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MUD ISLANDS, PORT PHILLIP BAY Their Geology, Botany and Entomology.

Fig. 1.

The group of islands in Port Phillip Bay known as Mud Islands was discovered in 1802, but although only 30 miles from Melbourne it is seldom visited. From time to time men have been employed there digging guano, others have interested themselves in oyster culture, they have been visited by fishermen and by bird lovers studying bird migration, and a few of the more obvious facts relating to the group have been recorded, but no systematic examination of these islands has hitherto been attempted. In November, 1945, 143 years after its discovery, a party of scientists organized by the National Museum of Victoria, went there to investigate the group in relation to their several spheres of activity, R. A. Keble to investigate its geological history, S. R. Mitchell, to ascertain whether there were any traces of a former native habitation, J. H. Willis to investigate its flora, and A. N. Burns, its insect life.

The investigation was of peculiar importance as it was considered that the islands are of recent origin—according to Keble, at the most little more than 3,500 years old—and that they would furnish the material for an interesting ecological survey.

HISTORY AND GEOLOGY OF MUD ISLANDS.

By R. A. Keble, Palaeontologist, National Museum of Victoria.

The group of islands was first sighted on Monday, February 15, 1802, by Acting-Lieut. John Murray when he was working along the south shore of Port King, afterwards renamed Port Phillip by Governor King, to his first anchorage near Point King. He recorded in his log (Lee, 1915).

. . . to the N.E. by N., about 5 miles from the south shore lies a cluster of small rocky islands and all round them a shoal of sand; plenty of swans and pelicans were found on them when the boat was down, from which I named them Swan Isles . . . At half-past 3 p.m. we got to anchor in a sandy cove in 7 fathoms of water, bottom fine sand—Swan Islands bearing N.E. by N. distance 5 miles, a bold rocky point which I named Point Paterson E.S.E. $1\frac{1}{2}$ miles, a long sandy point named Point Palmer west, $1\frac{1}{2}$ miles, and the nearest point of the shore S.W. $\frac{1}{2}$ of a mile distant.

Murray's description of the group as a "cluster of small rocky islands" was an impression gained, doubtless, from a distance,

through binoculars—the rocks at the guano deposit being probably visible to him. One approaching the islands sees, from a long way off, numerous swans and pelicans on the beaches.

Other extracts from the log are:

Wednesday, February 27 . . . In the afternoon the boat went to Swan Isles and caught three live swans of a large size . . . Saturday, February 17 . . . Sent Mr. Bowen and Mr. Brabyn in the gig to get the latitude of the north end of Swan Isles and at noon I got the latitude of a point about 7 miles North and South of them from which a base line was got for the survey of the harbour.

The course Murray took when he charted the south-east portion of Port Phillip is shown on his chart made in 1802. It passes Swan Isles a short distance from the group which he shows as consisting of three long and narrow islands, the largest one to the north-west. Obviously Murray's survey party did not actually survey the group.

Charles Grimes, Acting Surveyor General of New South Wales, when he surveyed Port Phillip in January 1803, did not land on the group; he appears to have copied his outlines of them from Murray's chart.

The Rev. Robert Knopwood, who kept a diary during Collins's settlement at Sullivan's Bay near Sorrento, referred to the group as Signet Island. His entry for Tuesday, October 11, 1803, is as follows:

The same party Lieut. Nicholas Pateshall, Purser Edward White and self went on the shore of the island in the middle of the Bay, now called Signet Island, where we see a great number of black swans. I was the first that killed one on the island. We kill 3, and caught many alive, and caught many pelicans, and some sea birds.

The landing was made two days after the expedition arrived at Sullivan's Bay.

Lieut. J. R. Tuckey of Collins's Expedition who surveyed Port Phillip in H.M.S. *Calcutta* in 1804, sketched in four islands; he does not appear to have landed.

The first actual survey was made in 1836 by Lieut. T. M. Symonds and Lieut. H. R. Henry of H.M.S. *Rattlesnake* which afterwards figured prominently in the survey of northern Australian waters, with John Macgillivray and T. H. Huxley as naturalists. Symonds and Henry were the first to refer to the group as Mud Islands, and the channels to the east and west respectively as Pinnacle Channel and Symonds' Channel. In 1842 Commander I. C. Wickham and Captain Stokes in H.M.S. *Beagle*, the 10-ton brig so closely associated with the wanderings of Charles Darwin, extended Symonds and Henry's survey, and in 1856 it was further extended by C. J. Polkinghorne. On this

small scale chart, three islands are shown in their true positions; their outlines do not appear to differ from the chart published later in 1859-60 (Fig. 1) surveyed by Commander M. G. H. W. Ross assisted by Messrs. Turton, Sturgess and Deck and corrected up to 1863.

This last chart is the first to give a large scale outline of the group—the natural scale is $\frac{1}{24,400}$ —and is referred to here as Ross's chart.

In 1864, Commander Henry L. Cox, assisted by Thos. Bouchier, J. G. Boulton and P. H. McHugh, made the chart of Port Phillip at present in use, and the basis of all subsequent corrections and extensions. The natural scale is $\frac{1}{73,000}$. Cox appears largely to have accepted Ross's survey for Mud Islands.

PHYSICAL FEATURES.

The outline of Mud Islands as delimited by the Coast Survey in 1946 and on Ross's chart of 1859-60 is shown in Fig. 1. It will be seen that while at some places there is agreement, at others there is considerable variation. The question arises, then, as to what is to be inferred from these variations—whether they are due to inaccurate charting or progradation and encroachment during the last 80 years. Considering the difficulties in charting the islands and the changes now in progress in Port Phillip, the variations are probably attributable to both, and for convenience of reference, Mud Islands is assumed to consist of four main islands, none of which are named on the charts, but are known or referred to here as Western Island (69 acres), Middle Island (54 acres), Boatswain's Island (98 acres), and Eastern Island. Besides these there are some low banks, one of which, that between the southern extremity of Western Island and Boatswain's Island, is referred to as Low Bank (11 acres) (Fig. 1.)

The islands are situated near the centre of the Great Sand (Murray's "shoal of sand") trending N.E.; the Great Sand is a little more than 5 miles long by 2.3 miles wide, and outside the group is covered by from 1 to 7 feet of water. The depth increases abruptly to the north-west as one approaches Symonds' Channel which is from 20 feet to 55 feet deep; to the south-west is South Channel with 42 feet of water, and on the north east the southern portion of the Inner Basin of Port Phillip.

The Mud Islands group has been built up on the Great Sand at the only place inside Port Phillip where consolidated dune-rock is exposed above high water mark; dune-rock is the surface rock of the adjacent Nepean Peninsula to the south and east, and partly of the Bellarine Peninsula to the south-west. In the Mud

Islands group, it outcrops at the south-east end of Boatswain's Island, the north end of Western Island, and probably, before it was covered by sand, was exposed at other places. It is known



FIG. 1. MAP OF MUD ISLANDS

Scale: 6 inches to nautical mile.

Coast Survey, 1946

Ross' Chart, 1859-60 ———

from bores put down on the shoals in the southern portion of the bay (Keble, 1946) that dune-rock underlies all the shoals, sands and channels south of a line from St. Leonards to Rosebud. In configuration the group exhibits an atoll-like form—a circlet of

curvate islands enclosing a relatively large tidal lagoon—the Inner Lagoon—under a foot deep; this opens to the south-west into a smaller lagoon, the Outer Lagoon, which has a wide opening to the south. This wide opening is being rapidly filled with sediment, the Low Bank being formed across it. The bottom of the lagoons is sandy mud. The islands, except near their outer fringes, have a fairly level surface, about 5 feet above low water mark, of sandy mud similar to the bottom of the lagoons. Along the outer (western) shore of Western Island, sand-dunes are now being piled up and have reached a height of about 12 feet near the northern and southern ends of that island. All the islands support a low, thick scrub in which there are occasional open spaces where rookeries are found; the largest is on the Middle Island and Boatswain's Island.

Between the eastern island and Middle Island, and flowing over the south-east portion of the Inner Lagoon, Ross shows a waterway with an outlet between the southern extremity of Eastern Island and the south-eastern extremity of Boatswain's Island.

DEVELOPMENT OF THE MUD ISLANDS GROUP.

In a previous contribution (Keble, 1946), it has been pointed out that the so-called channels through the shoals in the southern portion of Port Phillip Bay could more accurately be called tide-ways, formed by the outgoing tidal stream of the Inner Basin of Port Phillip finding an outlet into King Bay or Bass Strait, and the incoming tidal stream through The Heads finding its way into the Inner Basin.

The Great Sand has been prograded to the north-east and south-west from a dune rock platform, portions of which are exposed at the south-east end of Boatswain's Island and the northern end of Western Island. This sand has been shaped, and the Mud Islands group given its atoll-like configuration, in the first instance by both the incoming and outgoing tidal streams. The main incoming tidal stream comes through the Heads and along the South Channel, finding its way through Pinnacle Channel and the channels east of it into the Inner Basin; it also sets to a lesser extent through Symonds' Channel. The outgoing tidal stream coming from the Inner Basin flows over the banks as well as along the channels.

AGE OF MUD ISLANDS.

There is evidence around the shores of Port Phillip of the world-wide raised beach, 15 to 20 feet above sea-level, but it is

complicated along the northern shore of the Nepean Peninsula by tectonic movements. Hills (1940) draws attention to the shell-beds up to 5 or 6 feet above ordinary high sea-level between Sullivan's Bay near Sorrento and "The Rocks" at Dromana. He points out that "The gradual fall in elevation of the raised beaches towards The Rocks indicates that their emergence was caused, at least in part, by tectonic movements." If the raised beaches referred to were formed at the Postglacial Optimum, these tectonic movements have occurred since then. The Postglacial Optimum is estimated to have occurred about 4,000 years ago (*cf.* Brooks, 1922), or, as suggested by the solar radiation curve (*cf.* Zeuner, 1945), about 10,000 years ago. Assuming Mud Islands to have remained static, with a progressive fall of sea-level based on the shorter estimate, they were uncovered between 1,000 and 1,500 years ago, but on the longer period between 2,500 and 3,500 years ago. If the tectonic movements evident on the north shore of the Nepean Peninsula extended to Mud Islands, an upward movement would tend to increase slightly these estimates and a downward movement to decrease them.

The author of this paper has stated elsewhere (Keble, 1946) that the Port Phillip Sunkland on which the Mud Islands group is situated is oscillating, but subsidence is much in excess of uplift.

SOME FEATURES OF THE MUD ISLANDS GROUP

The sandy mud of the generally level surface of the islands and forming the bottom of the lagoons, suggests a former sea bottom not unlike that of the deeper portions of the Inner Basin. The section at the guano rocks gives some idea of the geological history of the islands.

- a. Dune sand accumulating at present and contemporaneous with the unconsolidated dunes at Sullivan's Bay.
- b. Guano.
- c. Sandy mud which has been partly built up into the dunes (a)
- d. Shell limestone, loosely cemented Recent shells predominating.
- e. Soft limestone with Recent shells. The limestone layers dip southwards.
- f. Pleistocene dune rock comparable with the dune rock at Sullivan's Bay and elsewhere on the Nepean Peninsula and also at Queenscliff.

The guano has been completely removed but there is no doubt as to where its position was in the section. The workings suggest that it was not extensive and a foot or two thick. MacIvor (1879) comments on it as follows: "Flat (or Mud) Island Guano.—This, a Victorian guano, found upon a small island in Hobson's (*sic*) Bay . . . is poor in fertilising constituents, and therefore unsuited

for treatment with sulphuric acid The following average analysis will show its composition in 100 parts.

Moisture	6.12
Organic matter	23.64
Sand	44.82
Phosphate of lime	20.62
Carbonate of lime	3.31
Other substances	1.49

100.00.

The organic matter is non-nitrogenous consisting chiefly of vegetable *debris*."

It has been mentioned here that on Ross's survey a waterway (Fig. 1) is shown draining the tidal flat that formerly existed between Middle Island and Eastern Island; this waterway was joined by a short tributary from the north-west before it entered the open water of Port Phillip Bay immediately north of the guano deposit. On Cox's 1864 chart two other waterways are shown on the north-east side of Boatswain's Island and another was found on the eastern shore of Western Island. An examination of these shows that they are actually tideways. At high tide small basins behind the shore line are filled and as the tide is falling, this water in the basins finds an outlet into the Inner or Outer Lagoons by the tideways that have been suggestively indicated as creeks on the charts; when the tide is rising the water flows back through the tideways from the Lagoons into the small basins. This disposes of the possibility of any of these so-marked creeks being portions of a stream system that drained the surface during the glacial stage when it was dry land. Incidentally, it may be mentioned that on the Nepean Peninsula no streams have been formed on the dune rock and sand which are too porous to hold up surface water; exactly the same conditions are found on Mud Islands.

CONCLUSIONS.

The Mud Islands group has been formed by the incoming and outgoing tidal streams behind a dune rock platform, portions of which are exposed above high water mark on the islands.

The islands are not more than 3,500 years old—all vegetation and insect life found on them has appeared there within that period.

That no evidence of the former occupation by the aborigines was found is somewhat surprising in view of the fact that bird rookeries exist. The tangled vegetation leaves few open spaces

and the nature of the surface makes the search for evidence difficult and inconclusive.

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