OHMS

Western Victoria

Geological Notebook

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National Museum of Victoria

285-321 Russell Street

Melbourne, C.1

Victoria, Australia

Edmund D Gill

Coral growth 5-19mm per annum on niggerheads

Western Victoria

Notebook 33

Please return to Edmund D Gill

National Museum

Russell St.

Melbourne

Victoria 3000

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Oil Well corner

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170 Crack across

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173 Durvillea and

Tidal level

174 Tertiary, Woolsthorpe

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176 Mt. Eccles

Page 1

Dennington Calcrete

See Book 21, p.88

Photo View from Moulden's Q across swamp to coastal dunes.

Photo View from Moulden's Q back (N) towards village of Dennington. Merri R.

Photo Fossil B horizon A stripped then reconstituted.

Photo Original A horizon & terra rossa but the new A horizon a grey to black loam with tuff minerals.

Photo Maximal development of calcrete in cutting up hill above quarry.

Photo Terra rossa with angular pieces of calcrete showing it formed then was broken up.

Page 2

As Tower Hill tuff rests on calcrete the winnowing occurred before 7300 yrs ago.

2 Photos Sections of mammillae

Photo Mammillae on upper surface of calcrete under reconstituted A horizon.

Photo conglomerate to breccia. Angular to rounded pieces of calcrete in lithified terra rossa. Hence calcrete formed, fragmented, & then was cemented in terra rossa which was the original A horizon under which the calcrete formed.

See page 16.

Page 3

Stanhope Bay

2 photos Calcrete (Last Interglacial?) on sands over Miocene marine limestone with solution pipes.

2 photos See J.N. Jennings on cliff-top dunes

2 photos E. of Stanhope Bay stripped partly dissolved calcrete.

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4 photos E. Of Stanhope Bay subaerial weathering of exposed calcrete.

4 photos Looking W.

4 unlabelled photos

Page 5

2 unlabelled photos

See also pp. 17-18

Australite

2 photos as found in lag deposit on calcrete at Site 1 on p.6

Page 6

29.12.

Australites E. of Stanhope Bay

See Notebook 21 pages 133-136

Kathleen W. Gill & E.D. G. coll. the foll. Australites at the same site as above.

Diagram: Map showing location of Australite finds

1 E4432 2.448 g piece of button

Diagrams: shape of Australite E4432

Page 7

2 E4433 0.403 g

2 diagrams: Part of button. Frag. Of flange & sliver of core.

3 E4434 0.480 g

2 diagrams: Piece of thick flange

4 E4435 3.003 g Incomplete button

3 Diagrams: Australite with bubble structure

Page 8

5 E4436 0.810g

Diagram: Wedge shaped piece of core

6 E4437

Lens

0.856 g

Diam 11/11 mm.

2 Diagrams: australite E4437

7 E4438 3.662 g.

3 Diagrams: Piece of button

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8 E4439 1.683 g. Piece of core

3 Diagrams of Australite E4439

9 E4440 Lens 1.015 g

3 Diagrams of Australite E 4440

Page 10

Coll. 12.9.67

10 E4441 Australite 5.319g found among buckshot c.20' from cliff edge ~ 1 m E of Stanhope Bay where aeolianite ends = Burnie's Beach

Map of location of E4441

3 Diagrams of E4441

Page 11

Coll. 29.12.68

11 E 4442 0.378g

Coll. K.W. Gill within 15’ of cliff edge, E. of Stanhope Bay same loc. As E4433

2 diagrams

12 E4443 0.202 g

Same loc. & coll. date as E4442. Coll. KWG. Piece of Flange

2 diagrams of E4443

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13 E1052 Coll. R.T.M Pescott 30th Jan, 1953 high on aeolianite dune where he & I went to area (approx. loc. Marked on diagram p.10)

3 Diagrams of E1052

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Australite Etching

1 gutters (a) radial or (b) concentric

(a) change direction with strong angular action

(b) blunt ends

(a) Deep 3 mm

(b) Shallow 01.mm

(a) Radial gutters straight

(b) Concentric curved but none sinuous

2 Over-deepened areas

e.g. pits or depressions. These may be any shape. May follow flow structures. A number of pits may deepen & merge.

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3. Surfaces. There is diff. of opinion as to what the outside surface of Australites was like when they fell, but there is no doubt what the inside of a bubble looks like. Two large hollow Australites

(a) Brit. Mues.

(b) N.M.V.

Have been sawn open & reveal a perfectly smooth shining surface sometimes referred to as “hot polish”. Thus we can look at hollow Australites like E4441 and see what weathering has done to the original perfectly smooth & shining surface.

Note (a) Surface duller

(b) Some minute pits.

(c) A long straight incised line – prob. the beginning of a gutter.

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In E4438 & E1052 it can be seen that a combination of radial & concentric guttering can achieve a spalling effect so that the outer few millimetres can be removed.

On the exterior surface the removal of flow-rings, reduction of the flange & the over-deepening of some structures can be a measure of the amount of etching. The gutters are also good indicators.

2 Photos Mernane's Bay, E side of Childers Cove.

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29.12.86

Dogtrap Bay

On headland between Dogtrap Bay & Stanhope Bay is calcrete in angular fragments as seen re-cemented at Moulden's Q Dennington (p.2). Even more developed on headland between Stanhope Bay & Bernie's Beach. May be due to steep thermal gradients causing cracks.

Diagram: Geological section of Dogtrap Bay

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Stratigraphic section.

1 Miocene marine Lst – possible an island once.

2 Brown "Post Miocene Clay" to sand. – Pliocene.

3 Aeolianite – Pleistocene.

4 Brown clayey sand forming badlands. Infills old river course.

4 photos Stratigraphic Section

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10 photos Dogtrap Bay between Sandy Bay & Stanhope Bay

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Twelve Apostles

Photo View looking west. Note rather squared sides of island bec. Controlled by joint planes.

2 Photos In that the same soil occurs on island Tops as on cliff-tops it can be inferred that their separation is geologically very recent.

2 photos View looking east from same point. Strata furrowed differentially by wind. Shore platform on seaward end of island.

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6/5/69

Cundare Cutting

Paleosol in parna, with humic matter – sample taken for ^{14}C dating.

Rhizo concretions root casts filled with carbonate, oriented vertical to oblique, in top of paleosol;

round in cross-section.

Photo of one 6 cm x 7 mm wide filling pale yellow 2.5Y 8/3 soil dark brown (moist) 7.5 YR 4/2, uniform. Merges into parna which is mottled so if this considered part of profile then not uniform. This zone at a distance averages light yellowish brown 2.5Y 6/4 (moist). On dry surface varies from pale yellow 8/4 to light grey 7/2. This paleosol has vertical prismatic columns commonly 3” – 4” diameter.

Page 21

Parna below it darkened with wash & colour uneven thought not mottled in any even way so that can be recognized as mottling i.e. some discolouration but not mottling - 16” maximum thickness. Prism faces have brown wash on them & also lighter coloured material washed in from overlying parna.

Columns breaks into blocks, where pieces of prisms are adpressed there are slickensides – evidence of movement, no doubt from wetting & drying. Cracks up to 5 mm wide now though cutting compact when first cut. Montmorillonite from basalt the cause of movement? Parna also cracked but not as heavily as the paleosol.

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Paleosol dips S on cutting face at c.4^{o} but this an apparent dip because paleosol not appear in cliff on other side of road 40’ away.

[The main mass of parna is not in prisms but is cracked in blocks].

Diagram; cross section of road cutting

Shell

Just above the paleosol the parna is rich in shell, which is stratified. There are

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lenticles of pure shell. Dips up to 7 ° were measured on cutting face. Cross-bedding is present in places. The sorting is very poor. Some of the structures cannot be of aqueous origin but could be Aeolian e.g. material draped over a miniature dome. The richness of the shell indicates a beach or near it (cf the present shore). At place shown me by Ollier further N on E shore of L. Corangamite the shell blown up a ramp from the beach by N winds but the higher it blows the more broken it is, & the less the shell is obvious. The material with whole or major part of shells is a beach deposit or within say 6' of it.

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The Cundare cutting structures mean that a beach was transgressing a soil & so the lake was rising. The wind was blowing enough shell & other sediment to defeat the pedalogic processes. No sign of shell in paleosol. On any interpretation the structures mean

1 change of conditions

2 advance of windblown material from a beach to bury a paleosol & ultimately build a dune. Was the wind from the SW?

Diagram; Crossection of cutting showing topsoil layer

Columns up to 30" high. Platey to

Page 25

blocky at top of parna & impregnated with carbonate which also lines the faces of the columns.

Diagram Platey to blocky parna impregnated with carbonate

A local farmer said that where carbonate impregnated the subsoil Lucerne cannot be grown bec. The roots cannot penetrate the carbonate. The extent of the impregnation is clear by the variation in crop yield. One farmer (Harris) got in bulldozer & ripper to destroy such hard ground on his farm.

In the Cundare Cutting the

Page 26

Carbonate is a darker yellow than the parna & ranges to a pale brown ; pinkish in places. The A horizon is obviously not the source of the carbonate which is older. Hence a reconstituted A horizon. Parna younger that the lava flows (which it commonly overlies) & older than the Red Rock vulcanism. The lava flows are Stoney rises.

Diagram: crossection from cutting to lake

See map for this section line on page 27

See photos pp. 118-119

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6/5/69

Cundare Cliffs

Diagram: map of Cundare Cliffs

Diagram:detail of map showing four Lava Blisters

A survey was made where ^{14}C samples were collected on Beach 2. Datum was a survey peg on Island over Lava Blisters 2 hidden under edge of thorn bush.

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Table: survey data for shell deposits

^{14}C Samples

1 Shell Bed 2 (labelled "Upper Shell Bed")

2 Shell Bed 3 (labelled "Lower Shell Bed")

See photos pp 118-119

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Fossil Sponges

Grange Burn

Brownish-gray (dry) sediment from under the basalt at Grange Burn contains

1 Radiospongilla sceptroides

(Haswell) rep. by "The more slender incipiently spiny megascleres, & the rod-like gemmoscleres with distal armatures", "very common as a recent Australian species & endemic to Australasia".

2 Heterorotula multidentata

(Weltner) incl. Ephydatia lendenfeldi Traxler which is synonymous. "The more robust & occasionally heavy-spined megascleres with rather smooth distal parts, and the numerous birotulate

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Gemmoscleres are typical" of this species. Australian origin.

3 Radiospongilla synoica

Racek n.sp. Megascleres

Determinations by Dr. A.A. Racek, Senior Lecturer in Biol. Univ. of Sydney. See letter to me dated 12/6/69

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Lake Gnotuk

Notes fr. lecture by Dr. David Churchill at Botany Dept., Univ. Melb. 8.7.69

Diagram: schematic cross section of Lake

A = 2-3 m. nekron mud

B = Waterlaid volcanic ash with diatoms

Top of mud A scraped thinly <1cm with plentiful pine pollen etc ^{14} C age 625y. Flecks of peat etc eroded from edge of tree (& is prob. peat) dated by me. Present lake twice salinity of sea to F W acc. to how full it is. When full to rim – 5 pts per 1000 (perhaps as low as 0.5). Potable & suitable for algae. FW horizon in mud 4400 BC +1950 = 6350

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Palynological	1. Regional vegetation
Evidence	2. Fringe community
	3. Lake flora.

Cobrico Swamp

2/3 way down – 5000y (C14)

Open water deposit gradually shallowing to sedge swamp. Bullenmerri also has FW phase 3600 instead of 6300 BP. Same type of sediments but Bullenmerri a greater net productivity x 2 (Prob bec. of phosphate from tuff - EDG)

Flora of lake includes a marine diatom.

Kenyon AS 1928 Vict. Hist. Mag. 12:143 mentions Cobrico Swamp visited by Robinson the Abo. Protector.

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25.10.69

Warrnambool

Diagram Warrnambool Lady Bay – Thunder point area

See Book 52 p.119 (inland)

Middle Pleistocene duneline with Upper Pleistocene less consolidated calcarenite capped with calcrete & Tower Hill Tuff at present coast. The seaward part of the Wharf Island honeycombed by sea. In splash zone. Well dev.

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Visor is comparatively smooth (no honeycomb) but nevertheless there is differential weathering of very low relief (- 1/4 "). Smoothest surfaces are in rock pools & on ramps - both places where pebbles & cobbles rubbing.

Degrees of surface smoothness

1. Rock pools & ramps (abrasion dominance)
2. Visor on exposed cliff.
3. shore platform.
4. Exposed areas open to sea but in splash zone (solution dominant),

As pebbles so readily smooth this rock, the waves can only in a minor way be armoured with pebbles!

In protected places the cliffs of the honeycomb may have paper-thin walls showing no impact by pebbles or heavy masses of water. These walls could not be produced by abrasion & so

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must be largely a function of solution.

Diagram Cross-section of pool on wharf island

Next stage will be freeing of the 2 mini-stacks in the recess & so the provision of rock-pool pebbles.

Diagram: visored and non-visored coastal cliffs

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8/11/69

Map: road up to Thunder Point showing location of possible beach deposit sites a to d

Diagram: profile of beach deposit site b.

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2 Diagrams profiles at sites a and d

Coarse-grained aeolianite with E dip – 3 °

History

L.IG1?

1 Shallow water to beach sand, coarse & with pieces of shell, emplaced.

2 Lithified L.G1?

3 Eroded

4 Unstructured sand emplaced last interstadial?

5 Terra rossa formed with calcrete & rhizoconcretions. Some laminated calcrete & some mammillary

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6Tower Hill Tuff deposited – BP 7,300 ~~6,000~~ y

7 Post –tuff windblown sand

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Volcano S. of Oil Well Cnr.

Diagram: map of tuff pit and swamp crater

About 8 ch long Horizontal beds. Pieces of bedrock throughout, so enlarging pipe and/or reservoir.

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Table Cave

Steps to Cave. At turn in steps stratification horizontal, then turns over to dipping beds with fossil foot prints –

Diagram: showing dune beds change in dip

-4’ from surface 3” and ½” rhizoconcretions showing –

1 Surface exposed to subaerial agents air & rain: plant growth & accum. of sec. carb., so

2 Interval in sand deposition.

In marine pools beside Table Cave flat pebbles as seen in L/IG1 deposits are found in all stages of formation. At present destruction supersedes construction – erosion dominates over deposition. Only Holocene

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24.1.70

Construction of importance is the calcarenite dune from Dennington to The Cutting along the coast. This was built ~~prior~~ near to 6,000y. because dunes & sand ridges evident over tuff. Built as sea retreating from postglacial higher level?

Aeolianite Erosion

1 On land

Diagram: Gentle slope Talus apron

2 On coast

Diagram: Talus & soil removed

Cliff & platform cut

Related to S.L.

Mechanical & solutional processes

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Lake Gnapurt & Corangamite

Diagram: Map of Lakes showing fossil Macropus site

1 Parna dunes eroded from leeward side. Cliffs show horizontal bedding

2 Some dunes cut from windward

3 Other dunes cut laterally

See Armstrong Price on “Clay dunes” in Encyclopaedia of Geomorphology Lake Corangamite cliffs at 1

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show the following section :

Diagram of cliff section

1 The lake spread further in past. Covered lower flats in “creeping lakes” period.

2 Parna dunes on E of G. & C. so blown up from floors of both. Suggests separate basins even before parna dunes formed.

3 Parna deposited below present water level

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because it outcrops at & below present lake level.

4 Blown up in series of events as shown by the stratification in the parna. 14 C dates could determine length of cycles

5 Higher lake levels to 12'-15' above present as shown by horizontally bedded sediments to that height (estimated – needs proper measurement).

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Hopkins River Mouth

Old photos – printed prior to 1913 in Germany & taken by Essie Uebergang in 1919 – show:

Diagram of features including East Stack with photo

Some calcrete laminated as at Thunder Pt. & Dennington. Age – Last Glacial. Underlies 3+ft. Tower Hill tuff in cutting for steps from E end of parking ground to Hopkins River.

2 Photo's of Hopkins mouth

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The Gardens W. of Childers Cove

Called so (a local resident informed me – owner of farm with trig station on W side – because of all the pigface in the area. Where cliff can be descended large midden on top showing the aborigines descended there too. Large shore platform assoc. with large pools where descend – disappear on each side.

As usual the base of the cliff is of Miocene Marine Limestone – 50' above which is Upper Pleistocene aeolianite. The top is well lithified (extensive lapies) but the base is little petrified so that it readily erodes, thus –

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Diagram and section of Cliff Face

Photo of cliff face

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Large blocks of exceptional size as a result spall off the cliff face & last a long time in the surf below – long enough to form wave-cut nips & narrow shore platforms. The largest (estimated from cliff) is Hempel's Rock perhaps 25' x 18 ' see p. 124

60' x 35' measured p 133! Easy to under-estimate with high cliffs etc.

Diagram: showing wave cut notch in Hempels Rock

All the large blocks are of aeolianite with strike & dip at all angles. One block has the stratification vertical & a wave cut nip well developed.

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Diagram: fallen block with vertical bedding

Photo: W headland of Mernanes Bay

The wave-cut nip not just a function of solution or as well developed in landward as seaward side. Below SL not reduced. Certain mechanical effects also internal structure of this rock a minor effect bec. nip seems as well developed whatever the stratification. In these rough waters nip never dry so not a function in this rock of water layer. This more in rocks which decrepitate with wetting & drying.

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Breakwater Is. Platform

Diagram: Breakwater showing location of tide gauge

Table survey data for rock platform level

therefore LWL on open coast ~~shore platform~~ 2.8' lower than L WL on guage because ~~greater tidal range~~ 2.92 difference with local survey check – 4 nails at end of concrete wall 12.60' above 0.0 Tide gauge

Page 51 {NOTE THIS WHOLE PAGE HAS LINE THROUGH IT IN ORIGINAL DIARY}

~~Pleistocene Dunes & Bay Bars~~

~~Diagram Map of Thunder Point and Lady Bay~~

~~Given incorrect information. Submerged rocks continue dune line fr. Thunder Pt.~~

~~1. Aeolianite reef – remnant of bay bard when sea level lower? No!~~

~~2. Earlier bay bar now beach ridge?~~

~~First survey of harbour shows rocks near breakwater continuation of coastal dune-live rather than bay bar.~~

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Pickering Point

At end of point oppos. Merri island

Diagram: Vertical cliff section showing strata numbered 1 to 4

1. Aboriginal midden in base with dark gray soil

2. Fine lapilli at base. Shards of calcrete at interface.

3. Varying lithification. Band at base very dense. Laminated & an in places mammillary.

4. Red soil with rhizoconcretions (½" commonest diameter) charcoal and small planispiral snails.

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Top of point mostly stripped with shards of calcrete on surface.

Diagram: unlabelled cross section

Stratification truncated so erosion has taken place. Calcrete is the last glacial surface so either no high dune deposited here (Pt. Fairy Calc. only) or levelled before soil formed.

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Cliff opposite Table Cave

Diagram: Vertical cliff section showing strata numbered 1 to 5.

1. Gray soil at base of sand has abor. middens. This appar. the surface soil before European interference

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upset the balance. Introduced snails above this level but not in soil or below. Occasional chips of flint but no implements round.

2 Tuff has marine shells & charcoal collected for 14 C dating of this formation. Sandy, lighter in lower part.

3. White to pink (7.5YR 7/4) to reddish brown (5YR 5/3) travertine & calcrete up to 3'6" thick, dipping S at 10°. At seaward end a "red" paleosol is wedged in reaching 1' thick. The fossil soil is reddish yellow (5YR 6/6 to red 2.5YR 4/8) The calcrete has commonly rhizoconcretions. From 1/8" to 3" diam. although a little further E there are soil pipes to 10" diam. as seen in drain on N side of Port Fairy. Probably tap roots of large trees (Eucalyptus?) grown

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when sea at distance on continental shelf. Tough calcrete layer ½"-3" thick at base – a kind of soil pan.

4. Underneath the calcrete layer is a gray soil varying from yellowish brown (10YR 5/4) to occasional dark brown (7.5YR 4/2) with a good deal of charcoal. Rhizoconcretions present & mostly ½" diam. Second storey scrub? This soil dips 10° S. Planispiral fossil snails. Same in gray soil as red. So this the initial stage of a terra rossa?

5.   (Blank)

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Gaul's Cave Coast

Open, high energy, swell from Antarc. Shore platforms appear higher than in sheltered area but difficult to tell without an adequate survey. However flat aeolianite platform always at top of kelp zone. Absolute level of shore platforms varies with

1 Rock type

2 Tidal range

3 Energy status of coast

Miocene limestone in cliff cuts out west of Guano Cave & ~ 200 yds E of a prominent spur (on which car stood – see photos)   Large shore platform of M.M. L'st where it ends. Aeolianite platforms not immediately developed because of numerous fallen blocks. In that they did not fall on a platform it may be inferred that there has

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been a continuous history of fallen blocks arising from the nature of the rocks.

Diagram: Cliff section at Guano Cave

Crest away from coast & not as at Childers Cove area where cliff through crest.

Diagram: Cliff cut in aeolianite

Here is large open cave seen from breakwater at W'Bool.

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Diagram: multiple palaeosols in cliff

Diagram: fallen blocks from cliff top incorporated into the cliff above Sea Level

Huge block fallen from clifftop so that now forms part of cliff but is covered with lapies so was once part of clifftop.

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Fence 2 followed on way to cliff but not reach it.

Fence 3 ~ 200 yd W of spur with car (parked for day – see photos) ~ 100 yds W of large cave & fallen block above. Next bay has high near-vertical cliffs which are all aeolianite with thick paleosol in middle. Thin paleosol 2'-10' from clifftop. Except for the pedalogically petrified rock at the top of the cliff there is no real aeolianite but soft calcareous s'st as in last I'G1. formation.

Fence 4 ~ 400 yd W of car, then bay with sandy beach

Fence 5 ~ 500 yd. From here the cliffs descend in height, are more vegetated & there are well-developed shore platforms.

Fence 6 c150 yd further than we walked. ¼ to ½ ml further then we stopped the continuous sandy beach to the

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Hopkins River commences. When pass. from Miocene L'st to aeolianite, hare's tail grass becomes plentiful – a sign of copper deficiency.

Middens at intervals along cliffs E of car. Axe blank of greenish quartzite found in black sandy loam. Just E of fence 5 (p.60) midden of marine shells & flakes. Lapies outcrops continuously; 50-150 yd. of clifftop stripped of terra rossa. Other outcrops incl. top of ridge show a wide area so stripped – perhaps the whole dune-line of W'bool & Dennington. Dark gray to reddish-gray sand 2'-5' thick accumulated in the lapies since stripping – a uniform soil. History is probably:

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Last Glacial Terra Rossa formed.

Lower Holocene Stripped

Upper Holocene Replacement

See also p.117 29.1.70

Exceptionally flat seas present. Examined shore platforms betw. Thunder Pt. & Levy's Point. 12:45 (midday) tide turned. Dry platform 6"-12" above low tide. Mostly 9"-10". Covered with green "lettuce" algae, red fibrous seaweed, limpets, Pyura chitons, Dicathais (not numerous) no guide to tide levels & Galeolaria at inner edge of shore platform at base of wave-cut nip. The usual distribution:

Diagram: Cross-section of shore platform showing biotic zonation

In further than often bec. swell usually sends water over platform.

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"Wave cut" nip on exposed cliff faces. Less in lees exposed areas showing that there is an abraisional factor in formation. Same height nip as at Thunder Pt. in open.

Diagram: wave cut nip section

Photo: shore platform and nip

Diagram: undercut at end of gulch

Undercut at end of gulch. Greater attack because less impedence to water along gulch. Pebbles assist erosion.

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In rock pools sea anemones, Cominella, Parcanassa as well as limpets. Subninella to 9" above LWOST. Calerpa secretes small fish (2 spp). In splash zone on cliffs Nerita & another minute gasteropod.

Diagram: map of coast showing sheltered re-entry

Photo:coast and rock platform

In sheltered re-entry a ramp of boulders cobbles & gravel. ~ 300 yd. W. of trig. there are the remains of what was once an extensive point – the most prominent in the area. A normal rock stack ¾ of the way out. Two larger but depressed stacks near the shore. Between these is

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a sloping ramp.

Diagram: Promontory 1 showing residual stacks

2 Photos: (unlabelled) promontory

Diagram: vertical section at promontory

Photo Rock species in rock pool & on edge of it.

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Diagram Map showing Promontory 1 to 3 and Bays A and B (see p.65)

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On W side of rock in Bay A there is horizontally bedded dune rock on top of the usual landward dipping strata.

Shore Ramp (as against shore platform) at Prom 2 rises to c. 3' above LWL. Only minute Mytilus (at seaward end) & splash zone gasteropods on top. Limpets in gulches & holes. Similar ramp at 1 between the two stacks on the W side (p.65). Similar on basalt coasts e.g. at Goose Lagoon. Function of areas in process of reduction in level, like the ramps at the inward end of shore platforms in embayments e.g. Table Cave, Thunder Point. Prom 1 has stacks; 2 & 3 just lost theirs & so ramps.

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Tracks over dunes from Thunder Point to Prom 1 are on seaward side of dune line, on top, & on landward side. All show dark gray sandy loam on calcrete. Coastal section same. Appears that the A hor. of the terra rossa stripped of the whole dune line & the black soil accum. since. Only in exceptionally well-sheltered areas is the whole profile preserved.

14C sample of shells from midden ~ 25' above SL, on the NE corner of Prom 1

Kelp Durvillea (top of holdfasts usually = M.L.W. ~~neaps~~) defines the level of shore platform formation.

Diagram: relative position of Durvillea on plarforms

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Multiple L/IGI dune lines

West of Warrnambool to Dennington the Princes H'wy follows a swale. The duneline N of it is L/IGl & so are a number of dune lines at Merri Vale. Where the road rises on to the 70' platform on wh. W'bool built on the W side of that city depots occur at the sites of old quarries now cut in vertical walls that show true aeolianite (Pen. IGl). This core of old rocks flanked by L/IGl sea along the Hopkins Estuary in the E & in the Merri Vale Dennington area in the W, greatly reducing the size of the embayment. This restored by the construction of the L/IGl.

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dunes so that the embayment completely filled again. The sea is now cutting back the L/IG1 dunes & so reducing the size of the embayment infill once there.

Masses of older rock (islands, rock stacks etc) appear to be incorporated in L/IG1 dunes. If sea retreated now the islands near W'bool harbour & the ridge running W would probably be engulfed in the new dunes. Bigger dunes where old structures covered & so sand migration. High dunes along W'bool Childers Cove coast so explained (normally dunes to 100'). If this so then the 200' dunes E of Hopkins Estuary have engulfed an island or ridge.

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Hopkins Estuary

Diagram Map of Hopkins Estuary above bridge showing fossil location

Splash, spume & rain have hardened the cliff face on the E side of the estuary. Large blocks lie at the base of the cliff for much of its length. At place marked above rock-facies shells, very worn (as in shell gravels of the present cote sauvage) & Anadara form a conglomerate with heavy siliceous gravel, pebble cobbles &

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huge blocks of highly indurated aeolianite. This conglomerate has been excavated by the river for some 10' under the cliff. The conglom. gets softer as go in but the blocks of aeolianite are just as tough. So these may be from an old cliff engulfed in the L/IGl dune.

NB 1 High energy deposit therefore open sea site then.

2 Estuary of protected waters not far way to supply the Anadara shells.

3 Contains Ninella therefore L/IGl or older, but also has Anadara which L/IGl or younger therefore age is L/IGl. check with ionium.

Later; Dated ~ 400 000 years by U/Th. Shows Anadara been here longer than thought.

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Yangery Cr.

31.1.70

The NW flow of the Merri R. (like the W. flow of the Hopkins R.) marks the interface betw. basalt & aeolianite. Yangery Cr. continues this orientation & in so far as it does, is marginal to the basalt. Further upstream the position is complicated by the Tower Hill tuff.

Diagram: Map of Merri River and Yangery Creek near Dennington

Basalt occurs on the N. side of Yangery Creek.

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31.1.70

Tower Hill Beach

5500 years of history have been destroyed by wind & sea. As stable for so long it appears that interference by man set this cycle going. It has been "cured" by another introduction of man-marram grass. The twin beach ridges have now been restored & they are higher than originally acc. to local report & judging by the fossil soils.

Concentrations of basalt & other pebbles are native fire places – evidence of food other than shells viz. mammals, birds, fish

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1.2.70

Mt. Eccles

See photos back cover see book 48 p.p. 150-173

Diagram: map of Mt. Eccles showing line of eruptions

Included in Pastoral Licence of Eumeralla W. taken up in Oct. 1842 by Hunter Hoskin & Davidson. Rolf Boldrewood took up Squattleseamere Pastoral Licence S. of Macarthur in 1844. Land Acts admitted settlers when gold digging dies down in 1850 s. Macarthur 7 district surveyed c.1857.

The basalt shows overflow from the main crater, but deep retreat in the vent accommodated the returning lava & the considerable

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volume of rock that collapsed therein. This could be calculated. Or is it a collapse or fault feature associated with the fissure? Eruptive (scoria) & effusive phases. Reserve only 84 acres – too small – quarry in scoria.Lava covered some 50 sq. ml. to W & S blocking Darlot Cr. & flowing down its valley to Tyrendarra. Lake Surprise 770 x 200 yd & 43'6" deep in deepest point in winter. At narrow ends 15' deep. Canal continues in branches to W & S for 2 mls. Last outward flow via this, then drained back into crater. Lava Cave a branch that drained back by tunnel flow. Floor c 8' below entry point Scoria cone built by W winds? Ash is being quarried 2 m. fr. Macarthur.

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2.2.70

Goose Lagoon

Map Goose Lagoon showing auger holes 1 to 5

A = corner post

B = telephone

Auger 1 0'-4' (Gyttja) Muddy peat, ground springy. Watertable at about 4'

4'-4'6" Fibrous peat (sample) Damp above water-table & wet below.

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4'6"-12'6" (Gyttja) muddy peat

12'6"+ Black peaty clay stiff.

Peat reddish-black 10YR 2/1 to very dusky red 10YR 2/2 wet

Clay Black

Cliffs Basalt 3' and 4'+ peat =7'+

Aeolianite – vertical on W side of lagoon. Sloping in E.

Auger 2 Peat 4'+

Auger 3 Peat 4'+

Auger 4 Peat 4'+

Auger 5 'Dark gray" sand 2'5" mottled with "orange" at base with decomp. basalt pebbles. Moist black 5YR 2/1 to 2/2 dark reddish-brown sand. At base mottles of dark reddish ~~brown~~ gray 5YR 4/3.

Photo River Moyne Port Fairy

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Cape or Point Reamur (Pronounced Ray-moor)

Tip called Boulder Point on the Military map.

Diagram: map of Port Fairy - Goose Lagoon area showing Pt. Reamur

This E-W section of coast is out of character with the general structural lines of the coast. The reason is that this is a function of a Penultimate Glacial lava that infilled the valley of the ancestral Moyne. Goose Lagoon is marginal to

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the western limit of the lava field. During the Last Glaciation of the stream at the interface cut a valley of unknown depth. As the sea rose clay was deposited, then the valley was sealed off between the basalt on the E & the L/IGl aeolianite on the west. The Goose Lagoon peat then accum. Sands in this valley developed in the L/Gl a terra rossa with calcrete subsoil that was (a) near horizontal &

(b) rich in rhizoconcretions.

Over this Holocene dunes devel. with dark gray soils rich in Austrosuccinea australis.

Basalt vesicular & columnar with occasional scoriaceous layers suggesting a caterpillar track type of progress.

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All the basalt outcropping appears to be the one flow.

Diagram: map of Pt Reamur

Limestone (Prob. L/IGl) between boulders on end of Point & on west side. Very highly pitted surface due to solution; also evidences of erosion. Sparsely fossiliferous. (coll.) This evidence of the effect of wetting & drying at cost is a means of lithifying calcarenite.

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3.2.70

Basalt forms ramps of in situ lava & huge blocks on headlands & more open places. In bays basalt reduced to an uneven platform. Some gulches & pools.

Diagram Plan Basalt Boulder in limestone showing weathering zones

Diagram Cross section of same.

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Boulders carried from point by storms?

Diagram of boulders in red limestone.

Mass of this material 3’x2’6”x9” hurled up among the big boulders & standing on edge. Limestone originally shell sand & shell gravel left by retreating sea after L/IGl. Probably level with top of boulders but now reduced by erosion & soil formation. Consolidated during Last Glacial. The biggest boulders are on top of everything else 7& appear to be remanie. On W side Cape R 3’ boulder with sausage shaped gas bubble. c 1’long & sub circular cross-sect. of c 4”.

Diagram Hole showing nature of structure.

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4.2.70

Reamur Middens

On the neck of the Cape are extensive middens of

(1) marine shells Limpets (2 or 3 spp) Subninella, Haliotis, Dicathais, large Monodonta Scutum, chitons, Katelysia & rare chitons (limpets & Subninella predominating Many burnt.); also piece of burnt cuttle-fish.

(2) charcoal, mostly disseminated making the soil black

(3) cooking stoves of basalt (mostly), calcrete, so apparently cooked other kinds of food there – perhaps small mammals & parrot fish. No bones in midden but in this exposed position with heating & cooling, salt spray, trampling, can soon disappear. More middens along shore & some associated with paleosols in the sand dunes where they face the sea. Also some in the swale where shelter from cold winds. Katelysia shows sand as well as rock shells collected.

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Goose Lagoon Dunes

Large tracts of dunes blocks the debouchement of Goose Lagoon. These dunes are of Holocene age, the sand probably being produced by the transgressing sea eroding the L/IGl sand formations & the shell fish producing a fresh supply. However, there are 3 stages

(a) Mobile dunes.

(b) Stability & soil formation.

(c) Present instability showing in hair-trigger condition disturbed by man.

Walked through these sand-shills showed

1 Dunes are still active, with fresh sandfalls in many places.

2 Sand falls show some built by S winds sweeping up a E side of cape but

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most formed by SW winds blowing in on W side of cape. Whole formation so oriented (see air photo).

2 Gray sandy paleosols show dunes built up ~ 100’ before soil formation.

3 Snails in these paleosols all Austrosuccinea and plentiful to considerable heights. Probably higher or better distributed rainfall then because now char’ic of wetter ground.

These dunes may have been built at the time of the stripping of the terra rossa (which very widespread) pre-Tower Hill Tuff – perhaps ~7000 y. ago.

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John Clapp Collection

Small Museum at Goose Lagoon (private)

Bone awls 4” (1) and 6” (2) long from Tyrendarra

Mortar 8x4x2” Crossley

Anvils (2) from Goose Lagoon

Mortar from Goose Lagoon

6x4x2 ½”

Axes (2) from Dura.

Axe (sandstone) from Pt. Fairy

Grooved unpolished axes (2) from Goose Lagoon.

Axe blank (porphyry) do.

Grooved unpolished axe also from Crossley

Reamur Calcrete

Where the basalt cuts out a terra rossa calcrete comes in associated with very well developed rhizoconcretions.

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Diagram: Cape Reamur cross-section

It appears that the rhizo forest was planated to a level c4’ lower then during a lower SL or some such event since sand & pebbles & shells were lithified thereon. The black colour may be from heaps of seaweed or a temporary swale facies.

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Diagram Profile showing calcrete and sand layers

Calcrete is a stripped terra rossa.

Diagram: Above section continued N. Section c. ½ mile.

Rich in rhizoconcretions 1/8”-10”, and many soil pipes & other calcrete structure.

Diagram & Photo of soil Funnel

Funnel smooth inside

On outside 1/8” diam. rhizoconcretions in red soil.

~ 2’ long (photo) two funnels close together

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Diagram Mushroom-shaped funnel

At some sites three layers of calcrete.

Diagram: cross section showing 3 calcretes

See photos

Where cliff drops to c.7' high there is a solid mass of 1/8"-1/4" diam. rhizos & occasional

Page 91

ones of 2"-3" diam. Form a massive network (see photos) On two areas here heaps of horiz. bedded calc. sand cemented lightly – stage 1 in aeolianite formation.

Where the calcrete reaches the intertidal level it forms platforms & reefs. At the N edge of the Goose Lagoon structure where the L/IGl dunes begin, the calcrete disappears for a short distance which is the Holocene outlet.

In part of section shown on p.90 large boulders of calcrete front the low cliff for much of the distance but of course these occur no longer where the calcrete is in the intertidal zone. Where the cliff is ~ 3' high there is a brown

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loam lithified by rhizo & other sec. carb. In the top of this soil are concentric circles of sec. carb. which is eroded areas prove to be "Puritans Hats" of lithified soil.

2 Diagrams: plan and elevation of Puritan hat

This brown loam & the oldest of the Holocene gray sandy loams can have rhizo, but nowhere near the extent of the level in the L/Gl calcrete. Brown sandy loam owes it colour to incorporating some of the breakdown materials of the terra rossa. To date it would give a minimal age for the stripping.

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Diagram: Blowout above sect. p.88

In many places the top of the calcrete has been broken up (as occurs now to calcrete exposed to weather), a terra rossa devel. through this material (angular fragments of many sizes) & then the whole cemented again.

Phase 1 Calcrete formed under terra rossa.

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Phase 2 Terra Rossa stripped & calcrete broken.

Phase 3 New terra rossa formation & re-cementation.

Phase 4 Holocene stripping.

Therefore two climatic stages represented since the L/IGl, a division widely recognized (e.g. Shotton in QJGS).

Photo Looking E on W shore of Cape Reamur with formations labelled

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Erosion Embayments

Diagram: schematic map of cape showing 3 embayments

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The Craigs

Diagram: Cliff section

Diagram Cross-section of rhizoconcretions. All layers tough. Centre one dense carbonate – calcite?

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N.B.

1 The red paleosol continues right round this series of cliffs. Contain planispiral snails & charcoal sensu stricto. Prob. same as persistent soil horizon at Thunder Point.

2 Hard rhizoconcretions form "forest" below the paleosol with which may be associated Product of scrubland? When sand advanced over scrub, the wood decayed & the root cavities filled with carbonate in three sequences of deposition? Check relationship with paleosol & consistency of three layers. Perhaps at site described on p.88 dunes eroded to Tough rhizo. level during sea retreat from L/IGl high, then glacial calcrete formed above. The rhizoconcretions associated with the calcrete are travertine and different in morphology

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and in their mineralogy (prob. calcite. Dense layered p.96) Forms boulders on beach.

3 The aeolianite is surface-hardened as is char'ic of L/IGl dunes. the soft sand inside has broken out & formed a sandslide, thus helping form the sandy beach.

4 The calcrete slopes toward Goose Lagoon outlet but is stripped along some of this section. Just below it is another paleosol which diversifies into a complex nearer the outlet. (Flat snails 5 charcoal – not humified wood). Similarly the black hol. paleosols on the N side of erosion embayment 1 p.95 are diversified in places into a number of places. This is no doubt

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due to the action of debouching waters from Goose Lagoon diversifying the slopes.

Page 100

Pt. Fairy Calcarenite in

Goose Lagoon Drains

2 Diagrams: maps showing fossil sites in drains

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Australites

collected in February 1970 between Stanhope's Bay & Burnie's Beach

3 Diagrams Australite E4624

1 E4624 0.8261 gm.

2 Diagrams Australite E4626 Similar to above but groove

2 E4626 0.4734 gm

3 E4625 0.8153 gm

Diagrams Australite E4625 Grooves and pits

Photo of Australites with scale

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Cape Reamur Artefact

Near beach in middle of erosion embayment 2 on p.95

2 Diagrams: plan and elevation of artifact

Calcrete, smooth except for a few chips & pecking (see above) on one side & roughly chipped all over on the other side.

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W. side of Cape Reamur

Photo: labelled features on W side of Cape Reamur

Photo rhizoconcretions on beach

Photo looking W down through blowout

2 x unlabelled Photos W side of Cape Reamur

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Estimates S.L./Time

Tas/Vic	Tas/King Is	Tas/Flinders Is
60 m	54 m	34 m
200’	175’	110’
15,000 y	13,500 y	11,500 y

Divers on T.V. said that in St. Vincents Gulf there are reefs at:

30 ft. Best preserved

60 ft well defined

80 ft. Remnants only

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Terang

Cutting in Princes H’way

Diagram of Cutting showing layers 1 to 4

Diagram just below Ground Surface

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Formation

1 Slickensided cracks near vertical

2 Non-slickensided cracks in 3 directions giving Blocky structure.

3-4 As bottom oppos. page.

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Coastal Erosion

See Ollier Weathering p. 44-5

Wentworth (1938) sugg. sol. of shore platforms may be caused by fresh water from land. Guilcher (1958) objects:

1 Doubts FW exceed saline even in wet climate.

2 Corrosion forms at foot of isolated rocks wh. too small to provide appreciable run-off or seepage

3 corrosion forms in Red Sea, an arid area where FW negligible.

Diurnal effects

1 If carb. dissolved at night & swept away by day, consid. corrosion Green algae & some inverts raise pH during day bec. absorb CO_2 in photosynthesis. Fall at night.

2 Nocturnal cooling increases sol.. of CO_2.

3 Solubility in sea diff. for FW.

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Joly (1901) showed basalt, obsidian, hornblende & orthoclase 3-14 times more soluble in sea than FW.

Surf with dissolved gases diff. fr. still water

Ollier p52 Biological Weather on Coast

Diagram: map of Thunder Pt – Breakwater area

NIP Height a function of

1 Age. Small when newly formed on fresh break or in embayment.

2 Exposure. Maximal height in a given area is where most exposed.

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Oct 1970

Table Cave Area

W'Bool

1 Photo

Thunder Pt. looking S from Table Cave.

Note small headland with figure consists of horizontal beds.

Dip N at Table Cave Horiz. area too wide to be a dune crest. Is

a Blowout

b Remains of earlier system

c Sand flat

Extensive fallen rock

2 Photo

Extensive areas of breaking waves are shore platforms connected to land or “islands”.

3 Photo: Horizontal bedding (see1) affects morphology of nip on lee side (but not on seaward side).

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Oct 1970

4 Photo: Between Table Cave & Merri Is.

N dip of Aeolian bedding.

Extensive fallen rock.

5 Photo: Rock stack in mouth of embayment at Table Cave. Figured in old post cards Not changed much in 40 years.

6 Photo: E side of embayment at Table Cave. N dip. Loose sand at top. Terra Rossa then Tower Hill Tuff with middens ^{14}C 3 7300 y.

7 Photo: Loose and as in 6. Paleosol sloping seaward is terra rossa. Flat top is Tower Hill Tuff.

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8 Photo: E of Table Cave.

Calcrete and thick soil pipe of changing diameter.

9 Photo: Cave e of Table Cave with shore platform and rock stacks.

10 Photo: Vertical cliff face with honeycomb weathering + differential reduction of strata.

Page 111

11 Photo: Middle Island (Island with Trig station) at end of dune line; Mass of fallen rock.

12 Photo: Over running sand. view of Merri estuary & windblown sand beside road to break-water.

13 Photo: Rock stacks at mouth of Table Cave embayment & dune line to

Page 112

14 Photo: E of Thunder Pt. N dip of bedding. Rock very broken & grading up into soft sand, as usual with Last Interglacial.

15 Unlabelled Photo of shoreline cliff

16 Photo: Table Cave embayment

17 Photo: E of Table Cave. Note solution arcs in aeolianite at platform level.

Cross-bedding ;N. Dips.

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18 Photo: Well lithified rock stacks in Table Cave embayment have stood little changed for many years.

19 Photo: N dip in dune line from Table Cave to Middle Island

20 Photo: E side of Table Cave embayment (see 6&7 for whole section). Tower Hill Tuff on calcrete stripped of terra rossa.

Soft sand – Last interglacial (late)

Calcrete – Last Glacial. Part of Terra rossa profile.

Tower Hill Tuff – c. 7300y.

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21 Photo: E of Table Cave

Water on shore platform swirls round solution areas. Sharp corners not survive if abrasion alone. Solution features recognizable as such all in sheltered sites.

22 Photo: View Table Cave to Middle Is.

23 Photo: Old cave collapse on same piece of coast. Morphology a balance between wave attack (incl. solution) & rock resistance.

This 1 Previous lithification by percolating waters (photo 24)

2 Lithification by sea splash & spray (wetting & drying) leading to case hardening, but sometimes solidification eg rock stacks (photo's 5, 13, 18.

24 Photo: Recently collapsed Cave. Note increasing lithification from surface. No calcrete layer at platform level.

Quarrying by sea formed cave (lower left hand corner) which later collapsed because of weakness of unconsolidated rock.

Evolution of Cave-Collapse

see p.130

1. Cave formation as photo 9. Weak rock quarried; also solution. Weak rock plucked from roof.

2. Collapse as photo 24

3. Trimming of walls & gradual removal of debris.

4. Bridge & mouth broken away and a small embayment like that at Table Cave results.

Much cave collapse on Middle Is. Function of weak L/IGl calcarenite.

page 116

Aeolianite ~~Henna~~ Ryot St

Warrnambool

Map showing quarry locations

3 Photos showing steep slope of beds

Steep leeward slope c 31°

Well cemented but no secondary crystallisation = Penultimate Inter-glacial. Footprints of birds, & animals found in Steere's Quarry as well as alleged human imprints.

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Point

Pt. (~~Leo~~)Levi Warrnambool

Area

5 Photos Shore platforms on E. Side of Pt. Leo (Levi??) 1970 on calm day with very low tide. Durvillea kelp exposed 1-2 ft above what is apparently LWOST.

See p.62

4 Photos

Pt. Leo(Levi??) with long platform running into sea, and stacks

Photo Aboriginal midden in dark soil on track down to Pt. Leo(Levi??). 2510y. BP

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North Cundare

4 Photos Terrace of former Lake Level. Date later than fossil soil (C. date)

See p.26

4 Photos Coxiella layers in road cutting at N.Cundare

4 Photos Cross-bedding in early layers of ? beach deposit above paleosol cf. layers of shells on present beaches.

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6 Photos of road cutting see p.25

Calcrete to earthy carbonate = B horizon of soil. Impedes drainage & farmers rip up up bec. dry out fast & pasture fail.

Photo Paleosol. See pp. 20-26

3 unlabelled Photos

Photo Beach & shell beds ref p.27-28

Photo Ken Simpson digs paleosol.

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Cape Reamur

Calcrete

Diagram Location of photo below

Photo: 2 paleosols in dune.

3 Photos: rhizoconcretions in cliff

2 Photos Last glacial calcrete with forest of rhizoconcretions.

2 Photos: view of coast

2 Photos The deepest section exposed showed fine roots continuing to 8’6”+ from surface.

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See pp. 79,87,102

7 Photos (unlabelled) rhizoconcretions

4 Photos: Paleosols in aeolianite “The Craigs”

Diagram: Map of Cape Reamur and the Craigs

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Coastal Names

Fowler, T.W., 1914. Notes on the discovery of The Victorian coast-line. Aust. Assoc. Adv. Sci. Rept 1913 Mtg. pp. 343-351

p 343 “Mahogany ship”

347 Lt. Grant in the “Lady Nelson” disc. & named Lady Julia Percy Is. etc

pp 348 Lt Baudin in “Geographe”; Cap Folard = Ronald Pt ;.Ile Latreille “on coast bet. above & W’bool. No such island exists” but I think prob = one of 12 Apostles likely. Can stand out in certain light. Baker’s Oven? Island at Sandy Bay or Bay of Islands.

Piton de Reconnaissance = Tower Hill

Cape Reaumer = Boulder Pt.

Ile Fourcroy = Julia Percy Is.

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Shore Potholes

Well developed in aeolianite. See Bird, E.C.F., 1970. “Shore potholes at Diamond Bay V.” Vict. Nat. 87:312-318

Wentworth, C.K., 1944. J. Geol. 52:117-20

Emery, K.O., 1946 J. Geol. 54:209-28

Dionne, J.C., 1964 Rev. Geogr. Montreal 18:249-77 (see bibliography)

Guilcher, A., 1958 Coastal & sub-marine morphology. London.

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Hempel(’s) rock

see p.48

p.133

2 Photos: Broken Bay – the Gardens

2 Photos: and beyond.

Photo: W. From the Gardens

Photo: Hempel’s Rock

Photo Block of aeolianite fallen from the high cliff.

Dip ~ 45^{o} seaward. Perhaps Gardens did not get so flat a platform bec no secondary calcification.

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1. As rock is aeolianite from high on the cliff (cliff-top dune), is well above the country water-table.

2. Its present dip has no relation to its in situ dip.

3. It has fallen far enough away from the cliff to have no relation to the groundwater.

4. So neither in its internal structure nor its present position can groundwater be a factor in platform formation, yet plat. like those round coast but narrower.

5. Judging by present

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rates of coastal restruction cannot imagine that Hempel Rock is more than two centuries old. If so platforms of same rock on same coast extending hundreds of feet into the sea must be very old, probably 2000 years.

Photo (unlabelled): Table Cave stacks offshore

Photo (unlabelled): footprints in ceiling

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Table Cave Baylet

10 Photos (unlabelled) Table Cave Baylet

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9 Photos (unlabelled)

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E. of Table Cave

6 Photos (unlabelled)

Photo Cave collapse – see p.130.

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Caves & Cliff Retreat

see p.115

Photo: Cave entrance

Photo: Cave Collapse

Photo: Soft calcarenite without much bearing strength caused to collapse by formation of cave

"Collapse Cave"

Photo: Some harder layers providing transition from tough aeolianite to soft calcarenite.

Photo Cave

Photo: See indurates cliff face soft calcarenite behind.

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Shore platforms highly indurated & highly resistant to erosion – hence so wide thus solution by sea must be limited.

Rock stacks at Table Cave show negligible change over half a century.
Cliffs where highly indurated are likewise resistant.

Over past 35 y. little change in indurated rocks but big changes due to collapse

1. Cave forms

2. Cave collapse

3. Fairly rapid removal of debris.

e.g. Table Cave

Two caves E of Table Cave.

Overhang of calcrete at Shelly Beach.

Area mined for stone at Thunder Pt.

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Here most progress not due to cumulative effects of slow (but in the aggregate important) processes. Cliff retreat mainly a function of the climactic event – cave collapse.

Method (for page 133). Measurements 3-5 taken with rope with a person at each end, then measured afterwards with a chain tape (very rough surface so measurement difficult & the rope seemed the best way). Rope that measured perimeter was laid out on ground in shape of Hempel Rock then length & breadth measured, so these approximate but of the correct order.

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9/1/70

Hempel's Rock

At "The Gardens" W. of Childers cove & Broken Bay

Diagram: plan of rock and coast

1. Width of rock – 35' N-S

2. Length – 60" E-W

3. Circumference round – 144"

inner edge of platform 54'

4. Profile outer edge of platform N side to same on SS

5 Profile E-W = 78'. 6. Volume 35'x20'x60' = 42,000 cubic ft.

Open ocean rocky coast H's Rock is a massive piece of aeolianite fallen from cliff,

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and since then under strong attack from the sea. Top strongly solution – weathered with lapies. Shore platform developed with the following features:

1. Vertical outer edge with Durvillea, sea lettuce, small brown alga, white tufted alga, heliotrope-pink, (orchid pink) calcareous alga?, chitons, limpets. Limpets continue up in wash zone & Melanerita (=Littorina) higher up in spray zone. Water 6'-10' deep.

2. 2'-6' wide on seaward side, narrowing at N & S ends to 0.5-3' on the landward side. Broken away at NW corner.

3. Platform surface varies in height by ~ 9".

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Rises towards rear.

4. Detail of surface pitted.

5. Rock has seaward dip ~ 45^{o} (to be measured).

6. No nip although such developed elsewhere

7. On landward side thin (to 5") terra rossa paleosol but this has little influence on platform formation.

8. Much secondary lithification of rock.

Diagram: shore platform and Durvillea

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Significance:

1. Fallen from high cliff ~ 150' – ~~200'~~,so unrelated to any groundwater effects.

2. dip ~ 45^{o} to windward so cannot have been formed in place because of aeolian origin. Many such blocks of varying sizes with dips ranging from vertical to horizontal.

3. Suddenly placed in marine situation so sea erosion a definite period without any earlier influences.

4. Bottom of cliff ~ 50' of Miocene marine limestone. Calcilutite.

5. Sea has developed a platform without nip or visor.

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6. Platform not as smooth or as flat as general platform – more like ramp area at base of cliff.

7. Surfaced pitted like gen. platform and not smooth as ramp at foot of cliff. Such polishing where not too open & rocks available for abrasion.

8. Platform wider on outer side than inner. Infer that while solution effective all round, abrasion results in wider outer platform.

9. The rock is relatively homogeneous.

10. Platforms are cut in it more readily than the other rocks of the region – Tertiary limestone & basalt.

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11. Area has been settled for 130 hears & tradition says rock always been the same. Certainly men now old fished off the rock when they were boys c.60y. ago. No large blocks like this have fallen in the 35y. I have been studying the coast. There are fallen blocks of different ages, the chronology determined by degree of

1. marine erosion.

2 subaerial erosion.

It can be inferred that it takes centuries to form even a narrow platform. At this rate, the wide platforms are thousands of years old. Further out from Hempel's Rock is a platform which appears to be the remains of a

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still earlier fallen block. At Table Cave at W'bool 2 rock stacks well indurated with secondary carbonate look much the same as photos show them to have been 50 years ago.

12. Rock structure affects platform formation but only in a minor way. Modifications can be seen in detail as a result of structure but there are no major effects.

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9/1/71

The Crack

Map Parish of Mepunga showing location of Hempel Rock and TheCrack

Cliff 150'-200' high. Break-away at top of cliff – large slice moved 2'-3' from cliff then fixed in that position. This common. Can climb down this crack to the top of the extensive

Page 141

talus slope which leads to the shore. Talus huge blocks down to running sand. Paleosols near top of section. About 40' of Miocene marine limestone at base of cliff.

In sea a very large block of rock as big as Hempel's rock in plan but not as high (~10') with aeolian bedding horizontal. Well developed nip.

Diagram showing nip and visor on fallen block

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Surface of nip pitted. Some fine indications of bedding i.e. some differential erosion. Large flat platforms wh. are interpreted as older blocks that have been completely planated. Similar platforms in Miocene l'st. but slower to develop there.

Processes:

1. Top of cliff calcified (L/Gl)

2. Cliff-top stripped.

3. Cliff-face fretted by wind? sea-mist. Hard layers stand out.

4. Spray etching to 50' up.

5. Miocene marine l'st. & fallen blocks of aeolianite strongly abraded by sea energy.

6. Marine solution.

7. Biotic solution.

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8. Rain solution & erosion of all exposed rocks.

Apparently Wilsons Crack named after David Wilson of Buckley Creek Station, which he occupied from July 1849-March 1857. See A.S. Kenyon "Pastoral Pioneers of Port Philip", stretched from Tooram towards Curdies River.

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The Crack

Lapies or Honeycomb?

Diagram: Plan of blocks on shore showing section lines A-B and C-D and faces 1 and 2

2 Diagrams: Profiles A-B and C-D

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Cellular limestone from faces 1 and 2 opposite.

1. Block has dip of 28^o seaward. Deep-cellular l'st of verticle face has cells dipping landward (=N) at 45^o.

2 Face parallel to 1 but cells dip E.

Same rock type, faces in same N-S direction (altho. opposite one another) yet cells (both dipping ~ 45^o) dip at angles 90^o to one another. Conclude

1. Rock type & rock structure no influence of consequence.

2 Dip of axes of cells a function of direction of spray (see green arrows opp.)

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If this can be established then the importance of spray is proved.

Unlabelled Diagram: cellular limestone

Much more complicated & much rougher than above, but NB.

1. Cells definitely present but not regular like those in Mesozoic s'st.

2. Cells much deeper than wide which is unusual.

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3. Surface very rough indeed as is char'ic of aeolianite.

4. Cells rather irregular but tend to be round in cross-section.

5. It may be that cells are being formed as in more normal honeycomb of Mesozoic s'st but the process is complicated by the solubility of the rock – hence the less regular cells (complications of 2 processes) & rough surface.

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11/1/71

Illowa

Cutting with tuff section in hollow ~ ¾ mile S of Illowa P.O. Samples for soil structure taken from W side of Princes H'way. Pt. Fairy Mil. map 342, 725 Seaward side of L/IGl duneline. Morphology depressed by tuff because none on calcrete ridges but hollow such as swales partly filled. Here 10'+ at cemetery W of Illowa bores have proved 100' infill.

Two series of samples taken in cans, provided by CSIRO Soil Div., Canberra. Called A & B 18" apart. Each series 4 cans each covering 6". Difficult bec. A horizon

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crumbly, B firm & C running.

A series bottomed on gray tuff

B series bottomed on off-white tuff

which usual here.

Profile:

0"-6" 10 YR 4/3 brown crumbly loam. roots throughout profile but most numerous here.

6"-15" 7.5YR 5/6 strong brown gravelly (bec. of lapilli) silt.

15"-24" N7/ Light gray to 5Y 5/ gray tuff & lapilli.

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11/1/71

Middle Island

Open ocean high energy rocky coast. Very low tide. Island part of Thunder Pt. Last interglacial dune-line with landward dips. Wide flat platforms with vertical or undercut sides. Diff. degrees of exposure:

Seaward	Landward
1. Wider platforms	- narrower
2. Surface pitting deeper	- shallower
3. Edges more undercut	- less undercut
4. Nip 4'-10'	Nip 0'-5'
5. More cavernous weathering	Less do.
6. More cave collapse	Less do.

7. Calc. algae common Rare

8. More honeycomb and lapies Less

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Much of surface stripped at W end (by SW winds) revealing mammillary laminated calcrete as at Moulden Quarry, Dennington.

Undercut of platform has led to collapse of some blocks on the seaward side; they then tilt & leave a channel a couple of feet wide behind. Further out are some tilted blocks covered with kelp wh. no doubt had the same origin.

On the seaward side platform edge with kelp white & red calc. algae, chitons, limpets ascidians etc; top with above less kelp + Dicathais, Galeolaria. Many shallow pools not undercut. There are elevated pools which are above platform. Photo of one c10'.

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Ramps smooth but platforms very pitted. On open ocean side deep pits 2"-3" diameter photographed. At base of cliffs many curves with sharp edges between. Cups to 5' deep above platform. Extensive & intense pitting, honeycomb & lapies on exposed side of island to top of cliffs ~ 50. Aeolianite reduced to a network almost in some place 10'-20' above nip.

Midden on lee side – concentration of shells, edible kinds & sizes, and charcoal.

Diagram: map of Middle Island

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Honeycomb A on SE side there is HC that approaches the typical HC of the Mesozoic sandstone.

2 Diagrams: Plan and section of honeycomb

Appears to have begun as 3 cells which coalesced and 2 second generation cells formed in the bottom. Sample collected. Most cells not as well developed as above.

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11/1/71

[B] Middle Is. at place marked on page 152 map.

Diagram Vertical cliff section showing sites 1 to 4

Two kinds of honeycomb.

Diagram: profile of rock surface at 1.

At 1: Surface smooth

Cells directed upwards (vertical)

Thick walls between cells

Cells simple or divided

Shallow to deeper than wide

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At 2 the cells are turning over so that their axes pass to 45° and beyond. At same time cells become deeper & more complex, the walls are thin & hackly.

At 3 the axes are horizontal and at 4 at a low dip following the stratification which weathering has followed. At 4 the cells are so numerous & inter-penetrating that they become almost a filagree, a photo in the recess was attempted.

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12/1/71

High Tides

1971	Hours Mins	Tidal Rise	
Sat. Jan 9	00.12	(2.8)	-------------
Mon Jan 11	00.59	(3.0)	-------------
Tues Jan 12	01.24	(3.1)	11.47 (1.2)
Wed Jan 13	1.47	(3.0)	12.37 (1.4)
Thurs Jan 14	2.08	(3.0)	13.18 (1.6)

Low Tides

Sat Jan 9	---------		14.16 (0.3)
Mon Jan 11	---------		17.12 (0.1)
Tues Jan 12	08.54	(1.1)	18.01 (0.0)

Wed Jan 13 08.47 (1.0) 18.40 (0.0)

Thurs Jan 14 08.52 (0.9) 19.14 (0.1)

Tide low all day. Wind in morning but dropped in afternoon and it was possible to walk out on platforms where I had not been before. The high tide at 11-47 am did not even reach the top of the kelp zone where highest. Only 3/4 of the platforms had water over

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them or awash with waves so people out on parts of them although "high tide".

The flat sea + the tide level made it possible to compare platform levels. Vary by only 6"-12" (inner end) which very little for such extensive structures with such varying conditions.

Platforms strongly pitted with cells up to as much as 6" across. Sharp ridges between in some places. White calcareous algae in open positions & pink – purplish one in sheltered places, is in gulches, that nonetheless receive the full surge of the waves. Some platforms so covered in plants that molluscs relegated to inner edges or occasional bare outer edge. (Caulerpa present).

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S.E. of Sewer Outfall

Diagram: map of rock platform S.E. of Sewer Outfall

Some platform edges strongly undercut, some vertical & some an angle of about 60° – and in between.

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Diagram: 3 types of undercutting

Sea gurgles through tunnels and issues through holes in platform as small fountains. chitons, limpets, Dicathais, a few Haliotis, Subninella

Cave collapse also p.163. From the outer platform one can see far more caves and recesses in the cliffs than can be seen by working along the cliffs. Caves occur at the ends of channels commonly (indicating the place of strong waves in forming them) but also at the back of platforms. There is a large cave collapse as marked opposite.

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Demolition of platforms due to

1. Undercutting of edges & breaking off of masses.

2. Tunnelling which soon weakens a platform. One tunnel came up in the middle of a stack next the island marked on p.158

3. Cave formation followed by collapse.

4. Pitting of surface so reducing the platform.

5. Quarrying by waves along paleosols, cracks & other lines of weakness. Hair cracks seen in landward end of island on p.158.

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At Breakwater Rock there is a crack about a chain long (4”-8” wide) across platform on seaward side along which sea is quarrying. Crack continues another chain right across the Rock. Where the platform finishes the crack is offset about 2ft due to fracture along a bedding plane. Such structures are important & are probably due to collapse over caverns and/or undercuts.

6. Biologic activity, but also constructive work by calcareous algae.

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Coastal Structure

Diagram: Typical coastal; shoreline stratigraphy (layers 1 – 7)

Marine Erosion

1. Strips 1-3 by spray, wind, & rain

2. Excavates 4 and calcrete collapses

3. Attacks 5-7 by physical abrasion, air & water pressure, quarrying, tunnelling, cave-formation resulting in

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collapse, solution, salt fretting, wetting & drying, biological attack + rain (strong solution) & wind. Also human activity over many millenia.

The sea that attacks the rock is held back chiefly by the induration caused by that same seawater.

However at weak spots it tunnels in, forms a cave, & then the weakness of the rock results in collapse. All along the coast the sea is attacking the weakest aeolianite – the Last Interglacial. Nowhere is it in contact with the Warrnambool Aeolianite or the other formation seen at Albert Park Quarry.

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Lapies

Above the comparatively finely pitted nip, are the two kinds of solution structure described on p.154. Honeycomb like pittings just above & where some shelter from direct blast & then the lapies on top. Photos taken on island of p.158.

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Platform Collapse

Calm weather permitting traverse of platforms not usually accessible in Pt. Levy area, and Middle Island show that this quite common. Platform collapse appears to be the chief means of demolition. Because soluble, undercuts & tunnelling easier (also because soft behind surface induration. Between cliffs and the island of p.158 there is much undercutting & tunnelling so that cracks have appeared and the bridge to the island is being destroyed.

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Rate of Coastal Erosion

The sea reached more or less its present level c 6000y ago. It was then dune like hills covered with terra rossa or later soils underlain by calcrete. The calcrete put an initial brake on erosion. The calcarenite below was hardened by seawater. The present coast is the result of 6000y of physical and chemical attack with oscillations of sealevel, ~~&~~ climate (rainfall, winds, storminess etc) & tide regime.

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Survey Shore Platforms

1. Sewer Fallout, Thunder Pt.

Warrnambool, 4 pm 12 Jan 71

Table of survey data

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2 Breakwater Rock

Table of survey data

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Platform varies in height

1. Where surveyed the general level is 1ft above water level at 5:53 12/1/71

2. Another area near the sea wall 1’6” higher

3. Another 1’4” higher

4. Highest 1’6” higher

Due to low tidal level & the calm sea it was possible to walk over the platform on the seaward side by the island. This is usually covered with breaking waves even at low tide. The edge stands c.3 ft. above LWL and its position appears to be the only explanation of its unusual height. Same dune, same lithology as that in which normal platform on the other side of the Breakwater Rock.

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Crack 4”-8” wide crosses the platform for about a chain & then right across the Rock for about another chain. Where the crack meets the shore platform, the break is offset c.2’ by failure along a bedding plane. Such cracks are quarried by the sea & so demolition aided. Factors:

1. Removal of rock by erosion removes support & can be a factor in rock failure.

2. Karst, undercutting, sea caves & such like result in the settling of the structure.

3. Heavy seas apply impulsive loading by the weight of the water, its momentum

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& the rock load it carries. The Breakwater Rock can be felt to vibrate under the attack of heavy seas.

Collapse has cut the Breakwater Rock into two near the sea wall. Due to cave formation & tunnelling.

Large cups along the sea-ward edge. These a feature where heavy splash. Cups to 6’ diameter & - 5’ deep (by which time some breaking away of edges). Relatively smooth surface because sanded. Similar surface in the narrow channels along which the water runs. Divers caught conger eel

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c 5’ long. Young seal dubbed Sam in harbour. People fed it, & it caught fish itself. Reported there for c.3 wks Took fish off fisherman’s lines. Quite tame.

Map: Durvillea potatorum limited to Maugean province.

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Durvillea & Tidal level

King says Durvillea the best of the alga for marking sealevel, if in an exposed position, top of zone ~~It~~ indicates mean low tide or sometimes spring low. On the Childers Cove – Cape Reamur coast it is ~ mean LWL.

He agrees with my observation at Cape Reamur & elsewhere that the Durvillea zone top can be at a higher level where constant wave breaking.

3 Diagrams: position of Durvillea on platforms of various ages

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March'71

Tertiary Fossils Woolsthorpe.

Miss Gwen Jones of "The Union" presented some "Limopsis" to the Museum in April 1971 from under the basalt at about 100ft.

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April '71

"The Union" Woolsthorpe

Miss Gwen Jones

Fossils from below basalt. White shells etc.

Glycymeris Mollusca

Dentalium Mollusca

Sphenotrochus Coral

Gasteropod indet.

Tertiary marine.

Det. by T. A. Darragh

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Mt. Eccles

See p.75

3 unlabelled Photographs Mt. Eccles

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