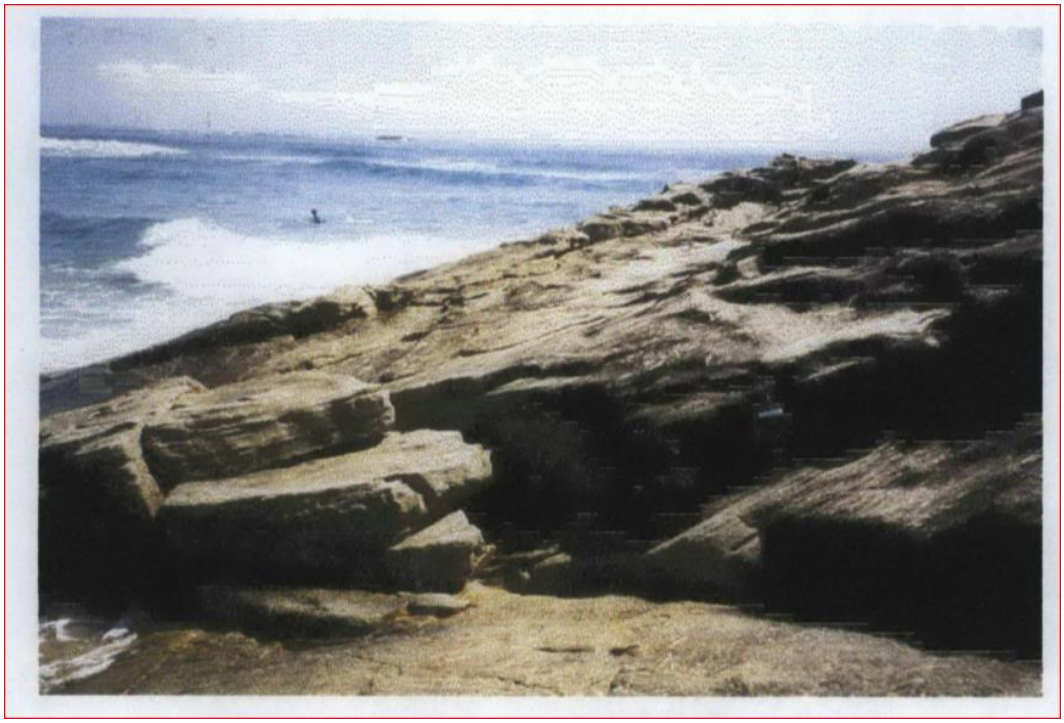
Unnamed Triassic Volcanics (Rv): This unit forms outcrop varying from 10m above sea level at Cape Moreton to 70m above sea level at Point Lookout and adjacent exposures to the south of Point Lookout. The emergent Shag Rock and volcanics in the subsurface APS Majara 1 offshore of Moreton Island also form part of this unit.

The unit on North Stradbroke Island was examined in exposures from Point Lookout to Adder Rock and in a quarry south of Point Lookout. In general, it comprises light grey to buff coloured and white coloured flow-banded rhyolite. In the quarry south of point Look out the rock is a flow-banded rhyolite with well-developed jointing and igneous flow foliation. A sample from the quarry indicated that the general exposure at this site is a sparsely K-feldspar-phyric rock with individual flow bands averaging 1-2mm wide. Compositionally the outcrop was similar at Cylinder Beach and at Adder Rock. Offshore rhyolite exposures occur at emergent exposure in particular Shag Rock and Flat Rock.

The unit is characterised by a well-developed igneous flow layering. The orientation of this flow layering is locally very variable and contorted particularly in the vicinity of Point Lookout where the orientation varies from almost flat lying to vertical in a single exposure. In the quarry south of Point Lookout at AMG 551323 6962531 the flow layering dips from 45-65^{o} in 45-60^{o} to the northeast (azimuth 32^{o}).

Rhyolite Outcrop at Quarry south of Point Lookout

At Cylinder Headland (AMG 552672 6966273) the flow banding in the rhyolite dips from 25-35^{o} towards the west (Azimuth 285^{o}).



At Adder rock flow layering in the rhyolite dips at about 35^{0} to the northeast towards Cylinder Headland. Evidence from APS Matjara 1 well was that the most common

dips was estimated at 20^0 to the east. Exposure at the gorge at Point Lookout dips at about 45^0 to the north, but dips close to horizontal are also present in this area.

The Gorge, Point Lookout

The total thickness of unit Rv is unknown. A guide from APS Matjara 1 offshore of Moreton Island that 611 m of volcanics equated with this unit were penetrated in this well (Cranfield & others, 1976). The presence of acid to intermediate pyroclastics in association with rhyolite flows in APS Matjara 1 well suggests that at least part of unit Rv was subaerially deposited. The rhyolitic volcanics on Stradbroke Island are most similar to the section between 555m and 646m in APS Matjara 1 well (Cranfield & others, 1976). Unit Rv underlies Woogaroo Sub Group rocks which are of Latest Triassic to Jurassic age.

There is no direct age dating of the volcanics on NSI. K/Ar radiometric age dates were undertaken on the section 119 –387m in APS Matjara 1 well. These dates ranged from 172.5 to 185 Ma (i.e. Early Jurassic) This part of the section was correlated on lithological grounds with the Brisbane Tuff of Late Triassic age, and the radiometric age dates were considered to represent a minimum age as the unit underlies the Woogaroo Sub Group.

11: Point Lookout Hotel a good lunch site with views to Moreton Island

Moreton Island In the distance from the hotel

12. Brown Lake (Bummiera) and 13. Blue Lake (Kaboora)

http://stradbrokeisland.com/straddie/view/brown-lake-on-north-stradbroke-island

Brown Lake is one of the 2 largest and significant sacred lakes on the island. Both Kaboora and Bummiera are acknowledged as being the home of an extraordinarily huge carpet snake. It's spirit resides in both lakes with the jargon attributed with being able to travel from one lake to another. The old Quandamooka people cautioned those that swam and skied on the lakes, so sacred were these lakes that old people would not approach them without a special acknowledgement. Many visitors go into these areas without a thought, but traditionally these lakes were approached with a sense of reverence, cation, respect and even fear. The Elders would always sing out in lingo before they went any further, standing back a fair way to see if there was a sign, before approaching closer to the lakes. If the waters were calm it was a sign that it was okay to proceed, but if there were any ripples or disturbance, it was a warning from jargon not to come any further. To the community, it was a ritual to stop, call out and observe, and the practice gave acknowledgement and respect to the lakes and yuri Kabool that lived there.

Blue Lake

Blue Lake (Karboora) means ‘deep silent pool’. Blue lake is a window lake into the regional groundwater. In contrast to Brown Lake the water is crystal clear. The track is 5.2 km return, and comprises approximately 1.5–2 hours walking. This walk is an easy grade; however, the path is loose sand and can be hot in summer. The walk to Karboora passes through wallum woodlands with stunted eucalypt trees, wallum banksias with an understorey of heath. The edges of the lake are thickly vegetated with eucalypts, banksias and sedges, making it a haven for birds such as honeyeaters and lorikeets. The lake supports waterbirds, such as grebes and ducks, and several species of native freshwater fish including rainbowfish and gudgeons. Visitors may catch sight of a golden wallaby (Wallabia bicolor) — a form of swamp wallaby found only on Peel Island and North and South Stradbroke islands—or, on overcast days, hear the call of the near threatened Cooloola sedgefrog (Litoria coolooensis). As Karboora is a significant place of the Quandamooka people there is a request that visitors respect their culture by not swimming in the lake.

Blue lake Observation site

The Quandnamooka website

https://www.google.com.au/search?q=quandamooka&oq=qua&aqs=chrome.1.69i57j69i59j0l4.5750j0j8&sourceid=chrome&ie=UTF-8) outlines the history of the indigenous inhabitants of the island and publicizes festivals http://quandamookafestival.com.au/).held throughout the year.

HEAVY MINERAL SANDS MINED AT NORTH STRADBROKE ISLAND AND THEIR USES

High grade Silica sand and three heavy minerals are mined from sand at Sibelco's North Stradbroke Island operation. These are rutile, ilmenite and zircon. The heavy minerals extracted account for only 1% of the total sand. The remaining 99% is used in post mining rehabilitation.

Ilmenite

Ilmenite is blended and processed to create titanium dioxide, a high quality white pigment which is UV resistant, water resistant and chemically resistant while also being non-toxic. Titanium dioxide is an important ingredient in the manufacturing of sunscreen, cosmetics, plastics, ink, paper, toothpaste and some foods such as flour and icing sugar to improve their brightness.

However more than half of all titanium dioxide pigment is used in the production of paints (household, industrial and automotive etc) as it reflects the sun's harmful UV rays protecting the paint from peeling. Titanium dioxide's UV resistance is also why it is used in sunscreens to protect your skin from burning. Titanium dioxide pigment was developed as a safe replacement to lead oxide, which was used in many paints decades ago until lead oxide was linked to brain damage.

Rutile

Rutile is used in three major applications: titanium dioxide pigment, flux core welding wire and titanium metal production.

Rutile, when processed into titanium dioxide pigment, can be used in the same products as ilmenite (explained above). Rutile is sometimes the preferred source for titanium dioxide pigment as it provides the most efficient product with the least waste in manufacture. Flux core welding wire is the preferred welding consumable for

pressure vessels, petrochemical piping, and heavy-equipment manufacturing, as flux core wire stabilises the electric arc ensuring a superior joint.

Rutile can also be converted into titanium sponge, which is then processed into titanium metal. Titanium metal's unique properties include its high strength-to-weight ratio, high melting point and its resistance to corrosion. This makes it a preferred metal in the aerospace industry for the manufacture of aircraft frames and jet engines. It is also commonly used to produce top quality sporting equipment, pacemakers, artificial limbs, surgical equipment, spectacle frames and watches. When titanium metal is mixed with other metals such as iron, manganese and aluminium, it forms alloys which are both temperature and corrosion resistant meaning they have a wide array of uses in difficult environments.

Zircon

More than 50% of all zircon is used in the ceramics industry due to zircon's ability to impart opacity, (whiteness and brightness) to create glazes on products such as tiles, sanitary-ware (baths, sinks and toilets) and the crockery we eat off. Zircon is a hard and tough material. It is able to maintain its physical and chemical composition when subjected to high temperatures and corrosive environments which makes it an extremely good foundry and refractory material, used in refractory bricks, especially in furnaces for steel and glass making.

Zircon is used to block X-ray emissions in cathode ray tubes (CRT) found in computers and TV monitors. It is also used in the production of some biomedical devices (such as hip and knee replacements), rechargeable light weight batteries, TV screens, fuses and in toothpaste as well as being used as a foundry sand, especially for investment casting or high-precision casting. Zircon alloy is used as the housing for fuel rods in nuclear power stations, due to its low thermal neutron absorption.