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NORTH QUEENSLAND NATURALISTS CLUB

Founder, Presd. The late Dr. HUGO FLECKER.

OBJECTS—The futherance of the study of the various branches of Natural History and the preservation of our heritage of indigenous fauna and flora.

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"Each Author is responsible for the opinions and facts expressed in his or her article."

LIFE HISTORY OF – ASCELES POMEFORMES – MAKER OF THE BLOODWOOD APPLE

Since man began to leave his cave dwellings and migrate to areas of the Earth that had no such ready-made shelter, he has used a wide range of materials to protect him from the elements and wild beasts. Today we have, spaced around the world, crude structures of leaves and branches, huts of mud, and on up to palaces of marble. In his long career from caves to cathedrals, the son of Adam and his little woman have never been able to provide food and shelter for themselves and family by biting into a convenient tree and injecting it with their saliva.

Asceles pomeformes is an insect whose females do this, and do so with the initial handicap of starting food production and house building while still infants.

At this stage the little insect resembles a tiny mite, less than ½ mm. long, wingless, with minute eyes and antennae, six microscopic legs, and a proboscis much thinner than a human hair. She thrusts her thin proboscis through the bark of a twig or small branch of a species of Eucalypt (bloodwood), and within a week a rough circular crater is rising around her body, which will, in a few weeks, completely enclose her in a roughly spherical gall formed from the tissues of the plant on which she is feeding.

During this period a drastic change takes place in her body. The eyes and all appendages except the proboscis are lost and she is now like a small spherical pearl coloured berry. She still has her proboscis inserted in the plant tissue and will remain so anchored for life. The gall is growing rapidly, is assuming a more evenly rounded contour and is forming a conical tube in its wall which fits around a hard black cone-shaped plug that is now forming on the insect's posterior. This conical tube is the only opening in the gall to the outside world and is probably a means of air control; through it she is presumably mated, and I have observed the emergence of the brood through this passage.

For some time the gall and its contained insect keep pace in growth, with the insect's body in firm contact with the inner surface of the gall. Her body is still spherical but the growth of the conical plug now gives her a broad top-shape. After this there is an increasing difference in growth rate with a gradually enlarging space around the insect's body, except at the feeding point and at the conical rear end which remains a close fit in the tube-like opening of the gall.

Small holes now appear on the rear half of the insect's body and around these a white chalky substance and small bundles of coiled cotton-like material accumulate. This may be a form of excretion as the latter material is also produced by the immature males that develop later in the parent gall, but this has not been observed in immature females prior to emergence.

The outside of the gall now has the shape of a small apple of a brown to grey-green mottled colour, with a conical pit in its outer surface opposite its point of attachment to the tree. This pit is the outer opening of the tube mentioned above and, in a healthy gall, the black plug-like cone on the insect's body can be clearly seen protruding into this pit.

When a few millimetres of space have formed around the insect, the first eggs are laid and these produce almost entirely males. When hatched, these juvenile males are about ¾ mm. by ½ mm., colourless, with a tapering body, stumpy legs, rudimentary antennae and eyes, and a proboscis less than 1/50 mm. in diameter. They commence feeding on the inner surface of the gall and grow rapidly, attaining a length of about 3 mm. and a diameter of 1 mm. by the time they finish feeding. As they grow the males become carrot-like in shape and colour and are tightly packed around the inner surface of the gall with their pointed rear ends to the centre, across which, like a huge grey sausage, lies the gigantic body of their mother.

Before the males have finished feedi.,g, a second batch of eggs is laid and these produce females with a very few males. The juvenile females are almost colourless on hatching, with a faint brown longitudinal band on the back. They are mite-like, less than ½ mm. long, and very active. They move to the inner sufrace of the gall among the males and commence to feed.

The males cease feeding soon after the females begin and lie loosely in the gall around the body of their mother while undergoing moulting. They moult onbe only, a rare thing in the insect world. The metamorphosis of the juvenile male to the adult is almost as striking as the change of a caterpillar to butterfly or moth. A helpless carrot-like creature with minute eyes and antennae and short, almost non-functional legs, changes to an agile winged insect with huge thorax, a long slender tapering abdomen, strong legs, large eyes, complex antennae, and a pair of large membranous wings. The abdomen is very flexible and is extensible by aboutone third of its length. It is more like a tail than abdomen and is held well clear of the surface when the insect is walking. The mouth parts of the mature males are aborted; they cannot feed.

The juvenile females feed while the males are moulting and for a short time afterwards. Growth is negligible and can only by detected by microscopic examination, and they are still less than ½ mm. long when they emerge from the parent gall. Their colour deepens to brownish black on the back and light brown at the sides.

The brood disperses from the maternal gall by the males taking flight with the tiny females clinging to their tails. From one to seven of these midget females have been observed on the abdomens of males prior to taking flight. Emerging insects have been taken in glass tubes in the field and examined on the spot with a hand lens, and every male carried one or more of these infant hitch-hikers.

Field observations indicate the lifespan of a gall is from 18 to 26 weeks, with a good deal of overlapping in that healthy galls at nearly all stages of development may be obtained throughout the year but are more plentiful during the wetter months. A very high percentage is destroyed by parasites and predators; some are killed by fungi, others by several species of beetles and wasps.

Mature galls examined had outer diameters from 22 mm. to 90 mm. but size variation in the insect's body was not proportional to that of the gall. The smallest mature female was 14 mm. and the largest 27 mm. long. The maximum volume of the largest of these galls could be more than 100,000 times that of the insect at commencement of gall formation, and the size of the mature insect less than 1/25 that of the mature gall. Rough checks of progeny in healthy galls gave a variation from about 1,700 to 4,600 males with slightly more females.

The great difference in development of the sexes on emergence from the gall (the fully developed male with his aborted mouthparts, carrying his baby sisters into a hostile world), and the time taken for the females to reach maturity, suggest that the males may mate with a previously established generation of females.

The life history of the insect outlined above, with its remarkable change in form and enormous increase in volume, its specific and precise control of the growth and shape of the gall, and the strange journey of the females to the outside world clinging to the "tails" of their huge winged brothers, is one of those fascinating highlights of the living world when Nature sings a more wonderful song or tells a more marvellous tale.

N. C. Coleman.

THE BEACH-RIDGE PLAIN AT CAIRNS

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The coastal plain on which Cairns stands consists of numerous sand ridges with intervening hollows (termed swales), many of which contain, or used to contain, corridors of swamp land. In the city area, around the railway station, and along the waterfront the orignal topography has long been concealed by infilling and building, but in the northern and western suburbs the trend of the ridges and swales can still be discerned. The sand ridge topography was closely surveyed during the nineteen-forties, when large-scale plans (1 inch = 200 feet) were prepared for the City of Cairns Anti-Malarial Drainage Scheme. These plans cover West Cairns and part of the Bungalow district, and show contours with a one foot vertical interval. The contour patterns are extremely intricate, but the alignments of ridge crests can be picked out, and these have been abstracted to show the ridge system in Figure 1.

The cross section in Figure 1 shows that the ridges are not evenly spaced. Some of them branch, and others fade away laterally. The contouring was based on an arbitrary levelling datum, but in preparing Figure 1 this was converted to State Datum, equivalent to mean sea level at Cairns Harbour. Spot-heights show considerable variation along the crest of each ridge, with a range from 5 to 14 feet above mean sea level and a typical maximum elevation of 10 to 12 feet. Intervening swales (not shown) range from 3 to 7 feet above mean sea level, and parts of these are invaded by the sea during the highest spring tides, which attain almost 5 feet above mean sea level at Cairns.

The pattern of sand ridges in the area not covered by the large-scale plans has been mapped by field survey and on air photographs, and the results have been included in Figure 1. In the Bungalow district the sand ridges decline in level and fade out into the mangrove swamps bordering Trinity Inlet, while to the north-east, beyond the watercourse that follows the railway line and flows into Saltwater Creek, another series of parallel ridges lies concealed beneath the built-up area of Cairns. These were somewhat lower (typically up to 6 feet above mean sea level) and more subdued in profile than those of West Cairns.

Their alignments have been taken up by Sheridan Street, Grafton Street, Lake Street and Abbott Street, and a walled esplanade forms the seaward margin, which was mangrove-fringed when the first settlers came to Cairns in 1876.

Continuations of the sand ridges can be traced on Admiralty Island and in the swamps south of Trinity Inlet, marked out by the presence of Eucalypts and other trees and shrubs that contrast with the prevailing mangrove vegetation.

These ridges have been dissected by the lateral meandering of tidal creeks, and one of them is being actively truncated near the Bark Hut, where a sector of sandy shore is exposed on the south bank of Trinity Inlet.

Geology.

The surface formation on the Cairns coastal plain consists of up to 14 feet of quartzose sand, with occasional pebbles and shells, underlain by a soft blue-grey clay formation containing relics of ancient mangroves. This has been demonstrated by the numerous boreholes sunk in the Cairns area to explore foundations for building construction. The soft clays thicken southwards, reaching a depth of 78 feet below mean sea level at the sugar terminal bordering Trinity Inlet. Underneath them is a firm yellow-grey clay formation up to 40 feet thick, which rests in turn on a basement of sandy gravel.

To interpret this sequence it is necessary to appreciate that sea level has risen and fallen several times around the Australian coast during the past million years. Episodes of lowered sea level coincided with the colder phases of the Pleistocene, when ice sheets and glaciers became much more extensive on the Earth's surface than they are now. In the last major cold phase – about 20,000 years ago – sea level stood 300 to 400 feet lower than it is now, and rivers extended their courses out over the emerged sea floor to shorelines that have since been deeply submerged. In North Queensland the Barron River is thought to have flowed out through the gap in the Great Barrier Reef known as Trinity Opening – and at this stage the Reef stood up as a chain of limestone ridges at the outer edge of a broad plain. In the ensuing period the sea rose rapidly, attaining its present level some 6,000 years ago, since when there have been only minor oscillations.

Underneath Trinity Inlet there is a deep trench, now largely filled with muddy sediments, which is thought to have been excavated by the Mulgrave River during one of the low sea level episodes in Pleistocene times. The fact that it is now filled with muddy sediment washed in from the sea rather than by alluvial sands and gravels of the type carried by the Mulgrave indicates that this river had been diverted southward to its present outlet at Mutchero before the last rise of sea level. The deep blue-grey clay formation and the sands that rest on top of it in the Cairns district have accumulated during and since this last sea level rise: they are derived from sediments supplied by the Barron River, which drains to the sea just north of Cairns, and not from the Mulgrave (Bird 1970).

Supporting evidence of the age of the coastal plain deposits at Cairns has been obtained by means of radiocarbon dating of shelly material taken from the base of the innermost (i.e. oldest) sand ridge. This yielded an age of 5530 $\pm$ 130 years Before the Present, and since in radiocarbon dating the Present is taken as 1950 A.D. this represents a calendar date somewhere between 3710 and 3450 B.C., some centuries before the dawn of ancient civilisations in Egypt, Mesopotamia, India and China. It is not known how long the Cairns ridges took to form, but it seems likely that they were built up successively over a period of many centuries.

Origin of the sand ridges.

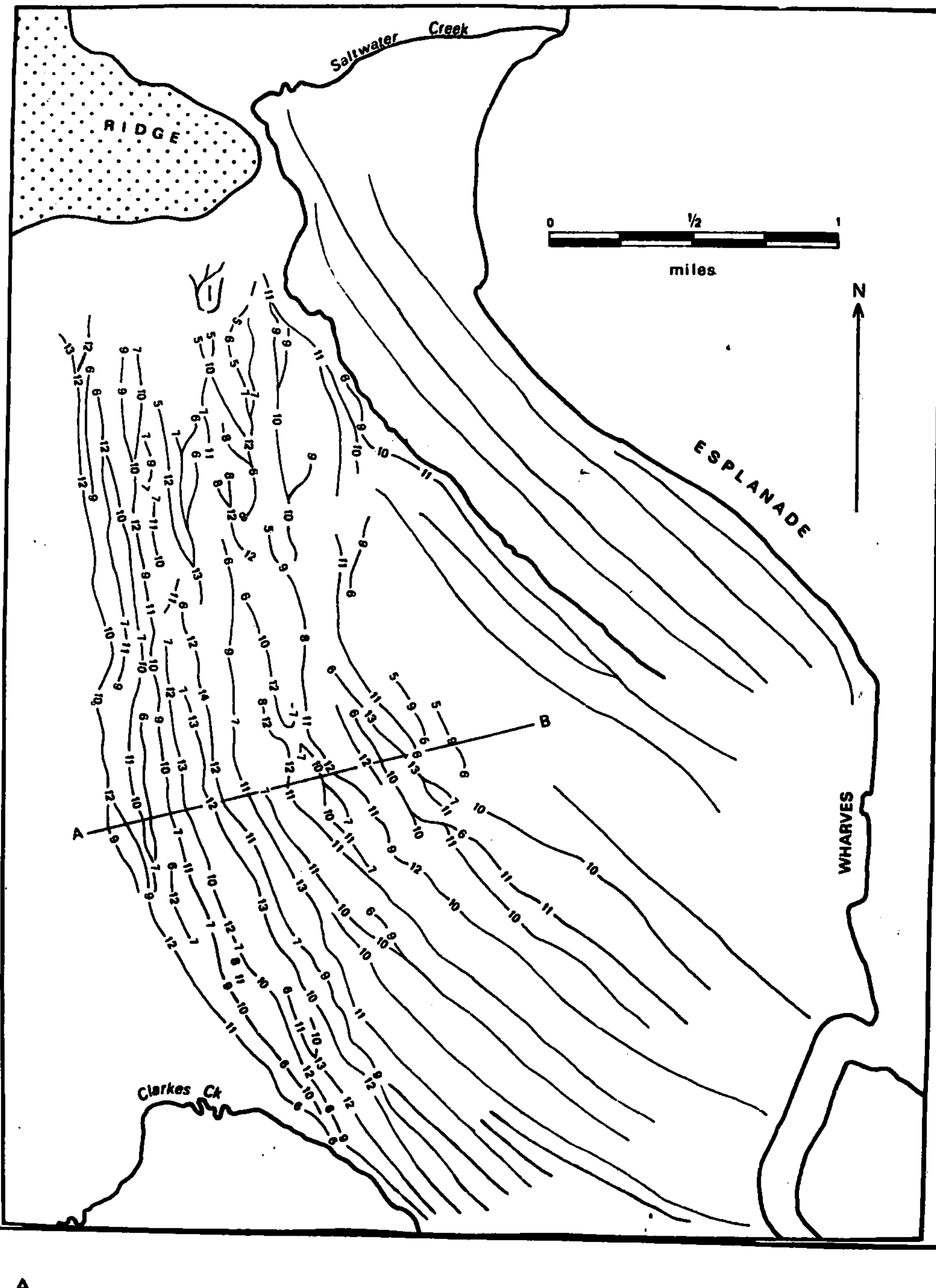
Examination of the form of these ridges and their rough parallelism with the present shoreline suggests that they were built by wave action, and this is confirmed by their internal structure, which shows laminations of the kind found on modern beaches. The ridges are thus beach ridges, produced by wave swash. Some have a thin capping of wind-blown sand, but in general the crest of the ridge represents the limit reached by wave action. In detail there are relics of transverse runnels and washover fans.

The closest analogy at the present time is the ridge of sandy material that extends south from the mouth of the Barron River to end in the spit at Casuarina Point. This beach ridge has been formed by southward drifting of sand from the river mouth, due to the action of waves coming in from northerly and north-easterly directions. Its crest marks a swash limit about 1 foot above the level of the highest spring tides. A similar feature at Ellie Point ends in a sand spit fingering into the mangrove swamps, extending each time wave action accompanies a high spring tide.

The sand (and occasional pebbles) in the Cairns beach ridges is similar in composition to the sand and gravel carried downstream by the Barron River; it consists mainly of quartz, with some felspar and fragments of metamorphic rock. When the beach ridges were being built, the mouth of the Barron must have been somewhere in the vicinity of the Airport. During each flood, quantities of sandy sediment were delivered to Cairns Bay, and wave action subsequently drifted these southwards across the mudflats and mangrove swamps. The completion of each ridge was marked by an episode of storm wave action, presumably generated by occasional cyclones, when the sand was piled up at the back of the shore. Subsequently a new ridge would start to develop in front of this, until eventually this too was piled up by storm waves. The sequence went on until the Barron River changed its course and began to build its delta out towards Machan's Beach, where similar parallel ridges were formed. Once this change had happened, Cairns Bay no longer received sandy sediment, and the construction of successive beach ridges came to an end. Depostion of mud continued, however, building up the extensive mudflats in the Bay, and preparing the way for mangroves to advance from its bordering shoreline.

The crests of the older beach ridges in West Cairns are typically 10 to 12 feet above mean sea level, whereas the outer ridges between the railway and the esplanade reached only about 6 feet, equivalent to the height of the modern beach ridge at Casuarina Point. It may be that sea level was slightly higher when the older beach ridges were under construction, and that it fell back to its present level by the time the outer ridges were added. There is a good deal of evidence in North Queensland, in the form of raised beaches, and emerged shore platforms, coral reefs and beach rock, suggestive of such an episode of sea level a few feet above the present some 4,000 to 6,000 years ago.

Beach-ridge plains of the type seen at Cairns are found on several sectors of the North Queensland coast, especially near the mouths of the larger rivers such as the Burdekin (Hopley 1970). They have also been studied on the east coast of Malaya (Nossin 1964) and in Mexico (Psuty 1965), and seem to be characteristic of low wave energy sectors of humid tropical coasts where a sand supply is available to be built into ridges by wave action, but where wind action is too weak for dunes to be formed, except to a very limited and local extent.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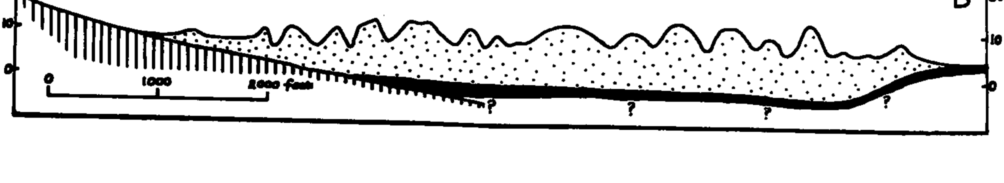
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NOTE: Inevitably, regretfully, it has been decided that our subscription rates must be increased, as shown on Page 1.