HANDBOOK OF MELBOURNE.

FOR THE USE OF MEMBERS OF THE

AUSTRALASIAN ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

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The History of Victoria.

By Alexander Sutherland, M.A.

The foot of civilisation first trod Victorian soil on the Christmas of 1797, when that stout-hearted surgeon, George Bass, spent nine days upon the shores of Gippsland. His was the most courageous voyage on record. In an open whale-boat, with a crew of six convicts, he had faced a great ocean, had explored 300 miles of coast, and now, while a wild gale blew over him, he was sheltering his frail craft in a little inlet, waiting to prosecute that further voyage in which he was to explore 300 miles more of coast never seen before by discoverer. After a wild and adventurous time he reached as far as Western Port, which he roughly examined. Then returning along the shores, he brought with him to Sydney a pencilled chart, which gave to science its first knowledge of Bass Strait and of the coasts of Victoria. Five years later there came explorers from the other side. The "Lady Nelson," a schooner of some 60 tons burthen, despatched by the English Government for survey purposes, and commanded by Lieut. Grant, sighted the shores of Australia at Cape Northumberland, and holding eastward discovered and named Portland Bay, Cape Otway, Cape Schanck, and intermediate features of the coast. It was the same vessel which, commanded by Lieut. Murray, a year later first sailed into Port Phillip, though the gallant Flinders was only two months behind, when, quite independently, he worked the "Investigator" through the Heads, and rowed in his barge over the waters of the silent inlet.

Flinders made a nautical survey of all the coasts of Victoria, such as left little to be discovered from the seaward side; but it was not till 20 years later that the world learnt what manner of country lay within those rocky bulwarks or those fringing sands. It was in 1824 that Hamilton Hume, accompanied by Captain Hovell, set out from Lake George in New South Wales to penetrate the secret of the south. They had a party of six convicts, a waggon each, and horses. They crossed the Murrumbidgee by an ingenious device. They discovered the Murray, which they called the Hume. They saw and named the Ovens River; then, following very much the line of the present railway from Albury, they passed through a land silent and lonely, but offering a smiling welcome to the coming settler. Unluckily they turned too soon out of the south-west course, which would have been the wisest, and struck due south, involving themselves among the ranges that lie behind the Yan Yean. In vain did they toil and struggle through those wildernesses of giant trees; in vain did they cut their way through fern-tree gully and over scrub-encumbered ravine. They fell back again, and, holding to the west, crossed the hills just as the railway does at present from Kilmore to Beveridge. Then their course was easy. Over grassy plains that delighted the pastoral heart of Hume they passed by easy stages; but by keeping so far to the west they were near the site of Geelong ere they came within view of the sea. A rapid journey brought them home with news that was sure, sooner or later, to bring settlers and flocks to the fair land they had traversed.

Accordingly, the Government at Sydney proposed to form a convict settlement, but trusting to the ill-informed Hovell, they sent it to Western Port, which he declared to have been the inlet they had

reached. The settlement struggled for nearly a year with adverse circumstances, and then the little township it had formed on the shores of the port was abandoned.

But at this time there were persons who would have shown in private enterprise more sense and determination than had been exhibited in the Government scheme. A lawyer named Gellibrand, and a roving unsettled youth of the name of John Batman, sent in a petition in 1824 for a grant of land at Western Port, in the hopes of utilising the fine pastoral country said to lie thereabouts. Their request was refused, on the ground that instructions from England forbade the unnecessary scattering of settlements. Lonely out-posts, it was considered, were dangerous, and involved increased expense.

Yet there were others resident on the shores of Victoria who made no pretence of asking leave. These were the sealers, who lived in knots of twos and threes and fours, along all the coast from Gippsland to Kangaroo Island. A favourite haunt of theirs was Portland Bay, and there, in 1829, Captain Dutton formed a regular station, with substantial buildings. Thither in 1833 came Edward Henty on his way from West Australia to Tasmania. He liked the look of the land. He saw that whales were plentiful, and seals by no means scarce. In the following year he was back with flocks, and men, and apparatus; he brought whaling boats with him; he built a substantial house; he erected sheds, and cultivated the soil, and from that time forward Victoria was the permanent abode of civilised men. He, too, applied to the British Government for formal leave to settle in these waste parts of the earth. It was refused. But the march of events forced the authorities to accede to a course they were loth to initiate.

For Captain Sturt in 1832 had taken that memorable voyage of his down the River Murray; being the first to float on its winding stream. He had, in an open boat, accompanied by the ardent George Macleay, and six convicts, rowed down the stream to Lake Alexandrina, and then through appalling hardships had pushed his way back to civilisation. His two volumes, published soon after, made known the fact that land of excellent quality lay all along the valley of that river, and the news awakened the greatest interest in Tasmania. John Batman, now some ten years older, felt his old enthusiasm revive. He proposed to Gellibrand to take up land in that favoured district without waiting for legal permission. The lawyer, then in good practice at Hobart, but largely interested in pastoral enterprises, agreed, and became chairman of an association of 10 or 12 members, who subscribed funds to send over John Batman on a reconnoitring expedition.

And so in May, 1835, the "Rebecca" took him on board at the mouth of the Tamar, and after a tedious voyage he entered Port Phillip Heads. Landing on the Geelong side of the inlet, he followed up the shores of the Werribee District, observing with delight the sheep-bearing capacities of these treeless, but grassy plains. Subsequently the vessel was worked up the Bay to the mouth of the Yarra, and Batman in the ship's boat rowed up the stream. On the rough chart he made, he marked in upon the site of Melbourne the words, "This will be the place for a village." Landing with several men, he made his way inland for some days, reaching the neighbourhood of Sunbury; then holding eastward, came upon the Merri Creek, on the banks of which he caused his memorable treaty with the blacks to be decorated with the serpentine strokes, which he called their signatures; and when Batman returned to Tasmania

bearing this precious document, the company, somewhat increased in numbers, took immediate steps to occupy this fine grazing country, and sent over a surveyor named Wedge to estimate the area of the estate they were supposed to have bought for blankets, tomahawks, and toys. A rough division was made among the members of the association, and each of them began to hurry his stock over as fast as vessels could be chartered.

But there were other people in Tasmania whose regards were fixed on the pastoral lands across the Strait. An association was formed having Mr. Dobson for its chairman and W. J. T. Clarke for one of its members. They also sent forward their stock and prepared to follow and settle in the new district. Another company was formed by the energy of John Pascoe Fawkner, a restless publican of Launceston. He joined himself with several tradesmen of that town in order to fit out a schooner, the "Enterprise," for a trip to Western Port, where Fawkner proposed to get from the blacks of that district a document analogous to that received by Batman from the natives of the Yarra basin. He was too seasick, however, to prosecute the voyage, and was landed at the mouth of the Tamar.

His party crossed to Western Port, disliked the appearance of the country for pastoral purposes, and carried their vessel round to Port Phillip. Entering the Yarra, they settled down on the wattle-scented banks of the river, not far from the spot where the little creek, which now is Elizabeth Street, discharged its waters into the main stream. Here they were warned off by men employed by Batman's party, but, declining to budge, they made preparations for permanent occupation. Soon after, Fawkner himself came over, and built the first house of the nascent settlement.

Meanwhile petitions were on their way to England from Batman and his friends requesting Imperial recognition of the native grant. This was refused, but the authorities in England, hearing that quite a stream of settlement was flowing into the Port Phillip district, wisely resolved to sanction and regulate a movement which they could not have arrested. Instructions were sent to Governor Bourke at Sydney to make all necessary arrangements for the formation of the province. Bourke at once sent down a party of three surveyors, who proceeded to lay out the streets of a town on the banks of the Yarra. He himself came round in March, 1837, to see the district for himself. He named the chief streets of the city that was to be, and being dissatisfied with the progress of the work, he left Mr. Hoddle to act as surveyor-general and prepare plans of the land for sale by auction.

Accordingly, three months after his return to Sydney, the work was done, the plans were ready, and the first land sale was held on June 1st, 1837, so that the city of Melbourne is almost exactly contemporaneous with the reign of Queen Victoria. Up to this date the people had been living in turf huts, or in houses made of wattle boughs daubed over with clay. Now, these were all cleared away, and for months the open woodland glades rang with axe, and hammer, and saw; while weatherboard houses were being erected, and the streets began to show some signs of their aligment. Soon they started the making of bricks, and Fawkner's Hotel, the most imposing edifice of the settlement, was of that material.

At this time Captain Lonsdale was acting as magistrate in charge of the new district; but, in 1839, there came from England Charles Joseph Latrobe, appointed by the Colonial Office to be

superintendent of what it was even then intended should be before long a new colony. For this was an eminently colonising period of English history. It was 20 years after the great wars had ceased. There was little outlet for adventurous spirits, and there was felt the increasing pressure of population. Hence came the great emigration schemes that founded Perth and Adelaide. These had been costly, and had involved the British Government in heavy expense. It welcomed a self-directed, self-supported colonial enterprise that promised to form a peculiarly advantageous field for emigration, and the stream of settlement that had been anticipated was not long in setting in from England to Port Phillip.

In large measure this was due to the publication of the travels of Sir Thomas Mitchell. That officer, who was Surveyor-General of New South Wales, had in 1836 been sent to follow up the work of Sturt. He had descended the Murray to its junction with the Darling; then, turning back, had bent his course southward and westward along the valleys of the Loddon and the Avoca, till he reached the waters of the Glenelg. He saw the Henty family at Portland, then, turning back, crossing the ranges near the site of Ballarat, he had found his way home over the Murray. He had seen and named many rivers, and some mountains, but he had above all traversed a district grassy and promising beyond all other parts of Australia he had seen. He called it Australia Felix, and that name, as well as his glowing descriptions, determined to the shores of Victoria a large share of that vigorous emigration then looking round for a suitable destination.

There came a surprising number of cadets of good family, with high spirits, abundant enterprise, and a little capital. These took up runs; when, by paying a licence fee of £10 per annum, each had the right

to depasture on Crown lands as many sheep each as he pleased. Soon all the land around Geelong was taken up, and that between Geelong and Melbourne; out by Dandenong, and away down to Western Port, and as far up as Mount Macedon, the country was all apportioned in separate runs, whereon the young fellows lived a rough but enjoyable life in the open air, while their flocks increased around them. Then settlement pushed out to Colac, and up to Ballarat. From Portland as a centre, squatters and their sheep radiated over all the Western District, while from the north came the "overlanders" driving their cattle and their flocks from Sydney over the Murray. These settled along the valleys of the Ovens and Goulburn. And so all the central parts of the colony were occupied before 1842. A year or two later increasing pressure sent the squatters north-west into the Wimmera district, and south-east into Gippsland, and in 1846 the whole area of the colony was thinly occupied by about 800 stations, carrying 3,000,000 sheep.

The process of peopling the colony was greatly quickened by what was called "Bounty Immigration." The young squatters could afford to come out on their own resources, but in the colony they could have done little without the labour of those who had strong arms to work with, but no cash to bring them so far. The money, therefore, that was derived from the sale of land within the district was set apart for bringing out labourers for the district, and for a long time the funds were ample. After deducting 20 per cent. of the land fund, to be used for the purpose of making the aborigines comfortable, if possible, all the balance was employed in assisting immigration. In one year as many as 9000 persons were thus imported, and the total up to 1845, when the process was discontinued, must have been over 30,000.

Thus Melbourne became an influential little city of 10,000 inhabitants, Geelong and Portland were thriving towns, Belfast, Warrnambool, Hamilton, and Kilmore were fast rising into importance; and, while the district grew in wealth and population, it grew also impatient of the delay that was taking place in its separation as an independent colony.

Many were the meetings, and much the eloquence displayed, but Irish troubles and Continental politics blocked the way in London till 1848, and then there were so many preliminaries that the spring of 1850 was advancing ere the Bill introduced into the House of Commons was duly passed. But this Act not only constituted the new district into the colony of Victoria, but gave to all the colonies, Victoria included, autonomous powers, and left them for all practical purposes independent.

The news arrived at the end of 1850, but the Act did not come into operation until July 1st, 1851, and great were the rejoicings; three days were spent in festivities. Latrobe became Lieutenant-Governor. He appointed a Ministry; and a Legislative Council was elected to administer affairs, and frame such a form of constitution as might best satisfy the political aspirations of the people.

The first fifteen years of the colony's history are bound up with pastoral interests. Its progress was dependent on sheep, and its exports consisted mainly of wool and skins. But in the early part of 1851 Hargraves was making his discoveries in New South Wales, and for the next ten years the history of Victoria centres round the pursuit for gold.

While streams of men were leaving the colony, not only for New South Wales, but also for California, the prospects of Victoria seemed likely to receive a check, and local committees of citizens sought, by offering rewards, to stimulate the search for gold. But

this was scarcely needed. The tale of the hundredweight of gold discovered near Bathurst set the people of the colony in so great an excitement that very soon sands, and rocks, and river-beds in all directions were being examined by eager eyes. The first news of success came from Mount Buninyong. On the lower slopes of that volcanic hill there was a small township, and its inhabitants amused their leisure with the prevailing craze. One of them named Hiscocks found in a little sandy patch at the bottom of a gully what were unmistakable gold grains. Of these he gathered enough to fill a match-box. Meantime, there was another searcher on the right track at the station of Clunes. This was Esmond, who had been a coach-driver in the Western District, and had gone to California to seek his fortune, but had come back without it. He seems to have been struck with the general resemblance of some of the country among the lower ridges of the Dividing Range to the auriferous country in California, and in his examination he observed some golden specks in pieces of quartz jutting out of a bank upon a little creek; then trying the bed of the creek itself a little further down, he came upon remunerative supplies of that metal which so many persons were then so eagerly seeking. In other parts of the country small finds had been made, but the fame of these two attracted all the treasure-seekers, and ere long there was a crowd at Buninyong and a crowd at Clunes. However, the actual result was poor in both cases, and as so often happened, the occupants of each place, finding their hopes disappointed where they were, became possessed with the idea that the other must be the lucky spot. Hence there were two adverse streams of would-be diggers. They met midway, and each disillusioning the other, they settled down

to examine the intermediate country. The result was the discovery of Ballarat. Who was the first discoverer it would now be idle to assert, for there were so many on the ground, and the lucky ones were so secretive when they had struck the fortunate spot that practically there were several parties, all equally original in their discoveries, and there is no evidence to give priority to one rather than to another.

But Golden Point, on the banks of the Yarrowee Creek, became for a time a magic name, not only in Australia, but ere long in Europe also. At first the miners, when they "bottomed" on clay, abandoned their shafts as being worked out; it was not till one more enterprising than the rest had carried his excavation through the clay that the richest treasures of all were discovered. Then came the opening up of the "jewellers' shops," and gully after gully was baptised with fantastic names by the crowds that poured in by thousands to unearth their riches.

Throughout all the colony the effect was at once felt. All classes were more or less penetrated by the thirst for gold. There were but two policemen left in Melbourne. The warders of the gaols resigned in a body. The Customs Department was almost deserted. Of the ships in the Bay three-fourths of the crews deserted, and the other fourth were kept to their duty only by being carefully watched; two large vessels were left without a single man, and ten times the usual rate of wages could not secure others to take the places of the deserters.

Meanwhile the road to Ballarat was like one long processional picnic; in a fortnight there were about half the adult men of the colony either on the road or on the goldfields, and the discovery very soon afterwards of the Bendigo diggings completed the craze. Multitudes began to pour in from the

adjacent colonies. Adelaide became as deserted as Melbourne or Geelong; Sydney also felt the effects of the madness, and ere long 50,000 men were at Bendigo, in addition to 10,000 at Ballarat. What busy scenes they were! It was all surface digging. Half a dozen "mates" formed a little company; one cooked and took charge of the home, if an improvised tent might so be named. One worked at the windlass, and one carried the stuff to the creek, where another washed it to get the gold out of it; while the others toiled at the bottom of the shallow shaft to send up the dirt in buckets to the top. An aspect of good order, good spirits, and open-air enjoyment characterised the scene, and as the average earnings for the first year or so amounted to nearly £200 per annum per man, there was much prosperity on the fields. New diggings were constantly being discovered. Creswick's Creek, where Creswick now is, Forest Creek, which is now Castlemaine, May-day Hills, which is now Beechworth, and so on; and, as soon as time had elapsed for the news to reach Europe, vessels began to appear in Hobson's Bay in numbers unparalleled in colonial history. For some time there came an average of a ship per day, and all were laden with adventurous hearts bound for the diggings. In the next two years some 200,000 men thus arrived. At first, by their very numbers they were to themselves the cause of much distress. The sudden influx of so many persons into a colony containing not above a third of their number, taxed the resources of the place beyond all calculation. Provisions, house-rent, and, above all, cost of carriage to the diggings, became fabulously high, and thousands starved in Melbourne who had hoped to revel in wealth at Bendigo.

But by degrees matters righted themselves, and the majority of the fortune seekers made the colony

their home, though the late comers got but little gold. For four or five years the surface gold had held out; but still the diggers continued to arrive. Then there was little more gold to be had from shallow sinking. Deep shafts had to be made and elaborately timbered; and then it was found at Ballarat that the miner had, in his descent, to fight his way through three great layers of bluestone, which once, as molten lava, had buried the beds of miocene creeks. Time was now needed, and capital. The lucky ones of the previous years invested their fortunes, and hired the labour of the unlucky. Hence, a reorganisation of the industrial elements on the goldfields. Large companies began to be formed, and by the year 1860, Ballarat was the scene of operation of great associations with ample machinery and miles of "drives" underground. In Sandhurst, as Bendigo was for municipal purposes named, when the surface gold was exhausted, the miners attacked the quartz, whence the gold had been derived by the age-long action of streams. But this, too, required time, and capital, and organisation, and so on all the goldfields. Thus, in 1862, Victoria was a great ramification of mining speculation; it was no longer necessary to purchase a "swag" and be off to the diggings in order to be in the thick of the excitement. All that was wanted was that the adventurous spirit should buy so many shares and wait the turning of the wheel of fortune. It turned but badly for most; for, on the average, it took twenty shillings or more to raise a pound's worth of gold. Dozens of companies disbanded or became insolvent, and great numbers of miners were thrown out of employment, or forced to fall back on the search for surface gold, at a time when there was little gold left on the surface.

Hence came general agitation, out of which arose two ideas. One was that as these men were not

miners by profession, but had each a trade or calling in which he had been trained, it might be possible by a scheme of protection for local manufactures to secure them work in the colony, and so avoid the necessity of their departure. Another idea was that if the public land was sold in such a way as to encourage some of these men to become farmers, they would be kept in the colony, and the waste places of the land would ere long be smiling as gardens. And so it arose that for 20 years Victoria became the scene of eager political turmoil, unmarred, with but one exception, by any appeal to other than constitutional weapons.

That one unhappy exception was the conflict at the Eureka Stockade, near Ballarat. When the question arose as to the choice of a constitution, which the colony had been empowered to frame for itself, the miners, of whom a large proportion had been of chartist proclivities in Europe, demanded democratic concessions which they feared were not likely to be granted. And they had a grievance in the shape of a licence fee exacted by troopers once a month from all who wished to dig for gold. One Sunday morning at the end of 1854, the military attacked them in their stronghold, and at the cost of nearly 30 lives, authority was asserted. But the temper of the people was with the diggers in their demands, though adverse to their revolt. Under the pressure of popular feeling a constitution was framed of the most liberal complexion. A Lower House elected by manhood suffrage, an Upper House elected on a property qualification, formed the Legislature; while vote by ballot, and many similar concessions were made to the democratic feelings of the community. But when the policies of protection and free selection of the public lands came uppermost in the discussion of affairs, it soon appeared that the democratic party,

though a majority in the country, was a minority in the two Legislative bodies. Hence arose two struggles, first for the payment of members in the Lower House, so that the working man might sit in that body as the actual representative of his class; and secondly, for the reform of the constitution of the Upper House, so as to make it more amenable to public feeling.

From 1864 to 1880 the battle waged around four fundamental questions, with bitter words and strong feelings; yet the colony throve. First the policy of free selection triumphed, and, after various modifications, the principle was established that any man who whose to reside on his farm and work it, could obtain 320 acres of Crown lands on payment of one shilling per acre per annum for 20 years. Then the principle of protection to native industry was carried, with a proviso, then understood, that it was to last but for 15 or 20 years. Payment of members followed, and when the reform of the Council was effected in accordance with popular notions, about 1880, the period of turmoil came to an end. This important epoch was appropriately, though not intentionally, marked by a great Exhibition, which had a most salutary effect upon the manufacturing interests of the colony, now growing large and varied. And on its commission met and fraternised the various combatants who had waged a somewhat embittered warfare for years. Sir James M'Culloch, Mr. James Service, Sir Graham Berry, Mr. Higinbotham, Mr. Gillies, and so on through a long list of names honoured in the colony, all were joined in friendly rivalry to do the best for the country on that auspicious occasion. Since then nothing but peace has prevailed. The free selectors have become successful farmers, supplying the colony with all its food stuffs, sometimes having a surplus for export.

The manufacturers have in many departments overtaken the local demand, and in all have made great strides in that direction. The wool industry suffered for a while from the extraordinary fall of prices, but the last year has seen a phenomenal revival. The gold mining industry which for a while had languished is now healthful again and hopeful as ever, while the prospects of the manufacturing industries are now once more excellent.

There was always a scientific enthusiasm in the colony. When it was but a couple of years old, a mechanics' institute was formed, with its courses of scientific lectures and its little museum. A botanic garden was laid out when Melbourne was three years old, and when the goldfields had brought to its shores crowds of energetic and intelligent men, the fervour for knowledge increased. A National Museum, a University, a great Public Library, on a plan to cost eventually a million of money, and to form a vast national repository of all that science, literature and art could provide, were the notable features of that period; but amongst them must also be reckoned the Royal Society, the result of the amalgamation of two rival efforts in the cause of Science. That Society has completed some 40 years of existence, with a volume of papers for nearly every year, wherein much valuable work is conglomerated with much that is not valuable.

The Geology of the Neighbourhood of Melbourne.

By T. S. Hall, M.A.

The scenery of any country is but an expression of the nature of the rocks which form its surface as modified by sun and wind and rain. Where rocks of the same structure and composition cover a large area, then the surface forms, though they may be varied, are yet referable to the same type throughout. On the other hand, where we find the scenery variable in character, we can always correlate the changes with differences in the underlying rocks. Though in the immediate neighbourhood of Melbourne we find that the surface forms are moulded on a small scale, and that there is nothing to which we can apply extravagant adjectives expressive of our admiration, yet the diversity of types is well marked, and so we find a corresponding diversity in the nature of the materials that build up the land.

The low irregular hills with their gently flowing curves, on which the city is built, are almost entirely surrounded by plains, or by country with but such gentle undulations that we may disregard them in a general glance. But among these plains we may detect no less than four types, each with a distinctive facies of its own. The heath-covered land of the Brighton district, and the treeless western expanse, are the two of greatest importance. The other two comprise the Yarra delta, which near North Melbourne and at Albert Park is a low-lying swamp, while about Port Melbourne and along the beach front to St. Kilda it is formed, superficially that is,

of sand blown from the sea. We may consider these plains a little more in detail.

The Sandy Plains.

The first, which is well seen about Brighton, has really a wide extension though its character changes somewhat from mechanical causes as it slopes gently inland up to the foothills of the Dividing range. The surface is covered almost everywhere with white sand, here and there giving place to rounded quartz gravels, and with but a small admixture of clay and vegetable material. Owing to the porous nature of the soil there are no permanent watercourses, and where depressions exist water ceases to flow in them almost as soon as the rain stops falling. Near the coast the general surface is low-lying, but gradually rises as we go inland towards the north and north-east, and as the rapidity of the flow of water increases greatly with the inclination down which it flows, it follows that its cutting power increases in a similar manner. As a consequence of this, the plain-like, even character of the surface disappears, and we find that the sandy country becomes more broken, and is characterised by hills and hollows of considerable extent. Often the whole thickness of the deposit forming the sandy beds is cut through and even entirely removed over large areas, and the ancient contorted bed rock of the whole district is exposed.

An examination of almost any of the numerous cliff sections about Cheltenham shows that the white sands are merely superficial, and that they pass down gradually and irregularly into rusty sandstones which vary greatly in hardness, while here and there thin bands of shells occur in the deeper portions. We see then, that the iron which stains the sands, and cements them into hard stone, has been dissolved,

and removed by the action of some agent working from above. This agent is, of course, rain-water, containing dissolved in it, the acids derived from the decay of plants growing on the overlying soil. In many places throughout the district, the red rocks are exposed in pits and cuttings, and the same state of thing holds. The roads almost everywhere are formed from the iron stained sandstone, they are very dusty and in wet weather are free from the tenacious mud which, as we shall see, characterises the roads of other parts.

The soil, though light and poor, is well drained, and supports a dense growth of heathy plants, and near the coast the country is a favourite collecting ground for botanists.

The included fossils show the deposit to be marine, and of Miocene age, while its sandy or gravelly nature is evidence that it has been laid down near the shore in fairly strong currents. In its inland extension it seems to pass into a series of old river gravels, which now occur as cappings and terraces, owing to the streams having cut away the more easily removed ancient rock. Even the hills about Melbourne itself are capped in many places by gravels which, in some cases, undoubtedly represent these plain forming deposits, though in other cases they are possibly of more recent age. The surrounding country has been lowered by denudation, and the gravel protected hills have been left. The South Melbourne Hill, for instance, is an example of this. It is an outlier, a hill of circumdenudation, and the deposit of which it forms a part, once lay like a mantle over the whole country covering the South Yarra Hill, the high land where the University stands, and sweeping inland, it rose high on the flanks of the Main Divide. The denudation to which the deposit has been subjected can thus be dimly

seen. Here and there are standing solitary gravel topped hills which, like the pyramids, left by navvies in a new railway cutting, are a measure of the amount of excavating done. Thick and wide spread as the deposit is, it is clear that what remains is but a fraction of the whole, for it covered everything, even the heights of Kew and Camberwell. As the material derived from their waste has gone to form newer deposits, so it must be remembered that the substance of the Miocene beds has been derived from the waste of older rocks. Moreover as these red beds are composed almost entirely of quartz sands and gravels, they are what the miner would call concentrates, for all sandstones must be looked on in this light. The sand-grains of sandstones are derived originally either from such rocks as granite, of which they form an original constituent, or come from quartz veins, so that the quartz bears relatively but a small proportion to the bulk of the rock which contains it, and thus a cubic mile of ordinary sandstone must represent many cubic miles of original rock. A bed of coarse quartz gravel again must represent an enormous mass of rock, for it has all been derived from quartz veins, and quartz veins form but a small amount of the bulk as a whole of the rock in which they lie. It follows then, from these considerations, that all red Miocene beds are a measure of former rock removal from elsewhere. From the character of the ancient bed rock of the district, it is clear that a great part of the red Miocene might have been derived from its waste, but not all, and in fact very far from it. The sands in many places about Melbourne, from Spottiswood to Cheltenham are clearly such as result from the decomposition of a rock closely resembling a granite. The grains are large and roughened, and break in an irregular granular manner, and black mica is not uncommon. Additional remarks will be

made below as to the nature of the rock which has yielded the materials forming these deposits.

The Lava Plains.

The treeless western plain is in almost every way in marked contrast to the heath land just described. Its volcanic origin is so generally recognised that it may merely be alluded to.

The plain as we see it is the most easterly extension of an almost continuous sheet which extends westward beyond Hamilton, and which about Daylesford rises over the Main Divide and passes many miles to the north. Almost everywhere its character is the same; treeless plains extend as far as the eye can reach, with here and there a low cone of "cinders," which marks the position of a former volcanic vent. In the south-west of the colony these cones are thickly grouped and the district might be called the Victorian Puys. In some places the lava has flowed in smooth sheets, now covered with rich grass. In others the ground is closely occupied with rounded oval or circular depressions, four or five feet in diameter and perhaps six inches deep. Dead men's graves they sometimes call them, while another name, which anyone driving over such country will consider singularly appropriate, is "Bay of Biscay Country." The depressions are probably in many cases original, while in others they are caused by unequal weathering, probably due rather to physical structure than to differences in mineral composition. In some places in the colony there occur on these lava flows extensive tracts known as "stony rises," of which the most generally known is that between Colac and Camperdown. Here small abrupt ridge-like hillocks up to about 30 or 40 feet in height lie close together, and separated by long winding or basin-shaped troughs.

The surface is formed of large blocks piled in confusion. The country is thus extremely rugged and impassable except on foot. The form of flow seems to resemble the Aa of the Hawaiian Islands.

The traveller from Sydney by rail first encounters the northern limits of the lava plain between Kilmore and Wandin, where it sends long fingers up the valleys, its level expanse being in marked contrast to the rugged country which has just been quitted. From Wandin to near Essendon country of the same type is travelled over, and then the red Miocene sands are seen and continue nearly to Melbourne.

When coming overland from Adelaide the traveller enters the plain near Ararat and sees it stretching as far as the eye can reach to the south. Numerous interruptions occur where the older sedimentary rocks, presumably Ordovician, and granite occur, and finally on dropping down the geologically puzzling escarpment at Parwan the low-lying plain which extends to Melbourne is reached.

The most striking scenic features of the lava plains are the abrupt gorges cut into them by streams. The flat country is suddenly interrupted by a steep-sided narrow valley, at the bottom of which winds a small stream. The hard protecting cover formed by the igneous rock is not easily cut into by the streams, and as the lava was poured out as a viscid sheet it has levelled off all inequalities and no abrupt descents are, as a rule, found on the unweathered surface. As soon, however, as the cover is cut through, the underlying rock is met with. This rock of course was the land surface before the lava sheet was spread out, and consequently the rock now exposed differs from the lava in some important particulars. The minerals forming the lava are fresh and unacted on, and the hard tough rock has to be rasped away by the burden of sand and stones that the stream, whether it be

constant or intermittent, rolls down its bed. As a matter of fact very little cutting takes place in summer time for the streams are clear; it is then, however, that probably the chemical action on the rocks would be greater, as with increase in temperature the various forms of bacteria are more active and the solutions of the organic acids produced by them are more concentrated since they are not so continually diluted by the rain. When the floods come the heavy stones are hurried along and pounded one against another and against the river bed, and abrasion rapidly takes place. In the underlying rocks weathering has already far advanced, and they are thus the more readily acted on by the mechanical agents which gouge out the valley. The valley then rapidly deepens, cuts back up the stream, and we soon get the requisite conditions for a waterfall. These deep, steep-sided valleys, abruptly shallowing at their head are very characteristic of a lava covered tract, and the traveller, even in a railway carriage, is easily able to see examples of them on his journey.

The rock of our lava plains is an olivene dolerite or olivene-basalt, and when decomposed affords an extremely fertile soil. There is always a layer of rich soil covering the plains, but owing to the density of the underlying undecomposed rock, a sufficient supply of water cannot be stored to tide over the summer droughts and the ground rapidly parches. Conversely in wet weather, owing partly to the level character of the country whereby superficial drainage is impeded and partly to the impervious character of the rock the plains become covered with swamps and the water is too plentiful. Where the basalt is of greater age and where consequently it is more deeply decomposed and is more cut into hills and hollows we find the vegetation is richer. In some parts of the Puys of the Western District again, where the

volcanic cones are built up of shattered vesicular fragments, and where still finer fragments in the form of volcanic dust cover large areas, decomposition even in very recent basalts has proceeded to a great depth and the drainage and water-holding capacity of the soil are excellent, and so we get the richest pasture land in the colony.

The stiff, heavy soil varies in colour from red to black, and an unmade road in winter in such country is apt to degenerate into a veritable "glue pot."

Apart from agriculture the economic value of the basalt is considerable. Microscopic examination shows the rock to be a felted mass of long parallel-sided crystals, and it is to this structure that the toughness of the rock, as opposed to hardness, is due. Quartz is harder, but as it is brittle it makes a poor road metal, whereas our bluestone is one of the finest road building materials in the world. The rock is extensively used in Melbourne for flagging and stone pitchers, and basement courses are even exported to other colonies.

Basaltic rocks do not usually afford handsome cabinet specimens of minerals, but our Collingwood quarries yield some of the finest zeolites found anywhere. Unfortunately they are very patchy in their occurrence, and one visit may yield more than can be carried away, while at another time not a specimen will be seen.

Most people are familar with pictures of the Giant's Causeway and of Fingal's Cave, which show basalt cut by regular divisional planes into long columns. In almost any quarry near Melbourne traces of this peculiar structure are to be seen. Behind the Pentridge Stockade a fairly good pavement formed by the upper ends of such columns is exposed in the bed of the Merri Creek, but though the columns are displayed in the small cliffs and

in a quarry at this place they are very irregularly developed. The spot is easily reached by the Coburg tram which connects with the Brunswick tram passing the University. However, there is fortunately a magnificent development of basaltic structure at a spot which is easily and cheaply reached from Melbourne. The cliff where the exposure is shown is on the Saltwater River, two miles a little to the west of north from the Sydenham Railway Station. The spot was marked on the geological map by Aplin many years ago and might be named Aplin's Cliff after its discoverer; locally it is known as the Organ Pipes. The columns are, according to Aplin, about 50 or 60 feet in height, and are fairly straight and vertical. Their diameter is about a foot, and where the creek washes the base of the cliff they are clean cut as though with a saw. Where a talus has formed, and where consequently the columns have not been disturbed for a long period, they are cut into discs by horizontal joints and have all their angles weathered off, so that they resemble lofty piles of cheeses. Close by, the direction of the columns varies, and they are no longer vertical, but the precipitous bank looks like a tesselated pavement raised on edge. The numerous sections hereabout show a great variety of conditions in the basalt. Here it is sound and dense; here again it is weathered away to a mass of clay; in one place it is free from gas cavities, while in another we find the slaggy and vesicular blocks that indicate the surface of the flow. The irregular surface of the ancient rocks over which the lava was poured shows how the whole face of the country was changed by the volcanic outburst, and how a diversified surface of hill and vale was replaced by flat and desolate plain.

In many places on the banks of the Saltwater the cliffs give us clear sections which show that the basalt of the plains flowed over the red Miocene beds; in other words we see that the basalt is Miocene or younger. How much younger it is not possible to state with certainty as it is very probable that wide sheets of lava were poured out at considerable intervals of time. Still we can easily see that the western plain is far younger geologically than the heathy one, and that the characteristic flora of the Cheltenham district perhaps once occupied the tract known as the Keilor plains, was exterminated by the lava flow and owing to the different nature of the soil which has resulted from the decomposition of the lava, it has never since regained its footing there.

The Yarra Delta.

The two remaining types of plain may be taken together—the river delta and the sandy flats bordering the bay. That a river deposits near its mouth the bulk of the material which it gathers in its course to the sea is an everyday fact in physical geography, and in the estuarine beds thus formed, we find a gradual passage in the fossils from marine to freshwater forms as we pass inland. The plain extends from the Flemington racecourse to St. Kilda. Much of it was originally swampy, but has been reclaimed during the course of river improvement. In the early days of the colony the swamp was the home of numerous wildfowl, and it is not long since the last traces of the dense tea-tree scrub, which covered the banks of the river near Fisherman's Bend, have disappeared. Excavations for Coode's Canal and the Dock showed that the deposit consisted in the main of a black fetid mud with occasionally extensive beds of marine and brackish water shells. The commonest

shell of all, the Blood-cockle (Arca trapezia), is now practically extinct on our shores. A rather remarkable extension of the beds with these shells in them was exposed during the progress of the Yarra Improvement Works at a spot much further inland than was ever suspected, namely in the Domain, about a couple of hundred yards below the old Baths' Corner. Hundreds of loads of the shell-bearing silt were dug up and spread over the banks, so that we are clearly not dealing with a few accidentally transported fossils, but with shells that lived and died where we now find them. The low lying land occupied by the Friendly Societies' Gardens, and perhaps even still further up the river then formed a shallow muddy estuary, which at its mouth at Princes Bridge was not more than a quarter of a mile wide. This estuary was subsequently filled by a lava flow, which sealed up the underlying beds, and since then the Yarra has gradually pushed its way further and further into the Bay as its delta grew. The South Melbourne Hill was at this time probably an island lying just off shore and round its northern flanks have been piled the river borne muds, while to the southward the sea sand, driven shoreward by the waves, has been heaped up by the winds and so forms the sea front from the present river mouth to St. Kilda. This gently undulating sandy plain is still in parts clothed with bracken and was once sparsely dotted with Banksias, so that as far as its flora, and, in fact, its general appearance is concerned, it does not greatly differ from the heathy plain of Cheltenham. Yet it must be borne in mind that in the one case we have a plain formed of marine deposits. The inequalities of its surface are due to the action of denudation, and its formerly iron-stained sands have been bleached. In the other the whiteness of the sand is original and the irregularities in its

surface are, for the most part, due to its method of formation. Had the supply of sand been greater, and the situation more exposed, we should have had high dunes instead of gentle swellings and depressions, hilly country and not plain.

Such, then, in brief outline, are the chief features of the plains which surround Melbourne almost entirely. To the eastward, Kew and Toorak are built on an irregular range of low hills which, at their western end, are crowned by Government House. The foundation on which these hills are built, and in fact almost their entire mass, is made up of the series of ancient upturned and contorted rocks of Silurian age. These hills are continued, with a break of about a quarter of a mile near Prince's Bridge, by the irregular hills on which Melbourne stands. In the northern parts of the city, from the top of Collins Street to Brunswick, the hill top forms an almost level plateau, the surface of which is usually covered by a mantle of the red Miocene beds, which, as previously mentioned, pass under the lava plains to the north and west. Looking eastward from the edge of the plateau in Carlton, close to the University, we see the broad and deep valley of the Yarra, bounded at its further side by the heights of Kew and Camberwell, and a glance will show that the level of the surface on both sides of the valley is the same. We assume, then, that an uninterrupted plain once extended across the valley, and swept inland, gradually rising as it went. This plain is, of course, the Miocene one which we have previously dealt with, and, though the amount of denudation required to form the river valley between Carlton and Kew may rouse the scepticism of the non-geological reader, it will present no difficulty to the geologist. It has been said that the great bulk of the hills underlying the red Miocene

cover, is composed of Silurian rocks. There are, however, in several places, other sets of rocks sandwiched in between the two. And about a mile from the University is a spot where the nature and relationship of these rocks can be easily seen. The railway to Coburg, on leaving the estuarine beds which run up the Moonee Ponds Creek from the North Melbourne Station climbs into the Carlton-Brunswick plateau through a cutting on the edge of the escarpment, into Royal Park. Here the Miocene beds occupy nearly the whole of the depth of the cutting, and contain but very few fossils, and these with the exception, perhaps, of a few drifted leaves, are of marine origin. Under these is a series of beds, which, though stained red in their upper part, pass down into white sands. The sands contain no traces of fossils, as, though they probably did so at first, they have all been dissolved and removed. The upper part, which is usually of a richer red than the overlying Miocene, is only a foot or so in thickness, but is crowded with casts of shells. An examination of these enables us to refer the series to the same age as certain clays at Mornington and elsewhere, which are regarded as belonging to the Eocene Period. Beneath the marine Eocene occurs a series of irregular hillocks of a peculiar mottled clay, which, when traced to the south-west end of the cutting, gradually change their character and pass into ordinary basalt. In other words, the clays represent basalt which has decomposed in the place where it lies. This basalt, then, is of greater age than the Eocene beds which overlie it. At Maude, twenty miles north-west of Geelong, we can see a similar basalt underlying similar beds and reposing on beds which are still of Eocene age, so that the igneous rock which is generally spoken of as the "Older Volcanic," may be regarded as usually of Eocene age. Beneath the

basalt in the Royal Park cutting we find a small exposure of Silurian, but about a quarter of a mile down the creek, there is a coarse sandy deposit underlying the lava, the Silurian not being exposed, while up stream we find the Silurian more and more in evidence. As we go south-west from this point, we find by borings that the old Silurian land surface sinks rapidly, and at Altona Bay, distant some ten or twelve miles, it is about 400 feet below sea level. The Older Volcanic does not occur here, and the other tertiary beds have thickened greatly. The existence of Miocene beds has not been proved, as alone it can be proved, by fossil evidence; but the Eocene has changed to a stiff clay, full of marine fossil shells. Beneath this is a thick seam of lignite and a considerable thickness of sandy beds. These sands and lignites represent the sandy bed which, near Royal Park, as just mentioned, underlies the Older Volcanic.

It is unnecessary to describe in detail the various localities where the Tertiary deposits may be seen, but a few may be briefly mentioned.

The only outcrops of the lignite bearing series, which here contains no lignite, occur on the banks of Moonee Ponds, a little to the south of the Flemington Bridge Station, and at a couple of places in Royal Park.

The Older Volcanic rocks are seen in artificial section at the North Melbourne Station and Royal Park, while good exposures occur in river cliffs on the Saltwater River about Keilor.

The marine Eocene beds are poorly represented in the immediate neighbourhood of Melbourne, but can easily be reached at Mornington (30 miles), Geelong (45 miles), Spring Creek (60 miles), and are widely distributed over Southern Victoria.

Marine Miocene deposits are well displayed on the Sandringham–Mordialloc coast. At Beaumaris (15 miles) they are rich in fossils, mostly in a poor state of preservation, though an Echinoid *(Lovenia forbesi)* occurs in abundance and is in good condition.

The Bed Rock.

There remains now to be considered the bed rock of the district, namely, the Silurian and the great granitoid dykes which intersect it.

The best places to see these rocks is naturally along the valleys which the streams have cut deeply down through the mantle of newer deposits. The old valley of the Yarra, as has been mentioned, has been partly filled with a basaltic flow from Kew to Princes' Bridge, and it is interesting to notice how the river has cut its new channel between the lava and the old hills, so that it marks the boundary line between the basalt and the Silurian; only in two or three places does the igneous rock transgress on to the left bank of the stream, and the areas so occurring are quite insignificant. Along the banks of the Yarra, then, the Silurian is exposed to view, and the same may be said of the valleys of the Moonee Ponds and of the Saltwater River. Good sections may be seen in Flinders Street, next to the Australian Church, and may be taken as a fair type of the beds, which consist of thin bedded sandstones and shales, none of very coarse texture. They are tilted on edge, twisted, broken and faulted, and with such a constantly changing strike that nothing much can be learned of the structure of the district as a whole from the small outcrops that we can examine. From Toorak, north-eastwards up the Yarra Valley, exposures are more common and the rocks less disturbed, and it has been found that the strike of the

anticlinal axes, or the direction in which the main creases produced by the crumpling up of the rock run, is north-easterly. Needless to say, all traces of the irregularities of surface caused by this folding, have long since been planed down and removed. This planing down has brought rocks of different hardness to the surface, or, to put it more exactly, rocks of different powers of resistance to the action of weathering. The effect of this would be to cause the streams to carve their valleys out in a direction parallel to the strike, that is, in this case, in a north-east and south-west line. But, although the course of the Yarra is in this direction, it must not be too hastily assumed that the course of the valley is due to the strike of the rocks, indeed, it is more than probable that it has nothing whatever to do with it. The Miocene beds, it was stated, run up on to the flanks of the Divide, though, it is quite possible that a good deal of the material which once formed them has been cut into and redistributed by more recent streams, which ran across it after the elevations of the sea bed. The gradual sinking of the sea-bed means that, as the the sea shore creeps inland, all great inequalities are levelled, and we get what is called a plain of marine denudation, and such a plain was probably produced during the submergence in Miocene times. On this almost level expanse was laid down the detritus which built upon Miocene beds—clays, sands and gravels. When the sea-bed again rose, and it will simplify the matter from this point of view if we regard the elevation as being a sudden one, the level, plain-like character of the Miocene beds which lay like a mantle over everything, would be clearly apparent, and it was across this almost level expanse that the rivers first began to find their way. Their course would depend in the main on the original slope of the ground, and manifestly could not be influenced by the rock structure far beneath the surface. Once a river system is sketched out it is a thing that is very difficult to alter. The first existing valleys deepen, but do not greatly change their direction, and it is probably owing to these causes that the lower part of the Yarra has its present course. The upper course of the river is extremely old—even geologically—and possibly goes back to palæozoic times, but the lower part has seen strange vicissitudes, at one time entering the sea far to the north-east of Melbourne, and at another, as Mr. Howitt has shown, not reaching it till it had flowed to the south of Cape Otway, where, united with the Saltwater and the Barwon, it has left its notch on the continental shelf.

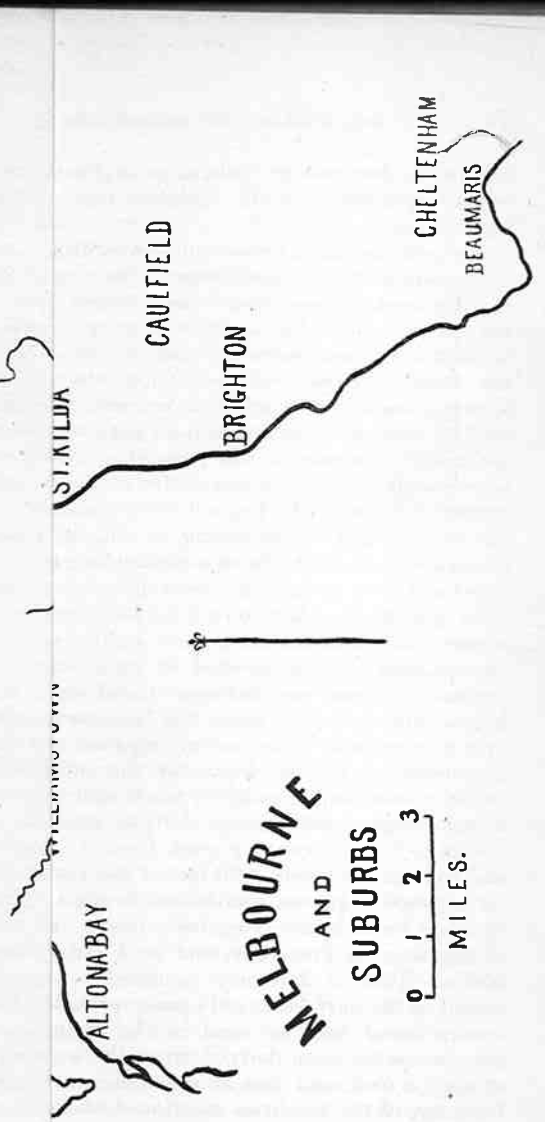
The sedimentary bed rock of the district, Silurian, is seamed with sheets of igneous rocks of several kinds. These sheets have either been injected between the bedding planes or cut across the country at varying angles with the strike. Many of the smaller ones which are seen in railway and road cuttings are now decomposed to a soft greasy clay, which presents a close resemblance to the clay produced by the decomposition of basalt. But as the discrimination of decomposed igneous rocks presents many points of difficulty, we must hesitate before calling them basaltic.

Mr. E. G. Hogg tells me that he has identified one of the dyke rocks from South Yarra as limburgite, so that, under the circumstances, we can only apply some such term as "basic rock" to the decomposed sheets. As to the age of these basic dykes there can be but little doubt that they are associated with the basaltic out-pouring of Eocene or more recent times.

In a few places we find dykes of another nature cutting through the Silurian rocks, but as they again are decomposed near the surface, their precise nature

cannot be determined. Some, at any rate, look like felspar porphyry, while others may be quartz porphyries.

Perhaps the most important dykes, from a geological point of view, which occur in the neighbourhood of Melbourne, are certain ones which from their nature have evidently solidified at considerable depth below the surface, and which have no connection with the basalts. The readiness with which the rock forming them has decomposed prevents us from definitely asserting its exact original nature. Wherever we find it, it is now in the form of a friable mass of large rough sandgrains and flakes of black mica embedded in clay. It looks like a granite, and the undecomposed rock, consisting of quartz, felspar and mica, would no doubt be in ordinary language termed a granite, but perhaps it would be safer to use the term granitoid. As the rock in its weathered state is very friable, it does not show at the surface, and its presence is only detected in excavations. It is extensively developed between Hawksburn and the Yarra, where a broad valley has been carved out of it by a tiny stream. The underlying rock is to be seen in several of the brick-pits of the neighbourhood, being covered superficially by sands and clays of very recent origin, and mostly derived from it. In a sewerage tunnel running east from Chapel Street, and close to the river, 2000 feet of the granitoid rock, decomposed in places, was driven through. The same rock has been found extensively under the tertiaries at Kensington, Footscray, and at Fitzroy Street, St. Kilda. That it formerly occupied a considerable extent of the surface would appear probable from the occurrence of beds of sand in the tertiaries, which have evidently been derived from the wearing down of such a rock, and this at a distance of many miles from any of the localities mentioned above.




KEILOR
SALTWATER
RIVER
MOONEE PONDS
ROYAL PARK
MERRI CREEK
DAREBIN CREEK
RIVER
KOROROIT CREEK
FOOTSCRAY
COLLINGWOOD
YARRA
KEW
MELBOURNE
HAWTHORN
PORT MELBOURNE
ALBERT PARK
PRAHRAN
HOBSON'S BAY
WILLIAMSTOWN
ST. KILDA
ALTONA BAY
CAULFIELD
BRIGHTON
CHELTENHAM
BEAUMARIS
MELBOURNE
AND
SUBURBS
0 1 2 3
MILES.

The above brief outline of what may be seen within easy reach of Melbourne may perhaps be supplemented by a bare mention of other geological formations, which can easily be visited by anyone having a day or two at his disposal. Graptolite bearing Lower Ordovician may be seen near Lancefield, Castlemaine and Bendigo. The Upper Ordovician is within reach by a suburban train at Diggers' Rest. The Silurian limestone of Lilydale is close to the Railway Station, but good fossils are not always easy procurable in the quarry. The well-known glacial beds of Bacchus Marsh can be easily seen in the day, though a good deal of walking is necessary. At Portarlington, half a mile from the pier, and again a few miles from Geelong, the Victorian Mesozoic coal beds are visible. In the Geelong district generally, and near Mornington, the marine Eocenes are rich in fossils. Other formations such as the Devonian, as well as many localities where fossils are plentiful, require longer excursions, so that reference to them would perhaps be out of place in what professes to be merely a short popular account of the geology of the district round Melbourne.

THE ABORIGINES OF VICTORIA.

BY A. W. HOWITT AND LORIMER FISON.

A few years hence an account of the Victorian aborigines may be written on the lines of the celebrated chapter on the Snakes of Iceland:—"There are no aborigines in Victoria." Before the incoming of the white man the native tribes roamed through the forest in considerable numbers, but contact with what we are pleased to call "our civilisation" has improved them off the face of the earth, with the exception of a miserable remnant gathered together at the various stations established by the Government and the missions.

It is needless to recapitulate the well-known causes of their decay and disappearance; but it may be well to point out that, among those causes, cannot be set down the lessening of their food supply. On the contrary, it is certain that in many respects the supply was considerably increased by the incoming of the white man. Though the introduction of sheep and cattle destroyed, to a considerable extent, certain vegetable products which they consumed, the war of extermination waged by the settlers, for the preservation of their flocks, against predatory birds and beasts, such as the eaglehawk and the wild dog, caused a rapid and enormous increase in the game upon which the blacks principally subsisted—opossums, kangaroos, etc.—at all events, until those animals began to be extensively hunted for their skins; and on the whole it may be said that the blackfellow had more to eat, and less trouble in getting at it, after the white man had made his appearance, than he had before that advent.

In a brief article such as this, it is, of course, impossible to give anything like a detailed account of the aborigines. It will be sufficient to point out the organisation of the Victorian tribes, together with certain specialities which, more or less, distinguished them from the aborigines in other parts of the Australian continent. For the accompanying sketch map we are indebted to Miss M. E. B. Howitt.

THE NATIONS.*

The Victorian Aborigines were divided into at least four distinct "nations," using this term for the sake of convenience, in order to permit the use of "tribe" as a distinctive sub-term. These nations were:—

1. The *Kurnai* of Gippsland.

2. The *Kulin*, who occupied the country from the Tarwin River, in Westernport, round the spurs of the Australian Alps; north-eastward to beyond the Broken River, and, probably up the Ovens River to Mount Buffalo, which was the north-western limit of another group of tribes which occupied the upper waters of the Ovens, Kiewa, and Mitta Mitta Rivers. This group of tribes may be represented by the Ya-itma-thang,† who lived on the Omeo table-land. This nation extended on the west to a line which may be approximately drawn between Colac and Geelong, northwards to the sources of the Avoca River, which formed the boundary between the Kulin and the Wotjo nations.

3. The *Wotjo*.—From the Kulin boundary to the north and north-west there was a great group of

* For the sake of convenience the several nations have been distinguished from each other by using the word for "man"—that is "Australian native"—occurring in the respective languages. Thus the Gippsland tribes were all Kurnai—that is "men," as distinguished from the adjacent alien tribes, who were called by them "Brajerak"—wild, or savage men.

† Ya-yan = Yes. Thang = Speech.

tribes, who we may call the *Wotjo*, and whose country extended nearly to the Murray frontage.

4. The *Mara.*—To the southward of the Wotjo, extending to the sea, and into South Australia, there was another group of tribes, to which we can apply the name of *Mara.*

The country beyond the northern boundaries of the Wotjo and the Kulin, represented by the strip shown in the map along the Murray frontage, was certainly not occupied by tribes belonging to either of the nations. Those to the north of the Wotjo had the class-divisions Kilpara and Mukwara, which extend far into New South Wales, to the vicinity of the Kamilaroi tribes.

Eastward of the Kurnai, and beyond the Snowy River, between the Kurnai and the New South Wales Murring. in the dense jungle which covers that part of the country, was a small tribe of "no-man's-men," called the Bidueli, who were neither Kurnai or Murring. They were probably broken men and fugitives from the surrounding tribes.

Local Organisation.

Each of these nations was made up of a number of tribes, and each of these tribes was composed of a numbers of local divisions, which we have found it convenient to call *Hordes*, where descent is through the mother, and *Clans* where the line of descent is through the father.

The entire nation had a certain tract of country, which was its own proper hunting ground. This was sub-divided into minor districts, which as far as the hunting right was concerned, were the special property of the tribes; and these again into smaller portions, claimed severally by the Hordes (or Clans). This distribution of the country will be apparent from the following table, showing the divisions of

the Kulin, as far as we have been able to ascertain them. The Kulin had descent through the father, and, therefore, the word clan is used for their local sub-divisions.

The Kulin Nation.

Tribe.	Principal Clan.	Class or Primary Social Division.	Headquarters.
1. Būnwurung	Not ascertained	Bunjil	Mordialloc.
,,	,,	Waang	Cape Schank
,,	Yalukit	Waang	St. Kilda
,,	Not ascertained	Bunjil	Sandridge
2. Woëwurung	Urundjeri	Waang	Kew
,,	Būlūk	Waang	Cranbourne
,,	Ngaruk	Bunjil	Dandenong
,,	Kurunjang	Waang	Werribee
,,	Gunung	Bunjil	Mt. Macedon
3. Thagunwurung	Nira	Waang	Kilmore
,,	Buthera	Bunjil	Seymour
,,	Yauang	Waang	Alexandra
,,	Waring	Bunjil	Muddy Creek
,,	Yirun	Bunjil	Benalla
4. Jajauwurung	Kurnung	Waang	Daylesford
,,	Galgal	Bunjil	Kyneton
,,	Learga	Waang (?)	Sources of Campaspe
,,	Kalk-kalk	Waang (?)	N.W. of Kyneton
,,	Wuringhere	Waang (?)	Near Galgal clan
,,	Tonemburlang	Waang (?)	Upper Loddon
,,	Leauragura	Bunjil	Smeaton
,,	Kri	Bunjil	Mt. Blackwood
5. Not ascertained	Bulungkara	Bunjil	Wangaratta
6. Wudthauwurung	Wudthauwurung	Bunjil	Geelong
7. Nguraiwurung	Ngurailum	Bunjil	Murchison
,,	Benbenbora	Bunjil	Mooroopna

Woë, Thagun, Būn, Wudtha, and Ngurai, are some of them certainly, and probably all of them,

simply different forms of the negative. Thus the Woëwurung are the people who say "Woë" for "No." "Wurung" is "lip" hence "speech." This nomenclature from the negative is common among the Australian tribes, *e.g.*, the Kamilaroi, or Kumilrai, the Wiraithari, or Wiradjeri, etc., where Kamil, or Kumil, and Wirai are the negative.

Each of the Kulin clan-names has a suffix, *balluk* = a number of people—or some other word. Thus the full title of the first Woëwurung clan is Urundjeri-balluk. This suffix extends beyond the Kulin. Thus, the Wotjo people are the Wotjo-balluk.

Most, though not all, of these names, have reference to some marked peculiarity of the locality inhabited by the clan. Thus Urun is white gum; Ngaruk, stones; Nir, cave, or a hole in the ground; Kurunjang, red earth. The Urundjeri-balluk are "The People of the White gum country;" the Kurunjang-balluk are "The Dwellers on the Red Ground."

The Kurnai.

The Gippsland Kurnai were locally divided into five great clans, the Krauatungalung (whose name has given to our maps the horrible corruption Croajingolong), the Brabralung, the Tatungalung, the Braiakalung, and the Brataualung. For further particulars the reader is referred to Mr. Howitt's monograph on the Kurnai in *Kamilaroi* and *Kurnai* (George Robertson, 1880), while for specific information as to the Mara he may consult Mr. Dawson's excellent work, "The Aborigines of Victoria" (George Robertson, 1881), which deals exclusively with some of the Mara tribes.*

*On the general subject there is much information to be gained from the elaborate works by Brough Smyth and E. M. Curr, published by the Government of Victoria. A sketch map, by Mr. Howitt, showing the geographical distribution of the Australian class-systems, will be found in the Journal of the Anth. Inst. for August, 1888.

Social Organisation.

With the exception of the Gippsland Kurnai, all the Victorian blacks divided into the two great exogamous Classes which are found everywhere throughout the continent, and these sub-divided into minor totems,* as well as into local Hordes.

The Kulin classes were Bunjil (eaglehawk) and Waang (crow); those of the Wotjo and Mara were Gamutch and Krokitch (identical with the South Australian Kumait and Kroki). In other words, these belonged to a still greater area of tribes having the two-class system, which extended not only over a great part of Central Australia, but also southwards as far as Port Lincoln in South Australia and Westernport Bay in Victoria. The eastern limits of the two-class system were in the Australian Alps and the Maneroo table-lands. All these have been established beyond doubt as the equivalents of Kilpara and Mukwara of the Darling River district; of Dilbe and Kupathin, the two primary classes of the Kamilaroi, which sub-divide into Ipai, Kumbo, Muri, Kubbi; and of the Queensland Mallera and Wuthera, which also split into four sub-classes. These four sub-classes, with their peculiar line of descent, and the totems attached to them, were not found in Victoria, unless possibly along the Murray frontage to the north of the Kulin.

Nor had the Kurnai the two primary divisions, though there is evidence that they had them in former times. Yet, while the customary class and totem-names had been lost, the sex-totems, which are peculiar to the south-eastern part of Australia, remained in full force. All their males were Yirung

*The word totem is conveniently used for the division of which the totem is the badge, as well as for the badge itself.

(emu-wren), and all their females were Djitgun (superb warbler). They are found also in other Victorian nations, and extend across the Murray into some of the Riverina tribes. It may be noted that these male and female totems extend among tribes far to the northward, along the east coast, and are independent of those indicating the various social divisons.

Kurnai and Brajerak.

Kulin and Kurnai are almost certainly the same word, found elsewhere as Kurn, Kurna, Korna, and signifying "man." Each of the nations called themselves MEN *par excellence*, thus distinguishing themselves from all the rest, whom they reprobated by some title which had in it an undertone of contempt, and hatred, and fear. Thus the Gippsland blacks were Kurnai—Men—and all the others were no better than Brajerak—mere *barbaroi*. It was a meritorious act to wipe them out of existence whenever an opportunity offered, and they left no opportunity unimproved. This, however, must be distinguished from their combats among themselves—the set fights which have been so often described as war. These were nothing more than the battle ordeal, the purgation of an offence, real or imaginary, against the tribal laws and rights.

SPECIALITIES OF THE VICTORIAN TRIBES.

It is needless, as well as impossible, to attempt any general account of the natives in a sketch so slight as this; impossible, because of the limits of our space, and needless, because there is no particularly noteworthy difference between the Victorian

and other Australian tribes in physique, weapons, and articles of manufacture, or in their general modes of life. Variations there are, of course; but in all probability the Victorian blacks do not differ from the other tribes much more than they differ from one another.

For instance, they were cannibals, as are the tribes elsewhere, but they did not eat the entire body of their enemies, nor consume their dead friends, in whole or in part, as a touching funeral ceremony, or as a means of assuaging their poignant grief, after the manner of some of the northern tribes. They ate the skin, the muscular portions of the legs, or the arms of their enemies, or drank their blood in accordance with local fashion, which varied in different parts of the country.

From Mother-right to Father-right.

But though a general account of almost any Australian tribe would serve fairly well on the whole for the Victorian blacks, these are of special interest to the anthropologist, and more especially to the student of ancient society, because of certain changes which have taken place in two of their nations, the Kulin and the Kurnai. We use the word "changes" advisedly, because these nations bear upon them manifest tokens of the older order, which is still prevalent among the tribes on the other side of the Murray, and indeed almost everywhere else in Australia.

Of these the most important is *the change in the line of descent*. The very general, though not the universal, rule among the Australian tribes is descent through the mother; but, though the Mara and the Wotjo still followed that line, the Kulin and the Kurnai had advanced to descent through the father.

The shaded portion of the map shows the extent of the area over which father-right prevailed.

Localisation of Totems.

This alteration in the line of descent among the Kulin has led to the localisation of the totems. Among the tribes which still follow the older line, there are in every horde, male representatives of the classes, and of many, if not of most, of the totems also—necessarily so, because the male child abides in the horde, and his totem is that of his mother, which cannot be that of his father, because the totems are strictly exogamous. Hence, father and son are of different totems. The totem-group, in fact, bears to the horde the relation which the Attic *phratria* bore to the *deme*.*

But among the Kulin, though the wife of a Waang man was Bunjil, his child was Waa, like himself. Thus, the Urundjeri people, for instance, were all Waang, while the Ngaruk were all Bunjil, the wives, of course, being excepted.

Individual Property Right.

This change has also resulted in a tendency to break up to some considerable extent the old communism, and to individualise property, at all events where property can be localised. The game which roams over the tribal territory is still the common property of the tribe, or of the clan—its property, indeed, consists in the game on the territory rather than in the territory itself—but, as for instance, in the case of the swans' eggs in the breeding places on Lake Kurlip, a lagoon formed by the Snowy River,

* See The Deme and the Horde, by Howitt and Fison, Journal of Anthrop. Inst., Nov. 1884.

and at Raymond Island in Lake King, we find certain individuals asserting a proprietary right to the exclusion of the rest of the community. Another striking instance of this was found in the Woëwurung tribe, where a famous quarry, from which stone axes were obtained, was claimed as the property of a family whose headman was one Bilibeléri. It is interesting to note, as a survival of the older line of descent, that whenever this property holder went away on a visit, he left the quarry in charge of his sister's son.

Exclusive Marital Right.

Still more clearly is this tendency seen in the marriage regulations, which gave the husband an exclusive right over his wife, or wives. Elsewhere, under the older order, we find a more or less restricted communal right, which asserts itself over that of the individual, the right of the individual being, at all events occasionally, over-ridden by that of the totem-group to which he belongs. This was not so among the Kulin and Kurnai; and they had nothing even distantly resembling the Pirauru custom of the Lake Eyre tribes, which is a form of group-marriage, coinciding with the so-called polyandry of the Nairs.

Kurnai Marriage.

The form of marriage among the Kurnai is unique, and of special interest. This people, though they had lost the old exogamous class-divisions, were strictly exogamous as to their local divisions; and they, moreover, retained a system of relationship more archaic than even that which is the outcome of the typical class-divisions, a system which resulted in a set of matrimonially forbidden degrees, handed down from generation to generation, and widening out in each successive generation, until it finally

embraced the entire community. Practically, the whole of each level in a generation—which indeed may be spoken of as a generation—had come to be in the fraternal group relation, and therefore marriage was impossible under the universal custom prohibiting sister marriage. Hence, the only possible form of marriage was elopement, the ordinary forms by betrothal, or exchange, being out of the question, excepting in cases so rare that they proved the universal rule. Elopement, indeed, was common enough elsewhere, but no other tribe in Australia, so far as we are aware, had it as its system of marriage.

That the Kurnai marriage by elopement was recognised tribal custom, notwithstanding the opposition of the kindred, is shown by the evidence of a special class of medicine men, called Bunjil-yenjin, from the "yenjin" or magic songs used by them to cause some particular girl or woman, to elope with some particular man. This was an openly practised magical ceremonial, as also was the formalities of pursuit by the kindred of the eloping couple.

As contrasted with the Kurnai marriage by elopement, we subjoin two diagrams which will illustrate the rules of marriage in Victorian tribes. Diagram I. is that of the Theddora branch of the Ya-itmathang tribe. Diagram II. represents the rule in the Woëworung tribe before mentioned. In the former descent was through the mother; in the latter it was through the father:

DIAGRAM I.

THEDDORA RULE.

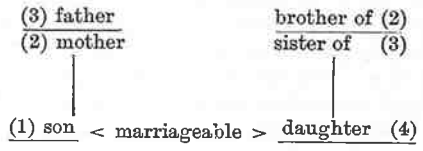


DIAGRAM II.

WOËWORUNG RULE.

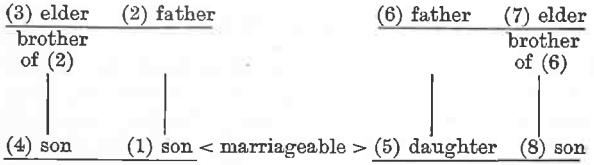


Diagram I. represents also the marriage rule of other tribes, *e.g.*, Maraura, at the junction of Murray River and Darling; Paruinji tribe, Paroo River; Ngarbana tribe, west side of Lake Eyre.

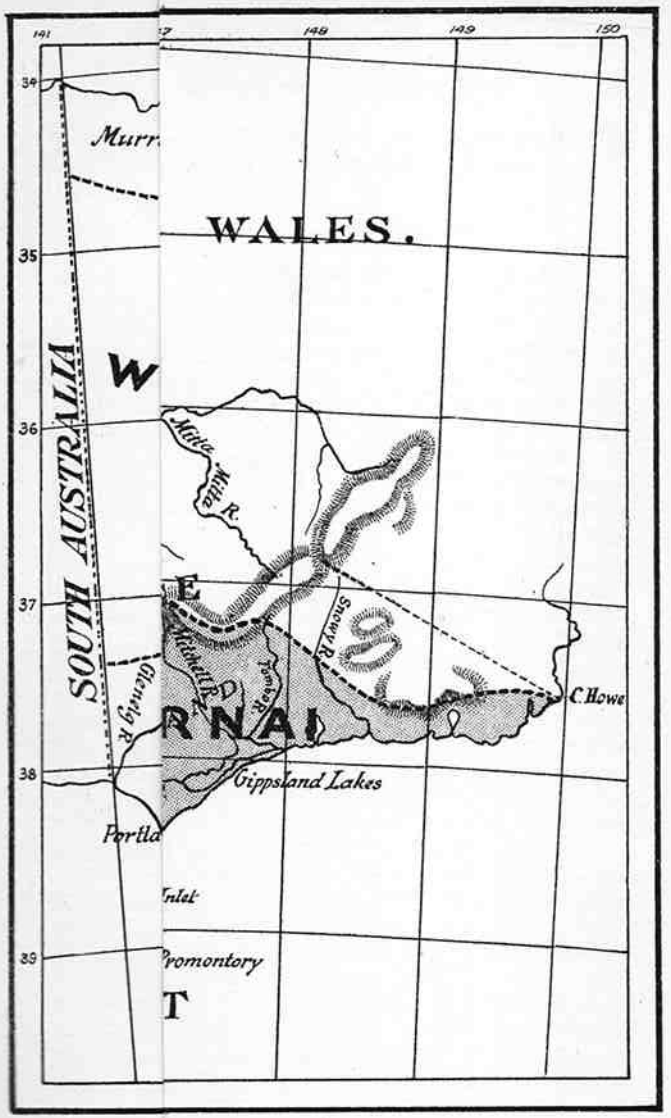
In the Theddora, a man's proper wife was the, daughter, own or tribal, of his mother's brother or father's sister (own or tribal), who indeed is the same individual—or group. In the Woëworung it was the elder brother of (2) who arranged with (7) the elder brother of (6) for the marriage of the daughter (5) of the latter with the son (1) of the younger brother (2) of (3). But it must be remembered that (3) and (7) are respectively the "elder" fathers (tribal—since there was no group marriage in this tribe) of the respective son (1) and daughter (5). In both these tribes the custom of betrothal obtained. That is, in most cases (1) and (4) Theddora—or (1) and (5) Woëwurung—being of the proper intermarrying classes, had been promised to each other when perhaps quite young children, but also perhaps not until nearly grown up. In these tribes, as in all others where there is the practice of betrothal, the result often, was that the girl when marriageable found herself promised to some man, perhaps very much her senior, or otherwise distasteful to her, or that she preferred someone else. The consequence was that elopement took place. But this differed materially from the

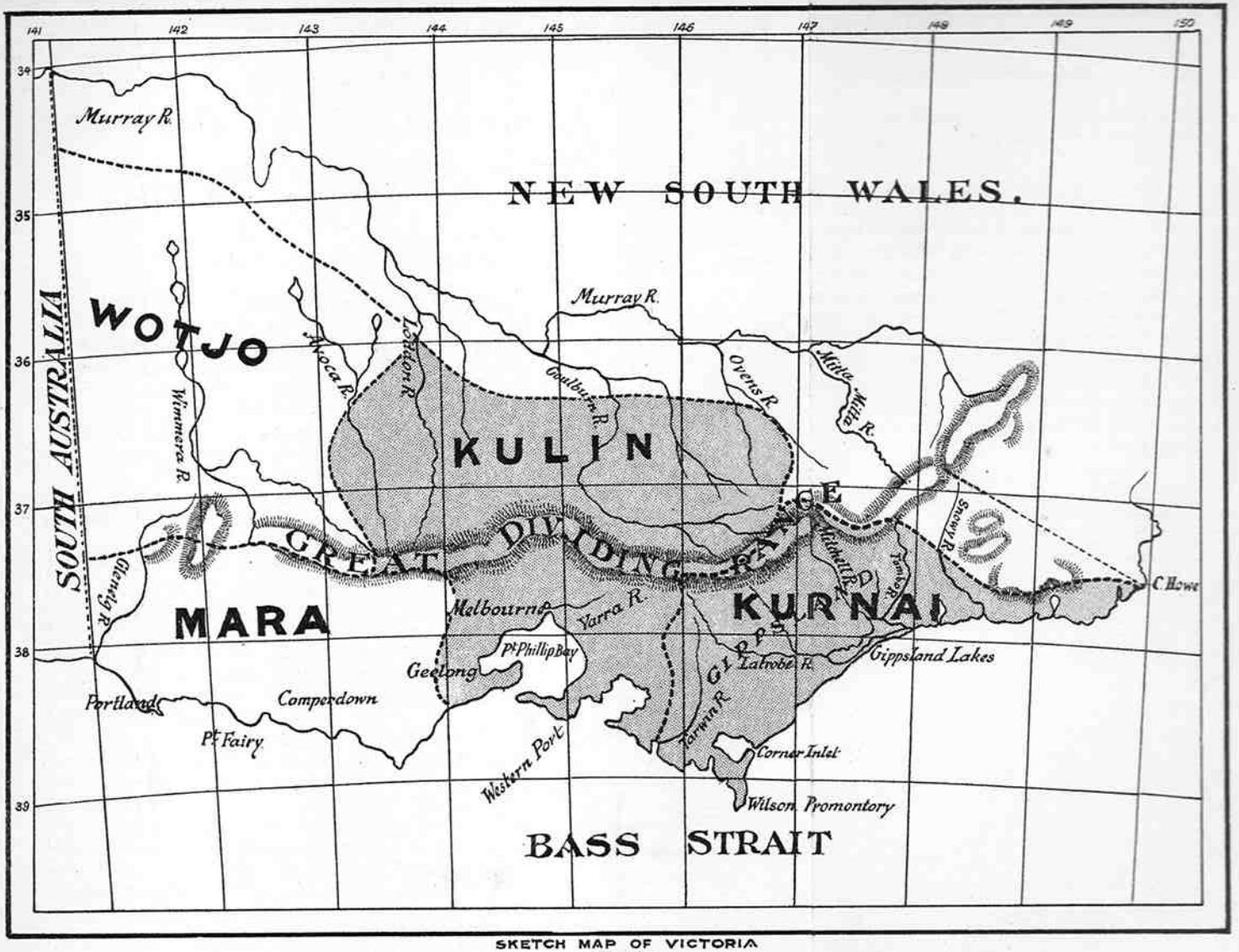
Kurnai custom, which arose out of the necessities of their system of kinship and not out of the custom of betrothal.

The Initiation Ceremony.

The Victorian aborigines differed from the northern tribes, in the fact that, with one exception, they had not the initiation ceremony known elsewhere as the Bora, and by other names, although evident survivals of it are to be observed among them. The one exception is the Gippsland Kurnai, among whom the ceremony was called the Jeraeil. Their Jeraeil rites, however, were far from being as full as those of the northern tribes, and the custom of knocking out one of the novice's upper incisors was not practised by them.*

*The tribes who formerly lived on the Murray frontage may possibly have observed the ceremony, for individuals belonging to them are known to have participated in the Burbung ceremonies of the Tatathi and other tribes in the neighbourhood of the river on the New South Wales side, although they themselves did not knock out the tooth.





SKETCH MAP OF VICTORIA
Showing
the Aboriginal Nations

The shaded Portion shows the extent of the Prevalence of Father-Right

A Sketch of Pond and Fresh-Water Life in the vicinity of Melbourne.

By J. SHEPHARD and W. STICKLAND.

In the last issue of this Handbook, Dr. Dendy had occasion to comment on our almost entire ignorance of the fresh-water fauna of Victoria. During the intervening years, however, partly through pond-life excursions promoted by the Field Naturalists' Club, partly through the independent efforts of two or three interested in microscopical work, something has been done to remedy this defect. But search has, so far, been almost entirely confined to a region extending a few miles from Melbourne in each direction; and even for this limited area much still remains to be done, especially in the description of new forms. Moreover the enquiry has been directed principally to two branches, viz., Protozoa and Rotifera; to these, therefore, the following pages must mainly refer. The abounding plant-life of our ponds, and those organisms whose animal or vegetable nature is matter of much dispute, such as the favourite Volvox (found in spring time here often in great profusion), do not enter into our consideration.

The Protozoa, all virtually living in water, are microscopic animals; the largest ($\frac{1}{20}$ in.) just visible to the eye in a bottle of water held up to the light; the smallest ($\frac{1}{5000}$ in.) only to be seen properly with the finest optical appliances, used in the most skilful way. Even very small forms, however, may produce an impression upon the unaided eye through their vast multitudes; may tinge the water green or brown, or give the appearance of whitish clouds in it.

At the base of the animal series we have the Rhizopoda, little jelly-like masses of living substance (sometimes barely distinguishable from the water itself) of no very fixed shape. The naked forms (of which we have several) usually belong to the genus Amoeba. Next come those, quite similar in nature, which protect themselves by means of a shell-like structure. This may be chitinous (Arcella), built up of sand grains (Difflugia), or of lozenge-shaped plates (Euglypha).

Vampyrella lateritia (found, so far, in two localities) half Amoeba, half sun-animalcule, leads on to the Heliozoa, small globular masses changing shape but little, radiating in all directions most delicate but fairly rigid threads of protoplasm. Small protozoa coming within reach, seized by one or more of these are slowly drawn or pushed down to the body and there soon absorbed. Common forms (always adhering about pond weeds) are Actinophyrs sol, and the very large Actinospaerium eichhornii. We find too Acanthocystis and Raphidiophrys (the latter chlorophyll-bearing), protected by a frame of silicious spicules. The interesting Clathrulina elegans, enclosed in a glassy perforated shell, mounted on a long stalk of similar nature, is not an unfrequent object.

The starlike masses of Anthophysa vegetans, either as originally attached to long brown granular stalks, or rolling freely through the water, and the tiny collared monads (Choanoflagellata) are common. The latter frequently increase greatly in water kept for a while, after the larger animalcules have died off. We find all the three important genera, Monosiga (single with naked body), Codosiga (beautiful tree-like clusters), and Salpingoeca (loricated).

The forms last mentioned introduce to us a new and most important organ, viz., the flagellum, a long slender thread of protoplasm, not rigid, but capable

of rapid lashing or waving movements, by which the animal may either swim or, creating currents, draw in supplies of food.

The possession of a distinct oral opening marks forms of higher rank (all hitherto mentioned take their food in simply through the body wall). An example found everywhere is Astasia trichophora. Somewhat tapering forwards in shape it swims steadily by means of a long stout flagellum, now and then wriggling itself into a shapeless mass, then again unwinding and resuming its course. The Euglenidae are a noted family, all coloured bright green with chloroplyll and carrying a red spot near the anterior end. They may attain to such inconceivable numbers, particularly at the close of a hot summer, that the water seems to be stained green. Besides the typical Euglena viridis we may note the long stiff E. acus and particularly the related Trachelomonas hispida. This is simply a Euglena enclosed in a bottle-shaped shell, decorated with minute points, which by its reddish-brown colour gives quite a rusty appearance to the ponds. Other interesting forms are the rare E. spirogyra and the parasitic genus Colacium, which often spreads a sheet of living green over the Entomostraca.

There are many forms with two flagella. We mention the pretty, shrub-like growths of Dinobryon sertularia, each animal enclosed in a clear vase-like sheath; the common rolling clusters of Synura uvella (resembling a bunch of grapes); the small Chilomonas paramecium ($\frac{1}{1000}$ in.), which may attain amazing numbers in an infusion a few days' old; and Anisonema grande. The last swims with one flagellum, while it drags a second and larger one, apparently useless, by its side (trailing flagellum).

In the class Ciliata, we find a more elaborate structure. The inner substance of the body is

somewhat fluid, the firmer outer layer constituting a cortex. Through this protrude the cilia, marvellously delicate protoplasmic threads, waving automatically with a vibration that in many species ceases only with life. These act, precisely like the flagella in the preceding class, both as swimming organs and for attracting food particles. In the division Holotricha we have forms ciliated uniformly over the body. The redoubtable scavenger, Paramecium aurelia, is one of the commonest and best types; elongated in form, it is rounded in front and somewhat pointed behind. The formation of food vacuoles can be most advantageously studied in this species. P. bursaria, full of chlorophyll grains and displaying a striking internal circulation, is common, but never numerous. Coleps hirtus, with thick cuticle furrowed into a series of squares, is also a greedy devourer of decaying matter. Trachelocerca olor and Amphileptus anser suggest, respectively, the appearance of a swan and a goose. The former is as common as the latter is rare. Good examples, too, are the brilliantly coloured Nassula ornata (rare) and the blackish Ophryoglena atra. Cyclidium glaucoma, a tiny form ($\frac{1}{1200}$ in.) notable for its power of leaping, sometimes swarms.

In the next division (Heterotricha) we find animals clothed with cilia, while a specially powerful series surrounds the oral region. The finest type of these is Stentor polymorphus, found everywhere about pond weeds. Often assuming most unrecognisable shapes, when fully displayed it resembles a wide-mouthed trumpet, the body being sometimes elongated to a mere thread. Powerful cilia, surrounding the head, draw food by a spiral convolution into the interior of the body It appears to contain much less chlorophyll here than in Europe. Other common species are S. roeselii and S. igneus, the last doubly coloured by chlorophyll and a scarlet pigment. The large

Bursaria truncatella ($\frac{1}{36}$ in.), shaped like a bag and very elaborate in structure, is a fine example of this class, regularly found in early winter. Parasitic in the frog's intestine is another large form, Nyctotherus cordiformis. Tintinnidium fluviatile is a curious and rather rare species living in a wide granular tube.

One or more convolutions of powerful cilia about the head, the rest of the body being bare, characterise the Peritricha. The large family of the Vorticellidæ furnishes the favourite examples of this type. In the genus Vorticella ("bell animalcule") we find the body shaped like a graceful bell or cup, attached by its narrow end to a slender hollow stalk of greater or less length. A fibre in the interior can contract, coiling the stalk like a spiral spring to withdraw the animal from threatening danger. The many species of Vorticella, as plentiful as they are beautiful, afford a fine subject for study. This type has been remarkably varied by Nature. In place of the flexible stalk we may find a stiff one (Rhabdostyla); instead of the solitary form, a colony in tree-like shape, consisting of a stout stem and many branches, along which the animals are evenly distributed. Such are the lovely clusters of Carchesium polypinum, often seen adhering to the side of a bottle in which pond-water has been kept for a while. Zoothamnium is another fine genus of this kind (not common). Other clusters, but mounted on rigid stalks, are the Epistylides, common species being E. flavicans and E. plicatilis. All these are usually attached to pond weeds, but many species are determined ectoparasites on larger animals, especially Entomostraca. Opercularia is yet another clustering form, distinguished by a conspicuous lid uplifted above the mouth. The genera Vaginicola, Thuricola, and Pyxicola, all inhabiting tubes of their own construction, are interesting forms which space does not allow us to describe. Halteria

grandinella, shaped like a hailstone, and making great leaps by means of long spines, which encircle the body, and the top-like Urocentrum turbo, which seems to pass its whole existence in spinning round, are also interesting examples of Peritricha.

The active cilia are confined to the ventral surface in the order Hypotricha. Moreover in many genera they are modified in various remarkable ways, and so strengthened as to serve for legs. In the common genus Litonotus we have animals tapering at both ends. Chilodon cucullulus (common) has a sort of lip-like anterior prolongation; it greedily devours diatoms when these are present. We note further, the mussel-shaped Stylonychia mytilus; S. pustulata (of speckled appearance); Oxytricha platystoma (recognisable at once by its curious spiral pharynx); the broad short Euplotes patella; the ridged Aspidisca costata and the odd Stichotricha remex, which inhabits a brown coloured granular tube of its own creation.

The Tentaculifera may close the Protozoan series of our pond life. They are variously shaped (spherical, triangular or elongated) masses of protoplasm, from which radiating tentacles protrude; either over the whole surface or in bunches from certain parts only. The tentacles may be either prehensile or suctorial; if the latter, being tipped with a knob-like sucker. The mode of feeding practised in this case strikes one as peculiarly revolting. An unwary animalcule touching a sucker is held fast, perhaps by one, if too powerful by several. Presently we see the tentacle widening; it becomes a distinct tube, and by this the soft internal parts are sucked into the captor's body. For a while the granular masses are seen, gliding steadily down until all are absorbed. The mere husk of the victim is then cast away. The forms of Tentaculifera usually found here, mounted

on straight and rigid stalks attached to pond weeds, belong to the genera Podophrya (body naked) or Acineta (body loricated).

The mode of increase throughout the sub-kingdom Protozoa is by self-division, either transverse or longitudinal. A constriction will be formed round the middle of the animal's body, steadily deepening so that a "wasp-waist" is produced. The halves are united at length only by a thread of substance. Meanwhile the front portion develops new hinder parts, the back portion new front parts. Thus, when the final tug separates them, we have two new complete animals. Of course many variations in the details of this process occur, the most singular, probably, being those presented by the Stentors.

Conjugation is a complementary process, which cannot here be explained.

Protozoa may be found in almost any rain-water pool in the winter; more permanent ponds are referred to particularly further on.

The Porifera have been very little worked, Von Lendenfeld's description of Meyenia capewellii apparently being the only work recorded. It is well, however, to mention that fresh-water sponges are met with in all the backwaters and lagoons along the valley of the Yarra, and when the water is drying up, statoblasts are usually found in large numbers.

The Coelenterata are also somewhat neglected if we pass over the large quantities used for teaching purposes. Hydra oligactis, a brown hydra with usually six tentacles, is found everywhere, though its occurrence in numbers is curiously intermittent in any one spot. The occurrence of a plentiful food supply in the form of Entomostraca probably being the chief factor in determining the prevalence of the polype at a given time. Again the Yarra valley is to be mentioned as an unfailing source of supply, one

lagoon near Camberwell reached by continuing from the Burke Road in a straight line towards the river, being specially known as never failing to yield some specimens. A green hydra is also found, but is very sparsely distributed. It has been doubted whether a green species exists here, but specimens we have seen from a lagoon near the bridge over the Yarra at Heidelberg undoubtedly contained chromatophores in the endoderm cells. Another interesting form, Cordylophora whitelegii is very well known as an inhabitant of the lake in the Botanical Gardens, and the now much diminished swamp to the east of the St. Kilda Road, near the boat-sheds. In the Botanical Gardens its prevalence simply depends upon the distance in time of the periodical cleaning-out of the lake. When left undisturbed for some time, the lake is so populated that no sunken stick can be taken out without finding this interesting animal, with its club-shaped body and numerous filamentous tentacles radiating therefrom, standing out from the creeping meshes of the stolon; the whole colony covering the submerged object with a whitish net-work. It appears limited in the neighbourhood of Melbourne to the localities named.

The Rotifera are very plentiful, but many of the species are very intermittent in any given locality, others being fairly constant. Commencing with the Rhizota, or sedentary forms, Victoria is certainly rich in species of this Order. The family Flosculariдae are to be met with in all the permanent smaller pools, in the Treasury Gardens, Botanical Gardens, and the lagoons of the Yarra valley. Still waters containing much plant growth are the habitat of the family. Their elongated bodies, surmounted by by setigerous lobes, protected by the sac-like gelatinous sheath, or tube, may often be found in thousands attached to the filaments of Spirogyra, and other

Confervoid plants The translucency and delicacy of outline of these animals prevent their being readily detected, unless portions of conferva are spread out and examined under the microscope. A well extended specimen is an object of great interest and beauty. The setae extend from the corona to a distance in some species equal to half the length of the rotifer, and, radiating outwards, form a funnel, which instantly becomes a balloon-like cage by the ends of the setae converging to the centre when a motile plant or protozoan blunders into the sphere of influence. The members of this family are better seen by means of dark field illumination, and the binocular microscope has distinct advantages in displaying details of anatomy necessary for the determination of species. Floscularia coronetta is perhaps most commonly found, and some eight or nine other species have been identified, including the well-known but remarkable form Stephanoceros eichornii, which was found last year in very large numbers in a small grotto near the Anderson Street gate in the Botanical Gardens. The family Melicertidae is also well represented, all the genera mentioned by Hudson and Gosse having been seen, except Trocosphaera. Seven new species of three genera are so far unreported outside Australia. Melicerta ringens and M. conifera, celebrated for the habit of building a tube with pellets manufactured by a special organ, are frequently met with in large numbers, in any fairly permanent pool. During the spring of this season, a single piece of Myriophyllum, taken from a shallow swamp at Cheltenham, half a mile due west of the State School and Cemetery, had hundreds attached to it. The Botanical Gardens grotto already mentioned, was well populated with these two forms in the summer of 1898 and 1899, and also yielded a new species of Melicerta—M. fimbriata—interesting

in that the tube is built of long filaments, instead of round or conical pellets, these filaments being fabricated by the same special organ which produces pellets in the other two species named above. The genus Limnias, with its horny tube, is very common, and occasionally associated with it is the rare Cephalosiphon limnias. The genus Œcistes is often found, and may be seen projecting its "wheels" from its fluffy tube. It is a determined worker, and a considerable amount of rough usage is required to put a stop to its industry. The Treasury Gardens pool nearly always yields species of this genus. Œ. pilula, a species building its tvbe of fœcal matter, has been procured from the Cheltenham swamp above mentioned. Lacinularia, a genus once including only the well-known L. socialis, which attracted the attention of Huxley and other celebrated zoologists, contains several species of great interest, species so far only known in Australia. It may be well to mention here that forms such as Conochilus have long been known which, though swimming freely, cannot be placed, on account of their structural affinities, outside the Rhizota. Some years ago, a free swimming species named L. natans was described. It occurred at Littleton, near London. Contrasting this species with L. socialis, we find L. socialis in colonies with each individual attached to a plant, and inhabiting a perforation in a gelatinous mass. L. natans has also a number of individuals associated in a colony, but the feet are attached to each other at the centre of a gelatinous ball, the animals radiating outwards, and by the action of the ciliary wreaths, the cluster travels through the water. L. natans is very common in open pools, and is more likely to be found in pools which dry up in summer. The Burke Road pool swarmed with this species last spring. L. elliptica is a species so far only recorded for

Victoria. It is found frequently in company with L. natans, and may be distinguished by the elliptical form of the colonies, the individuals being attached to a rod of mucous forming the long axis of the mass. This species occurred during the spring of 1899, at the Cheltenham pool, and in a similar swamp about one mile along the Balcombe Road from Black Rock. L. socialis is common in all weedy pools. Two species forming pedunculate colonies are worthy of special notice, L. pedunculata and L. striolata. Mr. T. Whitelegge, of Sydney, first found near Sydney a spherical colony with a peduncle extending from the centre of the mass, of a length up to half an inch, and attaching the colony to a water plant. Victoria has yielded in the neighbourhood of Melbourne two species with this so far unique characteristic. The most obvious difference between the two forms is in the corona, this being in L. pedunculata three times as wide as the body, and in L. striolata about the same width. Clusters are found over quarter of an inch in diameter, and Mr. Whitelegge's comparison with the "fallen flower of an acacia" is very apt. The colonies are originated by swarms of young, hatched out in the mature colonies which swim away, but after a time assemble and develop a peduncle and gelatinous nidus. There may be several thousands of individuals in a single cluster. L. pedunculata is generally to be found in the lagoons of the Yarra valley, and in the spring of this year was very plentiful at the two swamps at Cheltenham and Black Rock. L. striolata occurred in very large numbers at Brighton and Caulfield. The great prevalence of these species appears to happen after a pool has been dried up and about six weeks after the rains re-form the pool, the culmination and disappearing occupying about another six weeks. L. reticulata is also a striking form, its finely developed corona being larger

than that of L. socialis, and possessing a very deep sinus at the ventral edge. As it is a quiet beast to observe, a splendid view may be obtained of the ciliary wreaths, nerve threads and ganglia, and flame cells, when a corona is seen from the dorsal. The specific name is derived from reticulations of the cuticle of the corona. When first found, it occurred in small colonies of about a dozen individuals each, and was so described, but it has been subsequently found in large colonies, the Cheltenham pool early this season yielding many over one inch in diameter. These large aggregations are due to the rotifers, when hatched, taking up a position adjacent to their parents. The production of gelatinous mucous is copious. These colonies lie on the surface of the mud in the still water so loosely attached that the movement of a stick in the water near them causes sufficient wash to float them from their position. In addition to the locality named, this species has occurred at Springbank, near Heidelberg. There does not appear to be any record of colonies of rotifers approaching this species in size from any part of the world outside Australia. It would seem impossible for rotifers such as L. striolata, L. pedunculata, and L. reticulata to have been overlooked in Europe or America. Lacinularia elongata is another Australian species very considerably smaller in the corona, but of similar habit to L. reticulata. It was once found very numerous in the Lake in the Botanical Gardens. Megalotrocha alboflavicans is often met with in permanent pools, and this spring was extremely plentiful in the Burke Road pool. Males of this species, originally met with in India, were then present in numbers. It may be mentioned that the males of these species may nearly always be found when the colonies are plentiful; they are, of course, free swimming.

Proceeding to the Order Bdelloida or forms "that swim with their ciliary wreath, and creep like a leech," the family Philodinidae is well represented. In the genus Philodina, P. roseola, P. citrina, and P. megalotrocha are often found. The type genus Rotifer is here, as in almost every part of the world, found plentifully in R. vulgaris; R. tardus, R. hapticus, and R. macrurus also flourish. It is unnecessary to specify localities, as no accumulation of water is too small to deny the possibility of the occurrence of some of this genus. Their well-known quality of resisting desiccation enables them to flourish where other species could obtain no foot-hold. The genus Callidina has also its representatives, and when the mosses of our fern gullies are searched, more of this genus will probably be found inhabiting the cups and leaves of the Jungermanniae as C. symbiotica is found to do in Europe.

The important Order of the Plöima or free swimmers next claims attention, and of the two suborders the Illoricata come first. The family Microcodidae was created for the reception of one genus comprising one species—Microdon clavus. This form has been obtained from an artificial pond near Clayton, the water at the time looking too clear and free from plant life to yield Rotifera. This rotifer is in marked contrast to the more vegetative animals of the orders already mentioned. It is, when seen from the dorsal surface, bell-shaped, with the lip bent outwards to form a broad flange, and the foot represents the narrow handle of the bell. It is extremely active and minute, being only $\frac{1}{125}$th of an inch in length, the foot being one-half of the whole length. The family Asplanchnidae are of great interest, the species met with being numerous. It is useless to give a list of places where Asplanchua, the chief genus of the family, is found, with a view to direct

collectors, for it appears more a matter of time in relation to the autumnal rains. Observations of the occurrence of this genus suggest the general idea that in nearly all dried pools the resting eggs lie in the dust throughout the summer, and a few weeks after rain, Asplanchna is to be found in thousands, but for a short time only. They are carnivorous and very voracious, devouring the small forms of their own species as well as of other species. They provide admirable material to study the anatomy of the group. A sac-like body of extreme transparence reveals every organ. The stomach destitute of anal opening, with its attached gastric glands, the narrow but expansible œsophagus armed at the entrance with huge sickle-like jaws, the excretory system with its two canals running fore and aft on either side of the body, studded with numerous flame cells, and uniting in the large contractile vesicle, the nervous system with ganglion and ramifying threads, are all displayed, the only technique requisite being the application of a little weak cocaine solution to the water in the live box. The male may always be found, although much less numerous than the female. Some three or four species are met with. Asplanchnopus, a genus with a foot, is of different habit, occurring in all open pools, coming later in the season than Asplanchna, but flourishing for a longer period though never so numerous. It is probably the most bulky of all the rotifers. When spring is well advanced, a sweep of the net will secure it in almost any of the shallow pools of Brighton and Cheltenham. Synchaeta, of the family Synchaetidae, is a genus of similar habit, and may be met with in any clear pool. S. pectinata and S. tremula are both found, and though smaller, rival the Asplanchnidae in the accessibility of their internal structure to observation. Although transgressing

the limits imposed by the title of this chapter, it may be mentioned that the open water of Port Phillip has yielded a form probably identical with S. baltica. Of the Triarthridae, the two genera, Polyarthra and Triarthra abound. The possession of articulate spines is a peculiar feature. and causes these rotifers to puzzle observers when seen for the first time, the sudden action of the appendages enabling the creatures to pass out of view with the utmost rapidity. This family also may turn up anywhere.

Hydatinidae is a family chiefly seen in Victoria in the form of Hydatina senta. It is often plentiful, and generally in dirty farmyard pools. It is an interesting form and when starved by placing for a few hours in clean water, is well adapted to typify the internal anatomy of the group. Of Notops, two species, N. brachionus and N. clavulatus occur. The former having been noted in a gathering so far afield as Wodonga.

The large and important family of the Notommatidae are in force, but have not received sufficient attention. The species are often difficult to identify. There are, however, many representatives in our ponds, and species of the genera Notommata, Copeus, Proales, Furcularia and Diglena have been certainly identified. Copeus ehrenbergii obtained in the small grotto in the Botanical Gardens, being probably the most interesting form. It possesses the auricles or ciliated tufts on each side of the anterior of the animal common in the family, but they are in this species much extended and retractile, so that the difference in aspect under the two conditions is very striking. Another feature of interest is the gelatinous investment surrounding the animal, suggesting the development of the tube in the Floscules. This coating may, however be absent. Masses of conferva from a clear pool are the likeliest environment of this species and the Notommatidae generally.

The sub-order Loricata includes many attractive forms. In the family Rattulidae, Mastigocerca is a genus often found, M. carinata being common. The Dinocharidae have Dinocharis tetractis as a frequent representative. Salpinidae names a family with a lorica so membranous that it is often difficult to place the species. Diaschiza semiaperta is a good example commonly found in small and not very clean pools. The Euchlanidae are a family more often in evidence than any other of the order. In this family the lorica is composed of two distinct plates, very transparent and of most diverse shapes. The angles and projections are so numerous that the external form can only be made out by a study of the living animal as it turns and presents different aspects. They are useful in surviving for a considerable time in gatherings, and may even develop in a small vessel and remain at hand for many weeks. The open pools of Brighton and district rarely fail to yield species of the genus Euchlanis. E. dilatata and E. triquetra may be mentioned as most likely to occur. The family Cathypnidae is mostly composed of small forms often difficult to identify. Cathypna luna is very often seen and one new species, C. spenceri, has been found. The genus Distyla has yielded a new species in D. ichthyoura and this has subsequently been re-described in Europe and America under other names. Monostyla is a genus often met with in M. quadridentata. It is very common, and will flourish in a jar when every other living thing has fallen a prey to bacteria. The Coluridae are a family which may be relied on to yield new species when sufficiently studied. The forms are small and those met with often refuse to conform with descriptions published. Accumulations of fresh-water filamentous plants almost always contain this genus as well as nearly all the forms already mentioned in the

sub-order. Metopidia is the generic name of a group of small but very attractive species. They are all depressed and very transparent. Metopidia ovalis is a species described from Victoria and commonly found.

The family Pterodinidae are illustrative of the extreme diversity of form attainable in the Rotifera. Depression and lateral expansion of the external form are so extreme that we appear to have the rotiferal anatomy laid out on a translucent circular plate of extreme thinness, so that every portion may be examined with high powers of the microscope. Several genera are met with, sometimes a particular species very numerously, as on one occasion in the pond in Treasury Gardens, when an ounce or two of water, dipped from a floating mass of conferva, contained hundreds.

Brachionidae are a family of all the loricate forms most likely to turn up in numbers. Hudson and Gosse take a representative of this family to present the typical structure of a rotifer. The genus Brachionus is here most common in B. rubens, B. pala, B. bakeri, and B. angularis, all species of wide distribution. Probably no genus of Rotifera has had so many specific names mistakenly imposed upon it. The spinous processes of the lorica, as Mr. Rousselet has demonstrated in B. bakeri, are features subject to variation. Here we find B. pala occurring in the same small pool destitute of posterior spines, with these spines slightly developed, and very largely developed. Caution is therefore required in identifying these species. B. mulleri is a species likely to occur in brackish swamps near the coast.

The Anuraeidae comprises genera characterised by the possession of loricae with a finely tessellated surface, and often long spines projecting anteriorly and posteriorly. They affect open water and appear

early in season before the Asplanchnidae who prey upon them. Sweeping through the water with a net is the best method of securing members of this family. A number of species have been noticed, and the family is likely to yield new forms. The spines as in the Brachionidae are variable in length and shape in some species.

Of the Order Scirtropoda little can be said.

A Pedalion has been observed in gatherings from Willsmere and Heidelberg, but only a few specimens were met with. It is to be hoped that this animal will turn up again plentifully so that a form so widely referred to owing to its arthropodous affinities may be studied with a view to determine the extent of its agreement with the European species.

The aquatic worms are an untouched group. There are very many forms and when worked they will doubtless yield interesting results.

Fresh-water Polyzoa are very common in permanent pools. Two species have been noticed. One with the lophophore horse-shoe shaped as in Plumatella, with divergent tubes containing stato blasts. Another more rarely occuring has a circular lophophore as in Fredericella. All the swamps of the Yarra valley contain polyzoa and large masses have been taken from water fittings connected with the water supply of Melbourne.

The Entomostraca have received some attention, but workers in this group would find rich material to operate upon. The Copepoda are found everywhere, apparently chiefly represented by two species, one seemingly identical with the common Cyclops quadricornis, and the other is Boekella minuta. Phyllopoda are numerous in all pools liable to dry up in summer. A species of Lepidurus is widely spread and very common in winter time. It occurs as far north as Horsham, where it may be found in thousands in

small depressions in the fine clayey alluvial of the Wimmera valley. Estheria and allied genera flourish in the same pools, as well as a Branchipus. The latter, being found in thousands at Elwood this spring. The larval stages of all these forms may be obtained by taking the dried mud in summer and adding rain water at about the usual time of rainfall. In eight to ten days the young animals appear, and in less than a month Lepidurus and Estheria become mature. Forms of Cladocera are plentiful, and individual species occur in immense numbers. Daphnia carinata is one of the most common, and presents considerable variations. Two varieties in addition to the typical form—var. intermedia and var. magniceps —are named by Sars, but many individuals combine the varietal characteristics, and others possess them so modified as not to exactly agree with any of the three. The crest from which the species has been named, varies in size to an extraordinary degree, and is not at all constant in the individuals from one gathering. Other genera are met with, of which Moina, Sinocephalus and Alona are more often found.

The Ostracoda have received little or no attention in Victoria, but are very plentiful.

Attention is being directed to the Amphipoda and results will soon be recorded. At present it may be said specimens are procurable in any of the localities named.

In concluding, it may be pointed out that only the fringe of the fauna coming under the comprehensive title of "pond-life" has so far been touched by microscopic workers in Victoria. Much of interest to the investigator will be found, and the opportunity to execute good work will be afforded to any who will give time and effort to it.

Birds of the Melbourne District.

By G. A. Keartland.

Although the tropical swamps of Queensland teem with their myriads of waterfowl, and the scrubs of New South Wales with their beautiful fruit pigeons, there are few localities on the continent of Australia possessing a greater variety of birds than were once to be found in the Melbourne district. This may arise from the diversified character of the country, as the dense scrub and rocky gullies of the Dandenong Ranges supplied the wants of the Lyrebird, Pycnoptilus and Rose-breasted Robin, which love solitude. The sandy heath and ti-tree swamps of Mordialloc and the mud flats at the mouth of the Yarra, all catered for the waders and swimmers. So the open plains of Keilor were frequented by the Bustard and Black-breasted Plover, and the eucalypt forests of Ringwood and Heidelberg districts and the Mallee scrub at Melton, furnished food for the numerous honey-eaters.

Before the rapid strides of settlement had denuded the country within 30 miles of Melbourne of most of its ti-tree and wattle shrubs, and forests of various species of eucalypti, its avi-fauna was a feature of the district. Following the destruction of the ti-tree, the Bronzewing Pigeon has become rare, and as the red-gum and box forests have been converted into firewood, the Warty Faced Honey-eater and Little Lorikeet are seldom seen in places where they were formerly numerous. The gaudy plumage of the Blue-bellied Lorikeet no longer adorns the foliage of our forests, and the booming notes of the Bittern are listened for in vain.

Much has been said and written regarding the geographical range of Australian birds, and also of their times of breeding, but observations, however carefully made in one part of the continent, are often found to be totally unreliable in localities a few hundred miles away. In the northern portions of Australia migration and nidification are influenced by the rainfall to such an extent that birds breeding in spring and autumn in a favourable year will often omit doing so during a period of drought. In Victoria, and especially near Melbourne, where the seasons are more regular, the breeding time is more regular and systematic. Beginning with the Plover as early as July, the insectivorous birds have generally completed their task by the end of November. As a rule, the honeyeaters devote October, November and December to family cares, but the finches and other gramivorous birds are later, seldom laying before November, and frequently as late as January. Those preferring a mixed diet, such as quail, have a more extended season, often commencing as early as September and continuing until the end of March, during which time they rear three or four broods.

A few of our birds are migrants, such as the snipe, which arrive about September and depart in February. The swift flying Turnix only visits the south when driven from its home in the north by seasons of protracted drought. The masked and white-eye-browed Wood Swallows often allow several years to intervene between their visits, and are generally the harbingers of a hot summer. Many other birds regarded as migratory simply move from one part of the colony to another as the food supply necessitates. But most of our birds either remain all the year in the same districts, or simply follow their natural instincts, and when the food in one neighbourhood becomes exhausted, seek fresh fields until the supply is replenished.

The following brief notes are from my personal observation, and most of the birds mentioned have fallen to my own gun. The nomenclature is taken from Gould's Handbook.

RAPTORES.

1. WEDGE-TAILED EAGLE (*Aquila audax*), Gould.—This noble bird derives its name from the shape of its tail when expanded in flight. It is our largest raptorial bird, adults measuring about 6ft. 6in. across the wings. In the early days of the colony, young kangaroos, wallabies, and other native animals furnished their food supply, but the advent of sheep, pigs and poultry has also contributed to the same source. Although seldom seen within 10 miles of Melbourne, of late years, I have known them to be shot at Fairfield Park and Heidelberg, and once killed a pair at Preston near where some sheep and lambs were grazing. They are still numerous at Beveridge and Melton and breed annually at Myrniong near Bacchus Marsh. They usually hunt in pairs. Near Beveridge two eagles were seen alternately swooping at a hare which sought safety by following the course of a post and rail fence. As the long wings of the birds proved inconvenient for such close work one eagle dashed ahead for about 150 yards, perched on a post and when the hare approached expanded its wings with the result that the quarry ran out into the open and was seized by the pursuing bird.

2. LITTLE EAGLE (*Aquila morphnoides*), Gould.—These birds are sparingly scattered through tropical Australia, but occassionally visit Victoria, and in 1896 a pair were shot in the Oakleigh district. They are somewhat like the Whistling Eagle in shape and color, but are easily distinguished by their shorter tail and feathered tarsi.

3. WHITE-BELLIED SEA-EAGLE (*Haliaëtus leucogaster*), Gould.—Occasionally seen at Mordialloc and Frankston, where they feed upon the dead fish and other refuse cast ashore. They will also devour young lambs or poultry if opportunity offers. They are nearly equal to the Wedge-tailed Eagle in size.

4. WHISTLING EAGLE (*Haliastur sphenurus*), Gould.—Common at Beveridge, Oakleigh and Melton during the summer months, especially when rabbit poisoning is in progress. They are regular scavengers and whether on the wing or at rest keep up a peculiar whistling noise.

5. BLACK-CHECKED FALCON (*Falco melanogenys*), Gould.—Although usually confined to the coast or rocky country they are also met with inland, and several have been shot in the neighbourhood of Melton. They are strongly built and are the most fierce and courageous of our falconidæ. One shot at and wounded whilst in pursuit of a domestic pigeon near Bacchus Marsh, made repeated attempts to regain its victim. It was caught within a few hours in a rabbit trap baited with the dead pigeon and when skinned was found to be wounded in several places.

6. BLACK FALCON (*Falco subniger*), Gray.—Occasionally seen at Melton and Heidelberg.

7. WHITE-FRONTED FALCON (*Falco lunulatus*), Latham.—Common all round Melbourne during the spring and summer. They are very daring and swift on the wing and frequently come into the heart of the city and carry off domestic pigeons which they dash down upon whilst flying. A bird of this species shot near Brunswick, was carrying a pigeon 2oz. heavier than itself.

8. BROWN HAWK (*Hieracidea berigora*), Gould.—The most common hawk in Victoria and very bold. They are destructive amongst poultry and have been

known to pounce upon quail when shot and meet their doom from the second barrel. They frequently breed in the deserted nests of the White-eyed Crow.

9. NANKEEN KESTREL (*Tinnunculus cenchroides*), Gould.—Very common. It is a most useful bird, destroying large numbers of mice, crickets and grasshoppers. They are very handsome and have a peculiar habit of poising themselves over one spot for some seconds before dashing down and seizing their prey. Although they occasionally deposit their eggs in deserted crows' nests they usually breed in hollow trees.

10. GREY-BACKED GOSHAWK (*Astur cinereus*), Vieillot.—Very rare, but isolated individuals have been shot at Brighton, Heidelberg, and Brunswick. They are more numerous in the Gippsland district.

11. WHITE GOSHAWK (*Astur novæ hollandiæ*), Gould.—Seldom seen near Melbourne. They are very destructive amongst waterfowl. The sexes are readily distinguished by the greater size of the female. A remarkably fine bird of this species was shot by Mr. E. Crossley whilst carrying off a half-grown duckling from his poultry yard, and a few years ago I saw one perched on the roof of a church in North Fitzroy, after scattering a flock of pigeons, one of which it had wounded.

12. AUSTRALIAN GOSHAWK (*Astur approximans*), Gould.—Generally seen in the vicinity of water, where they feed on frogs and waterfowl. They are also fond of poultry, and are so daring in pursuit of their prey that one disabled itself on a wire clothes-line whilst striking at a young fowl. There is a marked difference between the adults and young in plumage. Whilst the immature bird has rather broad bands across the feathers of the flanks and under parts, the adult is much lighter in colour all over, and has the feathers of the breast and thighs crossed by fine white lines.

13. COLLARED SPARROW-HAWK (*Accipiter cirrhocephalus*), Gould.—Notwithstanding its small size and light structure, this hawk will attack any description of game or poultry. I shot one at Brighton whilst flying at and lacerating with its talons a fowl which weighed as many pounds as the hawk did ounces. They are very similar in plumage to the Australian Goshawk, and undergo like changes.

14. ALLIED KITE (*Milvus affinis*), Gould.—These birds are regular scavengers, preferring to gorge themselves on a carcase rather than kill for themselves, and never attack poultry or birds unless pressed by hunger. They are of a uniform dark brown in colour, and fly very slowly. Before the spread of settlement they were numerous during the summer months at the slaughter yards in the neighbourhood of Melbourne, but are now rare throughout Victoria.

15. BLACK-SHOULDERED KITE (*Elanus axillaris*), Gould.—These handsome birds with their snow-white underparts, light slate colored backs and black shoulders, have strongly built frames and powerful talons, yet they seldom interefere with poultry. They are frequently seen skimming slowly over the cultivation paddocks around Broadmeadows seeking for mice and insects, which constitute their chief food.

16. LETTER WINGED KITE (*Elanus scriptus*), Gould.—Similar in all respects to the foregoing, but derives its name from the fact that a peculiar V-shaped black mark is visible under each wing when flying. Birds shot at Brunswick and Oakleigh had their stomachs filled with the remains of mice, lizards and insects.

17. ALLIED HARRIER (*Circus assimilis*), Jardine and Selby.—This bird is generally observed in the vicinity of swamps and cornfields. It flies slowly

over and close to the ground in search of frogs, lizards and insects. They build their large stick nests on the ground amongst the growing corn or tall rushes and lay bluish-white eggs.

18. JARDINE'S HARRIER (*Circus jardinii*), Gould.—Similar in habit to the foregoing, but extremely fond of eggs. I saw one drive a sitting fowl off her nest in a field, upon which it at once commenced operations, and in a few minutes had sucked two eggs, when it was shot. This bird has one redeeming feature, as it is an inveterate snake killer, and is equally fond of young rabbits. At Beveridge, one was seen to make three attempts to carry off a half-grown rabbit, which ultimately escaped under a rock. The Harrier then made a dash at a ferret belonging to some sportsmen close by and was shot.

19. CHESTNUT-FACED OWL (*Strix castanops*), Gould.—Seldom seen. A friend shot one at Heidelberg, and during an afternoon ramble I disturbed one at the Merri Creek. It perched on a rock close by, and gave ample opportunity for identification.

20. SOOTY OWL (*Strix tenebricosa*), Gould.—Found in the Dandenong Ranges where it preys upon opossums, rabbits, etc. It derives its name from the soiled appearance of its face which looks as if the bird had embarked in the sweep's business.

21. DELICATE OWL (*Strix delicatula*), Gould.—This is by far the most handsome owl found in Australia, and the more carefully it is examined the more its chaste and delicate plumage is admired. Their white face and large black eyes gives them a very weird appearance. They are fairly common and are sometimes seen in the Melbourne Cemetery.

22. GRASS OWL (*Strix candida*), Ticknell.—About ten years ago a great many of these birds suddenly appeared around Melbourne, and just as suddenly vanished. A regular plague of mice

troubled our farmers that year, and it is probable the owls followed their food, as I have not heard of any having been seen since that time.

23. POWERFUL OWL (*Athene strenua*), Gould.—Most plentiful in the Dandenong Ranges, where a friend shot one in the act of devouring an adult male opossum, which it had killed whilst he was watching it on a bright moonlight night.

24. WINKING OWL (*Athene connivens*), Gould.—Occasionally seen in the Beveridge and Melton districts. At the latter place Mr. Alex. M'Innis shot one on the wall of a creek, and on climbing the rocks to secure the bird he found a large round egg in a crevice between two rocks.

25. BOOBOOK OWL (*Ninox boobook*), Gould. —This is our most widely distributed nocturnal bird, being found in all parts of the colony, in our parks and gardens, and even the streets of the city itself. Although generally seen at night, I shot one at Bayswater at two p.m., in the act of devouring a freshly killed Pycnoptilus.

INSESSORES.

26. OWLET NIGHTJAR (*Aegotheles novæ hollandiæ*), Vigors and Horsfield.—Found in all parts of the colony, and may frequently be seen in the city catching the nocturnal insects fluttering around the electric lights. They dart and skim like a swallow, but owing to the softness of their feathers are perfectfully noiseless. Their white eggs are deposited in hollow trees and when blown are readily distinguished from others of the same colour by the peculiar ringing noise they make when rolled together.

27. TAWNY-SHOULDERED PODARGUS (*Podargus humeralis*), Gould.—These useful birds pass the day sleeping amongst the foliage or on the thick

limbs of our eucalypti, when they appear just like a dead stump of a branch, but at night they are very active in pursuit of large moths and other winged insects. They make a small nest of fine twigs on a horizontal branch and lay two or three white eggs. They are very local in their habits, and breed near the same spot year after year.

28. Spotted Nightjar (*Eurostopodus guttatus*), Gould.—Occasionally seen at Clayton and Bayswater. A camp fire is a favourite resort for these birds, owing to the numerous insects which approach the light. They pass the day on the ground, and deposit their single egg on the bare ground without any attempt at nest building.

29. Spine-tailed Swift (*Chætura caudacuta*), Gould.—A frequent summer visitor. As its name implies, this bird has little pin-like spines protruding from the shafts of the tail feathers. They fly at a very rapid rate whether at a great elevation or skimming over the tops of the trees in the forest. The hotter the day the higher they fly, but on the approach of a storm or shower they are seen within gunshot. This swift is generally seen moving from north to south, but there is no record as far as I am aware, of their perching in Victoria. Where they come from or go to is shrouded in mystery.

30. Australian Swift (*Cypselus australis*), Gould.—These birds are somewhat smaller than the preceding species, and generally fly higher, they also lack the spines on the tail feathers, but are frequently seen in company with them. I have shot both species out of one flock. They usually arrive about January and may be seen as late as April. They feed on mosquitos and similar insects, which they capture on the wing, and are said to breed in Japan.

31. Welcome Swallow (*Hirundo neoxena*), Gould.—A regular spring visitor, welcome not only as a harbinger of the season, but also on account of its value as a destroyer of noxious winged insects. They build their mud nests in stables or under verandahs, and after rearing their broods, migrate in the autumn, but a few pairs remain throughout the winter.

32. Tree Swallow (*Hydrochelidon nigricans*, Gould.—At one time very numerous on what is now known as Clifton Hill. They lack the long forked tail of the Welcome Swallow, and are less brilliant in plumage. Instead of constructing an exposed nest they resort to the hollow branches of trees for breeding purposes. They are still numerous at Heidelberg and the Plenty River.

33. Fairy Martin (*Lagenoplastis ariel*), Gould.—A regular migrant, which arrives here in spring. They are smaller than the foregoing and build in company, as many as 64 nests having been counted under one overhanging rock at Keilor. Their nests are made of mud, and have a bottle-like neck entrance. In the autumn they retire northwards.

24. Australian Roller or Dollar Bird (*Eurystomus pacificus*), Gould.—This bird derives the name of Dollar Bird from a peculiar white spot which is visible in the wing when extended. A few instances have occurred of their visiting the Melbourne district, but they are more common in the north.

35. Laughing Jackass, or Great Brown Kingfisher (*Dacelo gigas*), Gould.—These well-known birds are numerous all round Melbourne, and frequent all the public parks and gardens, where they make havoc amongst the goldfish in the lakes. They are, however, highly esteemed as destroyers of snakes, mice and insects. Their grotesque antics and peculiar notes render them general favourites.

36. Sacred Kingfisher (*Halcyon sanctus*), Gould.—Found in all timbered country, especially near the

Yarra River, where they breed in holes in the bank, whilst at Brighton their nests are generally formed amongst the decayed wood in hollow trees. Their food consists chiefly of lizards and insects.

37. Azure Kingfisher (*Alcyone azurea*), Gould.—The rich blue of the back and rusty orange of the breast made this a conspicuous bird along the course of the Yarra and Plenty Rivers, but it has now become very rare. It is very silent and quick in its movements, and is seen either perched upon a branch watching for some unwary fish, or darting along the course of the stream.

38. Wood Swallow (*Artamus sordidus*), Gould.—This is the only representative of the genus which remains throughout the year. It is very local in its habits, and, unless disturbed, will be found in the same paddock, and often the same trees, year after year. They are useful as insect destroyers and occasionally indulge in a very pretty song.

39. Masked Wood Swallow (*Artamus personatus*).—Occasionally arrives about October in company with *A. superciliosus*, and is regarded as the harbinger of a hot summer. Sometimes five or six years elapse between their visits to this district, and as soon as their broods are reared, they migrate northwards. They are strictly insectivorous, and therefore much prized by our fruit growers.

40. White Eyebrowed Wood Swallow (*Artamus superciliosus*), Gould.—Whenever these birds visit our district they do so in great numbers, arriving towards the end of October. They commence building almost immediately, making a very frail nest of grass stems on any convenient tree, bush or stump. They are very tame, and are strictly insectivorous, therefore they are favourites with the gardeners. If it were not for the fact that their presence is regarded as a forecast of a hot summer their visit

would be most welcome. The male bird is pale slate colored above, with a deep chocolate-brown breast, whilst the female is less decided in markings.

41. Spotted Diamond Bird (*Pardalotus punctatus*), Gould.—These beautiful little birds are very plentiful amongst the mallee at Melton. The black head, wings and tail of the male has a round white spot on nearly every feather and a broad golden-yellow stripe extends from the throat to the abdomen. The female is less brilliant in color. They feed on small insects, particularly scale. Their nests are found at the termination of holes made in the banks of the creeks or the entrance to rabbit burrows. After tunnelling in a horizontal direction for about two feet, this pardalote hollows out a round space about the size of a cricket ball, which it lines with fine shreds of bark and grass in which it deposits four white eggs.

42. Striated Diamond Bird (*Pardalotus striatus*), Gould.—Common all round Melbourne. Instead of the spotted markings of the preceding bird, this species has alternate black and white stripes running from the base of the bill over the top of its head, an olive-brown back, and yellow throat and breast. Their loud note resembles the words "Pick it up." Their nests are similar to those of *P. punctatus*, but they occasionally build in hollow branches.

43. Allied Diamond Bird (*Pardalotus affinis*), Gould.—These birds are similar in most respects to the foregoing, but have a small yellow spot near the base of the primaries, whilst in *P. striatus* it is red. They are frequently seen in the Dandenong district.

44. Sooty Crow Shrike (*Strepera fuliginosa*), Gould.—Generally found in the hilly country of Melton and Bayswater, but also visit Heidelberg. Though living on insects most of the year this bird is fond of soft fruit, and a flock of them alighting in an orchard do a considerable amount of mischief.

45. Grey Crow Shrike (*Strepera anaphonensis*), Gould.—This is the largest species of the genus. They are now somewhat rare, but occasional pairs may be seen in open forest country actively searching the grass or clinging to the bark of trees in search of insects.

46. White-backed Crow Shrike (*Gymnorhina leuconota*), Gould.—These well-known birds, commonly called Magpies, have become very numerous since they have enjoyed the protection of the Game Act. Their merry carol is heard wherever a few trees remain, and they frequently breed in our parks. They have a peculiar habit of flying over the head of any person approaching their nests after their young are hatched, and snapping their bill in a manner that generally scares away our youthful nest robbers.

47. Collared Crow Shrike (*Cracticus torquatus*), Gould.—There are few criminals possessing so many names as this bird. Commonly known as the "Derwent Jackass," it is also called "Denver Bird," "Butcher Bird," and "Whistling Jack." It is very bold, and is a dangerous enemy to any pet canary whose cage may be left hanging in an exposed verandah. With its long bill with hooked point, one of these birds killed a number of canaries belonging to a lady at Beveridge. On one occasion it flew through the dining-room window whilst the family were at dinner, but instead of killing another canary died itself.

48. Pied Grallina (*Grallina picata*), Gould.—Whether known as Magpie-lark, Mud-lark, or other name, these birds are general favourites. Their jaunty stride and faultless black and white plumage is seen wherever water exists in the country, and their mud, basin-like nests are never far from the pool. They are strictly insectivorous and perfectly harmless.

49. Black-faced Graucalus (*Graucalus melanops*), Gould.—With its black face and light grey body this bird is very common in the forests. It is very useful in the destruction of insects, but has a liking for soft fruit. When indulging in its undulating flight it utters a low note, many times repeated.

50. Jardine's Campephaga (*Campephaga jardinii*), Gould.—These birds have only made their appearance near Melbourne within the last few years. They are slaty-grey, similar in size and shape to the English song thrush. When flying they utter a loud whistling note, which may frequently be heard in the Dandenong Ranges.

51. White-shouldered Campephaga (*Campephaga humeralis*), Gould. This bird is also known as the "Caterpillar-eater." The male is black and white, whilst the female is plain brown. They are partial to open forest country, but occasionally visit the orchards, where they are much appreciated.

52. White-throated Thickhead (*Pachycephala gutturalis*), Gould.—The loud notes of this bird are frequently heard near the Dandenong Creek. The male is very handsome, having a black head, white throat surrounded with a crescent of black, breast a brilliant yellow, and back olive. The female is light brown. Their food is principally insects.

53. Rufous-breasted Thickhead (*Pachycephala rufiventris*), Gould.—This bird is abundant along the banks of the Yarra and Plenty Rivers, and their open nests are often seen, built of fine grass and horsehair, and placed in the horizontal branches of the acacia shrubs.

54. Harmonious Shrike Thrush (*Collyriocincla harmonica*), Gould.—Although very modest in plumage this bird has a beautiful note which, coupled with their usefulness, gains them many friends in the country. Whilst ploughing is progressing these

birds may be seen hopping along the furrows picking up grubs, worms, or beetles, and thus benefiting the farmer. They make their nests in hollow stumps or in thick forked branches.

55. Frontal Shrike Tit (*Falcunculus frontatus*), Gould.—Amongst the timber at Clayton or Melton the tap, tap of this bird may be heard as it tries with its powerful bill to extract spiders and other insects from the crevices in the bark. It has a peculiar habit of standing erect and elevating its crest, and showing its yellow breast as if desirous of attracting attention.

56. Crested Oreoica (*Oreoica cristata*), Gould.—The singular bell-like notes of this bird are occasionally heard in the Melton district, but as the Oreoica is such an accomplished ventriloquist, it often evades being seen. The male bird has a very pert style of hopping along the ground, or amongst the branches of the large trees of the open forest, with its crest erect, turning from side to side as if to display its white face and black throat. The rest of its body is plain greyish-brown, but the white and black are absent in the female. When exercising its vocal powers the Oreoica lowers its crest.

57. White-shafted Fantail (*Rhipidura albiscapa*), Gould.—This is a bird of almost perpetual motion. It is generally found in scrub or near streams, and seems to court the society of man, possibly for the sake of the flies it gets off his back. It will follow a person for a long distance, fluttering around him or perching on a neighbouring branch, where it spreads it fan-like tail and keeps up a constant chirping. Its small, bowl-shaped nest is a marvel of neatness, made of fine grass and spiders' web.

58. Rufous-fronted Fantail (*Rhipidura rufifrons*), Gould.—This bird closely resembles the

foregoing in its habits, but is more wary and not so widely dispersed, being found in secluded gullies in the Dandenong Ranges. Its tail, with the exception of the extremity, is bright rusty-red. Its nest is generally built overhanging water, and when sitting the bird will almost permit itself to be caught.

59. Black Fantail (*Sauloprocta motacilloides*), Gould.—Owing to its habit of following cattle and sheep and hopping along their backs or around their heads whilst feeding, this bird has acquired the name of "shepherd's companion." It is very fearless and will frequently hop about a door or verandah where people are moving about, merely shifting out of the way. As it is fond of flies and other winged insects it is a general favourite. They seem particularly fond of teasing cats and will flutter around one for an hour at a time, but is always careful to keep just out of reach until puss walks off disgusted with her bad luck. Its body is all black except the breast and a white stripe over the eyes.

60. Restless Flycatcher (*Seisura inquieta*), Gould.—All black above and white beneath, these birds attract notice by the habit they have of fluttering over a certain spot for several seconds during which they utter a harsh grating note. They are numerous at Melton and Heidelberg.

61. Leaden-coloured Flycatcher (*Myiagra plumbea*), Vigors and Horsfield. As its name indicates, the head, throat, and upper parts are all lead colour, but the breast and abdomen are white. Whilst standing erect on a twig with its bill elevated this flycatcher keeps up an incessant tremor with its tail, which it does not spread like the fantails. They are found in the Ringwood and Croydon districts.

62. Brown Flycatcher (*Micræca fascinans*), Gould.—Although of a plain brown colour with the web of the outer tail feathers white, this little bird always attracts attention by its habit of flying from its perch to the ground and back to the branch again, this movement is repeated many times whether it secures an insect or is unsuccessful. It has a pretty note which it half whistles, half chirps. They are found either in open forest or scrub land. They make a very small nest, in which the brush cuckoo occasionally deposits its eggs.

63. Short-billed Smicrornis (*Smicrornis brevirostris*), Gould.—Owing to the fact that this is probably the smallest bird in Australia, and that it frequents alike the tops of the tallest trees and dense scrub, it is more often heard than seen. Its habit of creeping over the bark of large trees or amongst the foliage somewhat resembles the antics of the Sittella, and but for its constant twittering song might easily be passed unnoticed. It is brownish-olive above and pale yellow beneath, and has a very short bill.

64. Rose-breasted Robin (*Erythrodryas rosea*), Gould.—This beautiful robin is occasionally seen along the course of the Yarra, but is more plentiful in the Dandenong Ranges. Its head and back are dark slaty-black, and breast a beautiful rosy-pink, but the female is plain brown. Their nests are neat, cup-shaped, and usually placed in a fork or on a thick branch of a musk or blanket wood tree. As a quantity of lichen from the bark of the tree is usually placed on the outside walls of the nest it is difficult to find.

65. Scarlet-breasted Robin (*Petroica multicolor*), Gould.—This is decidedly our most brightly coloured robin. The male has the head and back a beautiful velvet black, except a small white patch on its forehead, and its breast bright scarlet. The female is plain brown with a little red showing on the breast. They remain throughout the year in scrubby country but visit the open forest in the winter.

66. Red-capped Robin (*Petroica goodenovii*), Gould.—Much smaller than the preceding, which it closely resembles except that a patch of scarlet extends from the base of the bill to the crown of the head. It occasionally visits Melton during the winter and spring, but is more common in the Wimmera district.

67. Flame-breasted Robin (*Petroica phœnicea*), Gould.—Immediately the autumn ploughing begins these birds arrive in great numbers, and are very conspicuous as they perch on the newly turned sods in search of worms. They generally turn their breasts to the intruder as if seeking admiration, and are so tame that they allow the plough horses to approach within a few feet of them before they move. The male has a white forehead, slaty-black back, and bright scarlet breast tinged with orange. The female is plain brown with a little white on the forehead and wings.

68. Hooded Robin (*Melanodryas cucullata*), Gould.—The Hooded Robin has its head, neck, and back jet black, a little white showing on the wings and tail. The under parts are all white. They are partial to open country, especially burnt land, where they are very active in search of insects, either on the trees or ground. They are found at Clayton, Oakleigh, Melton, and Bayswater.

69. Yellow-breasted Robin (*Eopsaltria australis*), Gould.—There are few creeks or gullies near Melbourne where these birds are not found. They delight in moisture and scrub. This is our only robin in which the sexes are alike in plumage. The head and back are slaty-grey and the breast bright yellow. They have a beautiful song and build a

rather large cup-shaped nest of strips of bark and spiders' web.

70. Queen Victoria's Lyrebird (*Menura victoriæ*), Davies.—Although now becoming very rare near Melbourne, owing to the spread of settlement and the ravages of foxes, a few of these birds are still to be heard in the Dandenong Ranges. The male bird is undoubtedly our finest songster and a splendid mimic. I have watched one rolling about a log in Sassafras Gully for forty minutes, alternately erecting its tail or spreading it over its back and all the time keeping up a song which was first heard a quarter of a mile off. On ceasing its song it indulged in a number of noises resembling those made by a crosscut saw, chopping, etc., varied with the laugh of the Dacelo or the scream of the Gang Gang Cockatoo. Formerly they constructed their nests on the ground but latterly they have been seen over 20ft. high in the fork of a tree. The female is very much attached to her mate and shows herself boldly whilst he is singing, but when the song has ceased and the female flies off the male is sure to be some distance away.

71. Coach-whip Bird (*Psophodes crepitans*), Vigors and Horsfield.—The note of the Coach-whip Bird is frequently heard near the Dandenong Creek and Ranges, but owing to its shy and retiring nature the bird is seldom seen unless the observer remains silent and motionless for some time. The bird then emerges hopping along the ground or through the scrub with his crest erect and fan-like tail swaying from side to side. Its head is black with dashes of white across the cheeks, the back very dark olive and the breast black splashed with white. The sexes are alike in plumage.

72. Superb Warbler (*Malurus cyaneus*), Gould.—These lovely little birds are found in nearly every

hedge a patch of scrub around Melbourne and in November 1898, a brood were hatched in Parliament Reserve. Whether the male bird changes plumage twice a year, as Gould asserts, is freely disputed, but it is quite certain that whilst birds in the modest garb of the female are numerous, the gaily coloured males keep out of sight until the beginning of October.

73. Emu Wren (*Stipiturus malachurus*), Gould.—These minute warblers derive their name from the open texture of the web of the tail feathers which are as open as those on the neck and breast of its gigantic namesake. They have very short wings and seldom fly, but are very active amongst the short heath and coarse grass at Oakleigh and Bayswater.

74. Downy Pycnoptilus (*Pycnoptilus floccosus*), Gould.—Bayswater is the only place near Melbourne in which I have heard the loud note of the Pycnoptilus. It will suddenly rise out of the scrub, perch on top of a bush and give two or three double notes and then drop like a stone out of sight. The sexes are alike, chocolate-brown above and rusty-brown on throat and flanks with a white stripe down the centre of the breast.

75. Rufous-headed Grass Warbler (*Cisticola ruficeps*), Gould.—In the coarse grass and short heath of Oakleigh these birds abound. They are also found amongst growing crops. This warbler has a very pretty song, which it gaily carols from the top of a thistle or low bush, but when disturbed the bird is difficult to find again, as it seeks safety in the dense cover. The sexes are alike, rufous-brown on the upper parts with narrow black stripes down the back, and light rust colour on the breast and throat.

76. White-fronted Sericornis (*Sericornis frontalis*), Gould.—These birds are always found in the dense undergrowth on the margin of the Yarra and

other streams, or the ti-tree scrub near the coast at Brighton. Their dark brown plumage renders them difficult to observe at a distance. Their nests are built close to the ground, frequently hidden in the *debris* left by a flood.

77. Little Acanthiza (*Acanthiza nana*), Vigors and Horsfield.—At Melton these little birds may be seen fluttering over the foliage of the eucalypti in search of small insects. The sexes are alike, light brown above, slightly tinged with olive, and pale yellow on throat and breast. These birds are but little larger than the Smicrornis.

78. Striated Acanthiza (*Acanthiza lineata*), Gould.—These birds are generally found in dense scrub, but their nests are often seen suspended from the fronts of the bracken fern or the low branches of the eucalypt saplings. How such a frail bird can strip the small pieces of stringy bark with which its ball-like nest is formed is quite a mystery.

79. Yellow-rumped Geobasileus (*Geobasileus chrysorrhous*), Gould.—With its lively habits and merry song the bird under notice is still very common a few miles from Melbourne, but before the introduction of sparrows, they were numerous in the garden plots of the suburbs. They are very fond of rose blight, spiders, and other garden pests, and so became general favourites. Whether peering into the crevices of an old fence or amongst the foliage of the garden, they always sing whilst they work. Few birds are more frequently burdened with the task of rearing cuckoos, to the detriment of their own offspring.

80. White-fronted Ephthianura (*Ephthianura albifrons*), Gould.—Dried swamps and sandy heathy country are the favourite haunts of this bird. They are less than the Scarlet-breasted Robin in size, and the male has a slaty-grey back, with white face, fore-

head, and underparts. A narrow black line divides the white from the grey of the head and neck, and crosses the breast in a broad band. The females and young are pale brown, with brownish-white breasts. The short jerky flight of a flock of these birds renders their identification easy.

81. Field Calamanthus (*Calamanthus campestris*), Gould.—On the sandy heaths of the Oakleigh district these birds are numerous, and their pretty song is heard morning and evening. They seldom fly, but are very active on the ground and dense undergrowth, running from tussock to bush with tail erect. Rather less in size than the Pipit, it has buff underparts, and a black stripe running down each feather of its rusty brown back.

81a. Little Chthonicola (*Chthonicola sagittata*), Gould.—The Chthonicola is generally found in the open forest hopping amongst the grass in quest of insects. It has a very pretty twitter, which is kept up whilst feeding. They are olive-brown above, with cream-white throat and breast, each feather having a black line down the centre. Owing to their nests being placed on the ground, with growing grass worked through the top, and fresh gathered moss sprinkled over them, but few are found. The eggs are deep red, lighter at the smaller end.

82. Australian Pipit (*Anthus australis*), Vigors and Horsfield.—Notwithstanding that the Pipit closely resembles the English Skylark in general appearance, it is almost destitute of voice except at the nesting season, when the male bird soars overhead and pours out a pretty song. Their cup-shaped nests are generally placed on the east side of a small stump or stone.

83. Brown Cincloramphus (*Cincloramphus cruralis*), Gould.—The male of this species is nearly as large as a thrush, and soon reveals his presence by

his loud song, winding up with a chirp which he utters during flight from tree to tree or when perched. Colour uniform brown, with a dark, almost black, breast. The female is smaller and lighter in colour.

84. Reed Warbler (*Calamoherpe australis*), Gould.—The Reed Warbler's notes are heard amongst the reeds and rushes which abound on the margin of the lagoons near the Yarra, but the bird is very shy, and can be seen only after a patient wait, or when disturbed by a water-dog. It is a long narrow bird, uniform olive-brown above and lighter underparts.

85. Horsfield's Bush Lark (*Mirafra horsfieldii*), Gould.—Similar in size and shape to the sparrow, and with a finch-like bill. This bird is easily recognised by its song, which is often heard far into the night. They pass their time on the ground, but when about to sing mount high into the air and soar over a very limited space.

86. Red-eyebrowed Finch (*Ægintha temporalis*), Lath.—Although our smallest finch it is by far the most common. Large flocks may be seen at Heidelberg feeding on the grass seed found on the river flats. Adults have a red bill, red stripe over the eyes and on the tail coverts, back olive-brown, and breast buff. They utter but a single note, their flask-like nests are built of fresh-gathered grass.

87. Spotted-sided Finch (*Staganopleura guttata*), Gould.—Much larger than the previous species. This bird is found in open forest at Melton, Oakleigh, and Yan Yean. It has a fancy for attaching its nest to that of the Brown Hawk, and on several occasions I have seen young birds in both nests at the same time. The head and back are brownish-grey, underpart white, a black band crossing the breast and running down the flanks, the latter marked with a number of round white spots.

88. Spotted Ground Thrush (*Cinclosoma punctatum*), Vigors and Horsfield.—These birds are very shy, and live almost entirely on the ground. They prefer rocky country or dense shrub, through which they run rapidly, but when disturbed, fly a short distance, and then hide in the undergrowth. They are common at Bayswater, near the Dandenong Ranges.

89. Mountain Thrush (*Oreocincla lunulata*), Gould.—Although known as the Mountain Thrush this species is most plentiful in the ti-tree scrubs of the Mordialloc district and along the Dandenong Creek. They delight in moist localities where they find an abundance of insect food. Though usually silent they have a loud single note. Head and upper parts dark brown, buff on the breast with a dark crescent shaped mark on the end of each feather.

90. Satin Bower Bird (*Ptilonorhynchus holosericeus*), Kuhl.—These birds are famous for the extraordinary bowers or play houses which they construct of small twigs. These are formed of two rows of twigs stuck in the ground so as to form an arch with an opening at each end. Around the opening and through the passage an accumulation of bleached bones, shells, bright coloured feathers and bits of glass are strewn. The adult males are a beautiful glossy blue-black color, but the females and young are brown above and greenish buff beneath with a dark crescent on the end of each feather. They are still found in the Morang district although immense numbers of them have fallen victims to rabbit poison.

91. Oriole (*Mimeta viridis*) Gould.—Like a thrush in shape and size the Oriole has a greenish olive head and back and white breast streaked with black, red bill and eyes. It is very destructive amongst soft fruit especially mulberries, with the juice of which it is often so stained as to raise a doubt as to its identity

until its note is heard. Its cup shaped nest is made of strips of stringy bark. Common all around Melbourne.

92. WHITE-WINGED CORCORAX (*Corcorax melanorhamphus*,) Gould.—The Corcorax is a sociable bird being generally found in flocks of from 10 to 12, and at breeding time two pairs occasionally work at and use the same nest; the females sitting side by side. The birds are black with a little white on the inner web of the wing feathers and the eyes carmine. Their nests are made of mud and grass stems similar to those of the Grallina.

93. WHITE-EYED CROW (*Corvus australis*), Gould.—Great diversity of opinion prevails as to whether the the good effected by this bird in the destruction of insects and the clearing away of carcases is compensated for by the number of sickly sheep and lambs they kill. It is certain, however, that whenever we are troubled with a plague of grasshoppers, the crows make their appearance in large flocks and birds shot are found to be gorged with the insects. The entire plumage is uniform, shining purplish-black and the eyes generally white.

94. TEMPORAL POMATOSTOMUS (*Pomatostomus temporalis*), Gould.—The antics and peculiar notes of these birds arrest attention at once. When disturbed they fly to the next tree, alighting on the trunk and low branches and then by a succession of jumps work their way towards the top, all the time keeping up an incessant chatter or mewing like a cat. They occasionally build two or three nests before laying their eggs. Head nearly white, back chocolate breast rufous and the tail tipped with white.

95. WHITE-EYEBROWED POMATOSTOMUS (*Pomatostomus superciliosus*), Gould.—Similar to *P. temporalis* in in general habits, but smaller. The head and upper parts are chocolate-brown excepting a white line from

the base of the bill over the eye; throat and breast white.

96. NEW HOLLAND HONEY-EATER (*Meliornis novæ hollandiæ*), Gould.—Many of the birds are found amongst the scrub between Brighton and Mordialloc; and near rivers inland. They are very tame and often breed in gardens and amongst the creepers covering buildings. Plumage is black and white in alternate stripes over the underparts, with brownish-black back, the outer web of the primaries bright yellow, and eyes white.

97. HORSESHOE OR TASMANIAN HONEY-EATER (*Lichmera australis*), Gould.—This bird is similar in size and shape to the foregoing, but not so bright in color and instead of the striated breast has a black crescent resembling a horseshoe. Occassional birds are seen at Bayswater, Ringwood and Mordialloc.

98. LEWIN'S HONEY-EATER (*Ptilotis lewinii*), Gould. Occasionally seen in the Dandenong Ranges. Crown of head and back olive green; underparts a shade lighter, yellow spot on ear. The sexes are alike in colour.

99. SINGING HONEY-EATER (*Ptilotis sonora*), Gould. —These birds are fairly numerous amongst the casuarinas at Werribee, where their loud chirps are frequently heard. The whole of the upper parts are greyish-olive, throat and breast yellow, striped with light brown. The sexes are alike in colour, but the male is larger than his mate.

100. WHITE-EARED HONEY-EATER (*Ptilotis leucotis*), Gould.—These birds are very plentifully scattered over the Dandenong district, and are said to do considerable damage to the soft fruit. Crown of head grey, face, neck, and throat black, a large oval white spot over each ear, the rest of the body olive-yellow.

101. YELLOW-TUFTED HONEY-EATER (*Ptilotis auricomis*), Gould.—In the mallee at Melton these birds

are constantly seen darting from tree to tree or seeking insects amongst the foliage. The sexes are alike, with black cheeks, crown of head olive-yellow, a bright yellow tuft projecting from each ear, the upper parts brown, tinged with olive-yellow, underparts yellow.

102. WHITE-PLUMED HONEY-EATER (*Ptilotis penicillata*), Gould.—This is by far the most common of our native birds. It is found in all descriptions of country, but especially near water, where they can indulge their love of bathing. They breed in all our parks and gardens. Plumage yellowish-grey, with yellow face and underparts, beautiful silky white plumes covering each ear.

103. FUSCOUS HONEY-EATER (*Ptilotis fusca*), Gould.—A number of these birds have lately arrived in the Melton forests, where five or six at a time may be seen performing all manner of antics as they seek their food amongst the foliage of the eucalypti. Entire plumage greyish-brown, with bright yellow ear coverts.

104. YELLOW-FACED HONEY-EATER (*Ptilotis chrysops*), Gould.—Our fruit growers give this bird a very bad character, alleging that it is one of the worst pests amongst the soft fruits. It breeds freely near Melbourne. Its colour is greyish-brown, lighter on the underparts, cheeks black, with a narrow yellow line running from the base of the bill to the ear coverts.

105. WARTY-FACED HONEY-EATER (*Meliphaga phrygia*), Lewin.—Although these beautiful birds were at one time very numerous near Melbourne they have now become extremely scarce. Their bright yellow and black-mottled plumage at once arrests attention. The bare skin around the eyes is covered with warty excrescences.

106.—SPINY-CHEEKED HONEY-EATER (*Acanthogenys rufigularis*), Gould.—This species bears a striking resemblance to the Wattled Honey-eater in shape, but is considerably smaller, and instead of the yellow breast of the latter it has a reddish-brown stripe from the base of the bill down the throat and neck. It derives its name from the fine white or yellow hair-like spines on its cheeks. During the winter months they become very tame and frequent the most popular reserves in the city.

107. WATTLED HONEY-EATER (*Anthochæra carunculata*), Gould.—This is the largest of our honey-eating birds, and also the most wary. Although the wattle birds are occasionally killed as game, they are still plentiful at Clayton and Melton, where they congregate in flocks during the winter. Their general color is greyish-brown, with a white stripe down the centre of each feather and a yellow breast.

108. BRUSH WATTLE BIRD (*Anellobia mellivora*), Gould.—In the ti-tree scrub which clothes the coast line from Brighton to Schnapper Point, these birds are very numerous, but they are seldom seen far inland. Their peculiar discordant notes soon betray their presence.

109. FRIAR BIRD (*Tropidorhynchus corniculatus*), Vigors and Horsfield.—These remarkable birds are now rare near Melbourne, but a few pairs still construct their stringybark nests and rear their broods at Whittlesea. From the bare black skin which covers its head this bird has gained the appellation of Leatherhead. Its general plumage is greyish-brown, lighter on the underparts, throat, neck and chest covered with glossy silvery white lanceolate feathers. A black horn-like knob at the base of the upper mandible adds to its peculiarities.

110. SPINEBELL (*Acanthorhynchus tenuirostris*), Gould.—This is our smallest honey-eater. It is

very tame and may be seen fluttering over the flowers in our suburban gardens in quest of insects and honey. Its long slender awl like bill has gained for it the name of "cobbler's awl." Its upper parts vary from glossy black to chestnut brown on the breast, and white markings on the throat and chest. The Spinebill makes a very neat cup-shaped nest in a low bush and lays two pale buff eggs.

111. LUNULATED HONEY-EATER (*Melithreptus lunulatus*), Gould.—Better known as the "Blackcap." The plaintive notes of this species are frequently heard amongst the foliage of the eucalypti in Studley Park. When engaged in extracting their food of honey and insects from the blossom they become so engrossed in their work as to permit man to approach within a few yards of them. The head is black with white band separating the greenish-olive of the upperparts, throat and underparts white, a small scarlet spot over each eye. Their nests are usually built near the top of large trees.

112. GARRULOUS HONEY-EATER (*Myzantha garrula*), Vigors and Horsfield.—These birds soon betray their presence by their loud notes and restless habits. They are very wary, and not only warn their fellows of the approach of danger, but frequently scare other game. I have noticed a flock of five or six birds hopping and uttering loud cries on the lowest branches of a tree as though an enemy was beneath them and immediately afterwards a hare scamped off. On another occasion my attention was drawn to a tiger snake in a similar manner. Plumage greyish-brown, with black across crown of head, and yellow on outer web of the secondaries. Bill, legs and feet orange.

113. BELL BIRD (*Manorhina melanophrys*), Gould.—Although Gippsland is the stronghold of this species, they are occasionally met with at Ringwood and Bayswater. Their bell-like notes soon denote their proximity, but their ventriloquial powers are so great that it is extremely difficult to find them when stationary amongst the thick foliage of the forest. The entire plumage is yellowish-olive, darker on the upperparts; bill, legs and feet orange-yellow.

114. SWALLOW DICÆUM (*Dicæum hirundinaceum*), Gould.—Unlike most small birds, the Dicæum seldom resorts to scrub, but passes its life in the open forest at the tops of the eucalypti, where it feeds on the fruit of the mistletoe and small insects found in the crevices of the bark. This bird is credited with the spread of the *Loranthus* from tree to tree by swallowing the fruit and passing the seed whole, which, being covered with a glutinous substance, adheres to the bark where dropped, and in course of time germinates. The male has the whole of the upper surface glossy blue-black, and the breast and under tail coverts scarlet, with a black line down the centre.

115. GREY-BACKED ZOSTEROPS (*Zosterops cærulescens*), Gould.—Better known as the "ring eye" or "silver eye" from the fact that each eye is circled with white. This little bird is very destructive amongst the soft fruits. It will hop from branch to branch of a cherry tree and pierce a hole in each of the ripest cherries and after a few sucks, hop off to another. But the damage thus done is amply compensated for by the insects which it destroys during the rest of the year. Its head, wings and tail are olive, back grey, throat and breast dirty white; sides chestnut-brown.

116. BROWN TREE CREEPER (*Climacteris scandens*), Temminck.—This is one of the tamest birds of our forests, and is equally at home hopping over the ground or clinging to the bark of the giants of the forest. When disturbed, it usually flies to the base

of the nearest tree, and, by a succession of hops, soon gains the branches, when it utters a loud note, and again glides off, scarcely moving its wings after the first two or three flaps. It feeds on the insects which it finds on the ground or in the cracks of bark and dead timber. Its nesting place is usually in a hollow limb. Plumage dark brown above, striated breast, and a buff band crossing the inner web of each of the long feathers.

117. WHITE-THROATED TREE CREEPER (*Climacteris leucophæa*), Strickland. Similar in habits to the foregoing. This bird is most frequently found in the hilly country of Ringwood, where it is highly valued by the fruit growers as an inveterate enemy of many orchard pests. It is readily distinguished by its white throat.

118. ORANGE-WINGED SITTELLA (*Sittella chrysoptera*). Whilst the Tree Creepers invariably ascend the trees and work with the head upwards, the Sittella will as frequently cling to the underside of a limb, or descend the trunk head downwards. Except at breeding time, they are usually seen in small flocks, and when one is disturbed, the rest follow. Its beautiful little nest is generally placed in a forked branch, and the outer walls are so covered with small pieces of bark resembling its surroundings as to render its discovery a difficult matter.

119. PALLID CUCKOO (*Cacomantis pallidus*), Gould. —Like the Cuckoos of the old world, this bird is strictly "parasitic," and although the adult bird satisfies its appetite with caterpillars and other insects, it generally deposits its eggs in the nests of honey-eaters, but occasionally insectivorous birds bear the burden of foster parents. At such times, it is interesting to watch two small birds industriously working to supply the wants of a bird about three

times their size. However, the duty sometimes devolves upon the Oriole or Wattle Bird, and then matters are more even. To compensate for its neglect of parental responsibility, however, the Pallid Cuckoo is one of our most valuable insectivorous birds. It is migratory, arriving in the early spring and disappearing in autumn. The male is olive-brown above and grey beneath, its tail is long, and its flight undulating. The female has all the upper surface spotted with light brown. Both birds have a fine yellow line round the eyelids and at the gape. Tail feathers toothed with white.

120. FANTAIL CUCKOO (*Cacomantis flabelliformis*), Bonap.—Somewhat smaller than the foregoing, but similar in shape. This Cuckoo leaves the rearing of its young to the *Maluri* and *Acanthizæ*. It is less common and is generally confined to hilly country. All the upper parts slaty-grey, breast rusty-brown, eyelash yellow.

121. BRUSH CUCKOO (*Cacomantis insperatus*), Gould.—Although closely resembling the Fantail Cuckoo in many respects, this bird is smaller in size, and lacks the white tail markings. Its eggs are also different, being nearly white ground colour with a well defined zone and large spots of slaty grey. They are found in the nests of robins and flycatchers.

122. BRONZE CUCKOO (*Lamprococcyx plagosus*), Gould.—Much smaller in size than the Brush Cuckoo, this bird has also a much shorter tail, and bright coppery-bronze head and back, its breast is grey, crossed with bronze bars. Its olive-coloured egg is frequently found in the nest of the yellow-tailed Geobasileus.

123. NARROW-BILLED BRONZE CUCKOO (*Lamprococcyx basalis*), Gould.—Scarcely distinguishable from the Bronze Cuckoo, except for its lighter colour and thinner bill. This bird lays its white egg, freely

spotted with red, in the nests of the *Acanthizæ* and *Maluri*. I have taken the two species of cuckoos' eggs from one nest, with two of those of the legiti- owner. I have never been able to ascertain how this Cuckoo manages to deposit its egg in a nest with such a small opening as the *Geobasileus*, but I have shot both *L. plagosus* and *L. basalis* on the ground, and, on picking up the dead bird, found its egg a few inches from it.

124. GREAT SULPHUR-CRESTED COCKATOO (*Cacatua galerita*), Gould.—Ever since the colony was founded, these Cockatoos have regularly visited our agricultural districts during the autumn and winter months, where they do considerable damage to the newly sown corn, but as spring advances they retire to the north and western districts to breed. Occasionally their nests are found in the hollow spouts of the large eucalyptus trees of Melton and Whittelsea. Their nesting places are easily recognised, as no matter how often the same opening is used, the birds always chip off the surface of the wood at the entrance, as though done with a hatchet.

125. ROSE-BREASTED COCKATOO (*Cacatua roseicapilla*), Gould. During the winter, large flocks of these birds make their appearance in the Broadmeadows and Bulla districts, where their constant cries always attract attention as they fly from their feeding grounds to roost. They destroy a small portion of the early-sown seed, but their stay is short, and before spring is well advanced they all disappear, and do not breed near Melbourne.

126. BLACK COCKATOO (*Calyptorhynchus funereus*), Gould.—Although in the early fifties these birds were common in the neighbourhood of Heidelberg and other places along the course of the Yarra, they are only found at present in the vicinity of the Dandenong Ranges. Their slow flight and loud

cries as they traverse from one part of the ranges to another at once proclaiming their identity. They are extremely fond of larvæ of insects, which they they extract from decayed trees by the aid of their powerful bills.

127. GANG-GANG COCKATOO (*Callocephalon galeatum*), Gould.—These birds are now becoming scarce, owing to the fact that they are so much sought for the sake of their distinctly Australian association. Whilst the female is dark slate colour, with each feather margined with greyish-white, a shade of greenish-yellow on the external web of the wing feathers, and a little red on the breast, the male has the whole of the head and crest a brilliant scarlet. They are so easily approached that they fall victims to the merest tyro with a gun. They are occasionally seen as near as Oakleigh.

128. BARRABAND'S PARRAKEET (*Polytelis barrabandi*), Gould.—This is the only representative of the genus that ever frequented this part of the colony, but although they were at one time very common in the vicinity of Keilor and Heidleberg, they have quite disappeared of late years, the only specimens shot being escaped cage pets. They are readily recognised by their bright green plumage, orange colored forehead, face and throat, the lower margin of the latter being fringed with scarlet, and a very long tail, black on the under side.

129. PENNANT'S PARRAKEET (*Platycercus pennantii*), Gould.—When in its adult plumage this is one of the most conspicuous birds of our forests. With head, neck and underparts rich crimson red; back black, but each feather margined with red; cheeks, shoulders and tail blue, it is at once noticed whether feeding on the ground or passing with undulating flight from tree to tree. Of late years they have developed a decided taste for fruit, which is not appreciated. The sexes are distinguished by the difference in size.

130. Rosehill Parrakeet (*Platycercus eximius*), Vigors and Horsfield.—The "Rosella" is to be found throughout the year in all our forests. It is very local in its habits, and frequently breeds in the same tree for several years. Its extremely showy plumage has rendered it a general favourite as a cage pet.

131. Red-rumped Parrakeet (*Psephotus hæmatonotus*), Gould.—From Campbellfield to Donnybrook great numbers of these Parrakeets are seen, either hopping amongst the grass or perched on the fences and trees. The male has bright green head and upper parts, red rump, and yellow breast. The female and young are uniform greenish-grey, darker on the upper parts.

132. Blue-banded Grass Parrakeet (*Euphema chrysogaster*), Gould.—These beautiful little Parrakeets are seen in large flocks near Melton during the spring months; but scattered pairs may be found throughout the year all round Melbourne. They are particularly fond of the seeds of certain plants which abound in potatoe fields. Their plumage is dark olive-green on head and back, blue on forehead and shoulders and bright yellow breast.

133. Swift Flying Lorikeet (*Lathamus discolor*), Gould.—At one time very common; these birds are now seldom seen. A few years ago specimens were secured at Brighton. A flock of these birds dashing through the forest forms a very pretty sight, as it reveals the bright scarlet under side of their wings. They are very restless and migratory, seldom remaining long in one place. They are never seen on the ground, but feed on the honey which they extract from the blossom of the eucalypti. Their plumage is dull green with red face, shoulders, tail and under sides of the wings. The sexes are only distinguished by dissection.

134. Blue-bellied Lorikeet (*Trichoglossus multicolor*), Wagl.—Although these beautiful Lorikeets

were at one time very numerous around Melbourne, and many of the blue gum trees in our Parliamentary reserve have been gay with their plumage as they satisfied their taste from the blossom, they are now very scarce. The last occasion on which they were present in numbers was in March of 1874, when they destroyed nearly all the ripe pears in the gardens at Dandenong. Since then only occasional birds have been seen. They may be known by their violet-blue head, green back and wings, and breast mottled with blue, scarlet and yellow.

135. Musk Lorikeet (*Glossopsitta australis*), Bonap.—This little honey-eater is very common all over the colony. Whilst feeding on a low branch, they are easily knocked down with a whip, being so engrossed with the blossom that they fail to notice the approach of an individual. They have recently developed a taste for fruit, which is not admired by our orchardists. Their plumage is all green except a band of crimson across the forehead, cheeks and ear coverts, and a small spot of yellow on each side of the breast. Except at breeding time, they congregate in flocks.

136. Porphyry-crowned Lorikeet (*Glossopsitta porphyrocephalus*), Bonap.—During the past two years these birds have made their appearance in considerable numbers in our parks and gardens. Their habits are similar to the foregoing, but the birds are smaller in size. Plumage uniform green with a band of scarlet and yellow extending across the forehead and ear coverts; the crown of head dark purple.

137. Little Lorikeet (*Glossopsitta pusilla*), Bonap.—This is the smallest species of honey-eating parrakeet found in Australia. It is occasionally seen in company with either of the two preceding species. A few years ago they were very numerous in the

Oakleigh district, but are now scarce. With the exception of a band of scarlet round the base of the bill, the entire plumage is green.

RASORES.

138. Bronze-wing Pigeon (*Phaps chalcoptera*), Selby.—These splendid game birds are becoming rare owing to the efforts of our numerous sportsmen to secure them. They have quite disappeared from the immediate vicinity of the city, but a few are still seen at Melton and Beveridge. Their flight is very rapid as they pass from one feeding ground to another or visit their accustomed watering places.

139. Brush Bronze-wing (*Phaps elegans*), Gould.—Slightly smaller than the foregoing and with shorter wings, the Brush Bronze-wing is confined to the ti-tree scrubs which skirt our coast-line. Its wings are ornamented with beautiful patches of bright coppery-bronze. Owing to the advance of settlement it has now become rare, but occasionally odd birds are shot at Mordialloc and Cheltenham.

140. Varied Turnix (*Turnix varius*), Viell.—Birds of this species are seen throughout the year in the hilly scrub of Ringwood and Bayswater. They are very local in their habits and feed largely on insects, but they fly swiftly when disturbed and run rapidly on alighting. They are highly esteemed as game.

141. Swift-flying Turnix (*Turnix velox*), Gould.—The home of the Swift-flying Turnix is undoubtedly the arid plains of Northern Australia, but they occasionally migrate southward in great numbers. Owing to their small size and rapid flight they test the skill of the sportsman to the utmost. They are furnished with a strong bill, more like a finch than a quail.

142. Collared Plain Wanderer (*Pedionomus torquatus*), Gould.—These rare birds are only found in

open plains with very short grass, through which they run with surprising speed. When set by a dog they will occasionally permit themselves to be caught rather than take to the wing. The female is particularly handsome: Head, back and wings light brown, each feather spotted with black; lighter on breast; a broad black band, spotted with white, encircles the neck; centre of chest rusty-brown; legs pale yellow and bare above the joint. The male is smaller, and lacks the collar and chest markings. They deposit their four eggs beside a tuft of grass or stone and surround them with merely enough grass to keep them together.

143. Pectoral Quail (*Coturnix pectoralis*), Gould.—Under the name of "stubble quail" these birds are well known. Owing to the delicacy of their flesh they are much sought as game; they are very prolific breeders, producing two or three broods of from nine to twelve chicks. They frequent alike corn fields and grassy plains, where they live on a mixed diet of seeds and insects.

144. Swamp Quail (*Synoicus australis*), Gould.—The grassy margins of creeks, or damp, swampy flats, are the usual haunts of the brown or swamp quail. During the winter months it feeds largely on clover and other vegetable food, which adds to the delicacy of its flesh. The swamp quail is local and can be found throughout the year in favourable situations.

145. Least Swamp Quail (*Excalfatoria australis*), Gould.—Frequently known as the "king quail," these beautiful little birds are generally found in damp, swampy localities, where their habits are similar to the preceding species. The sexes differ greatly in plumage. Whilst the female is somewhat like a diminutive *Synoicus australis*, the male has the upper parts slaty-brown; throat black with a crescent of white dividing it from the bright chestnut-brown of the breast and flanks.

GRALLATORES.

146. Australian Bustard (*Choriotis australis*), Bonap.—These birds are frequently seen during the spring and summer months on the open plains of Keilor and Werribee, where they render valuable assistance in the destruction of grasshoppers. They are very shy, but curious, and will stand looking at any remarkable object sufficiently long to permit the sportsman to approach within shooting range. They breed on the plains of the interior, usually laying a single egg on the bare ground.

147. Southern Stone Plover (*Ædicnemus grallarius*), Gould.—Although nocturnal in habit these birds are extremely wary in the brightest sunshine. On the approach of an intruder they run off very rapidly and only fly when followed. At times they will lie flat on the ground as if dead, and in this position I caught two of them near Heidelberg. They are usually found in pairs in open forests. At night they utter a loud weird note which sounds like "wetlo" or "curlew," which probably accounts for their being confused with the Curlew by our bush naturalists.

148. Wattled or Spur-winged Plover (*Lobivanellus lobatus*), Gould.—Whilst swamps are the favourite haunts of these birds, they are also found far from water in open forests. They are very handsome, having the crown of the head, black; forehead and nearly all the face enveloped in a waxlike yellow wattle; back and wings, brown; breast white with a black patch on each side of chest. A remarkable horn-like spur projects from each shoulder. They are often seen near the mouth of the Yarra.

149. Black-breasted Plover (*Sarciophorus pectoralis*), Gould.—These birds are found in large flocks on the Keilor and Melton plains, but immediately

ploughing is started they at once resort to the newly turned soil and renders the farmers valuable service in the destruction of crickets, grubs and other insects. During breeding time they become very daring and perform all manner of antics to allure the intruder from their young. They are about half the size of the of the Spurwing Plover, and derive their name from the black band which crosses the breast.

150. Black-fronted Dottrel (*Ægialitis nigrifrons*), Gould.—Along the banks of the Yarra these beautiful little waders are often seen. When disturbed they simply follow the course of the stream for a short distance, alight again on the bank and run rapidly along the water's edge in search of aquatic insects.

151. Red-capped Dottrel (*Hiaticula ruficapilla*), Bech.—This little bird seems to prefer salt water to fresh, and large flocks may be noted on the sandy beaches of St. Kilda and Brighton. They are not easily driven from any of their favourite haunts, and have been known to lay their eggs within 100 yards of the St. Kilda jetty.

152. White-headed Stilt (*Himantopus leucocephalus*), Gould.—The Carrum swamp is occasionally visited by these graceful waders. Their stately stride whilst searching for food contrasts oddly with the manner in which they fly with their long legs extended like two straws in their rear. Back of neck, back and wings, glossy black; head, throat and underparts white.

153. Red-necked Avocet (*Recurvirostra rubricollis*), Gould.—These remarkable birds frequent the Carrum swamp, and the mouth of the Yarra, where, by the aid of their awl-like bill, they capture the most minute aquatic insects. Head and neck, rich chestnut-brown, black on wings, remainder of plumage white.

154. Marsh Sandpiper (*Totanus stagnatilis*), Bech.—Solitary birds of this species are often seen on the margins of the lagoons at Heidelberg.

155. New Holland Snipe (*Gallinago australis*), Gould.—During the spring and summer months these migrants visit the swamps at Carrum, Whittlesea, and Werribee, in considerable numbers, but, owing to their restless habits, they seldom remain in one district for any length of time, so that sportsmen securing good bags one day may search in vain for them the following day. In hot weather they lie close, and are easily shot, but in cool or windy days they are very wild, rising thirty or forty yards away, and after following a zig-zag course for a short distance, dash off out of the district.

156. Straw-necked Ibis (*Geronticus spinicollis*), Gray.—During the summer months flocks of these birds may be seen at Rockbank, Werribee, Dandenong, or Heidelberg. They invariably appear simultaneously with the immense flights of grasshoppers which they devour ravenously. They are very wary, and, when disturbed, present a very striking appearance as they fly with their snow white tails spread.

157. Australian Crane (*Grus australasianus*), Gould.—On very rare occasions the Native Companion visits the open country near Bulla. Although seldom seen recently, they were shot in the early sixties at Fairfield Park.

158. Pacific Heron (*Ardea pacifica*), Lath.—These Herons are often seen at Rockbank and Melton, where their long white necks render them very conspicuous as they wade in the shallow swamps in search of frogs and aquatic insects.

159. White-fronted Heron (*Ardea novæ hollandiæ*), Lath.—These beautiful birds are common wherever water exists. Along the course of the Merri Creek they are often shot within three miles

of Melbourne. They are very fond of the black crickets, in the destruction of which they render valuable service to our gardeners. Face and throat, white; neck and back, slaty-grey; breast and underparts, grey, tinged with red.

160. Nankeen Night Heron (*Nycticorax caledonicus*), Less.—The course of the Yarra is a favourite resort of the Nankeen Heron. They pass the day motionless amongst the foliage of the high branches of the eucalypti, but resort to shallow swamps to feed. A flock of five or six birds have remained at the Royal Park for several years. They are very beautiful. Head and nape, black; upperparts, cinnamon-brown; underparts, cream colour. Long white straw-like plumes extend from the crown of the head.

161. Australian Bittern (*Botaurus poiciloptilus*), Gould.—Odd birds of this species are occasionally shot near the lagoons in the vicinity of Heidelberg.

162. Black-backed Porphyrio (*Porphyrio melanotus*), Temm.—All the lagoons and swamps in the vicinity of the Yarra, from Princes-bridge upwards, are frequented by these birds. Where they are not disturbed they soon become very tame. They roam over the grass, on which they feed, like domestic fowls. Head and upperparts, sooty-black; underparts, blue; under tail coverts, white; bill and frontal plate, wax-like; and red toes, very long.

163. Black-tailed Tribonyx (*Tribonyx ventralis*), Gould.—The swamps at Rockbank and Melton are occasionally visited by this species. When seen running threugh the grass with their tails erect, they are very like dark coloured bantam fowls. One rather wet season they bred in great numbers on Mr. Raleigh's farm, Melton, making very small nests around the shallow pools formed by the rain, and as soon as their broods were reared they all left the district.

164. Australian Coot (*Fulica australis*), Gould.—Numbers of these birds visit our Botanical Gardens and rear their broods around the lake. They are also seen at Princes Bridge swamp.

165. Pectoral Rail (*Hypotœnidia philippensis*), Bonap.—These showy waders are found in the long grass on the margin of almost every sheet of water near Melbourne. They lie very close when approached, and only fly, when forced to do so, for a short distance. They breed annually near the Merri Creek.

NATATORES.

166. Black Swan (*Chenopis atrata*), Wagl.—Flocks of these birds frequently pass over the suburbs during the night, as they traverse from one swamp to another. They are occasionally shot at Heidelberg, Werribee and Laverton.

167. Maned Goose (*Chlamydochen jubata*), Bonap.—Whittlesea and Melton are frequently visited by these birds. They breed in the hollow spouts of the large trees, and may be seen perched on the branches like one of the insessores. Generally known as the "Wood Duck." They are very handsome, and their flesh is highly esteemed.

168. Chestnut-coloured Sheldrake (*Casarca tadernoides*), Eyton.—The open grass padocks of Melton are visited by these birds in search of food. They generally fly in pairs and are the largest ducks found in Victoria.

169. Wild Duck (*Anas superciliosa*), Gmelin.—This is the most common and widely dispersed of our Australian ducks. As their food consists chiefly of grass their flesh has an excellent flavour. The sexes are alike in plumage. Although they occasionally make a nest amongst rushes on the margin of water they have been known to hatch their brood in a hollow branch over a mile from any pool.

170. Chestnut-breasted Teal (*Anas castanea*), Eyton.—The male of this species is a very showy bird with its green head, chestnut underparts with a round black spot on each feather. The female is less ornamental but the same size. They are shot at Carrum.

171. Common Teal (*Anas gibberifrons*), Müller.—These well-known birds are met with in small flocks wherever sheets of water exist. They usually nest in hollow trees far from water, but soon march their broods to their native element. They are true grass feeders and are capital eating.

172. Pink-eyed Duck (*Malacorhynchus membranaceus*), Swainson.—Occasionally a few of these curious little ducks are seen on the pools near Melton during the winter months. They are easily recognised by their large bills and a peculiar pink spot behind the eye.

173. White-eyed Duck (*Nyroca australis*), Gould.—These birds are such expert divers that it is a difficult matter to shoot them when on the water. They are very partial to large open swamps, but also visit the lagoons near Heidelberg.

174. Musk Duck (*Biziura lobata*), Eyton.—Along the coast-line from Brighton to Mornington, many of these birds may be seen resting placidly on the surface of the water or diving to avoid a passing boat. The male has a large leather-like appendage suspended from his throat and is much larger than his mate.

175. Pacific Gull (*Larus pacificus*), Latham.—Birds of this species in all stages of plumage, from the dark brown young to the pure white and black adult, may be seen in Hobson's Bay disputing with the next species for the offal thrown from the vessels at the piers.

176. Silver Gull (*Zema novæ hollandiæ*), Stephens.—These handsome gulls seem equally at home in

either salt or fresh water, and in stormy weather large flocks visit the swamps at Werribee and near Princes Bridge. They follow every vessel in Hobson's Bay and feed on the offal thrown overboard. Owing to their beauty and grace of their plumage and usefulness as insect destroyers they are in request as garden pets.

177. Bass Strait Tern (*Thalasseus poliocercus*), Gould.—These longed winged birds are constantly seen pursuing their rapid flight. They are solitary in their habits and generally seen singly.

178. Australian Pelican (*Pelicanus conspicillatus*), Temminck.—Near the mouth of the Yarra pelicans are often seen standing motionless on the mud flats as if resting prior to resuming their journey to more congenial haunts.

179. Australian Cormorant (*Palacrocorax novæ hollandæ*), Stephens.—Large numbers of these cormorants frequent the Bay, the Yarra, and even the lakes in our reserves, where they destroy large numbers of fish. When their appetites are satisfied they stand with their wings expanded in order to dry them before starting on a lengthy journey. They are commonly known as "black shags."

180. Little Cormorant (*Phalacrocorax melanoleucus*), Gould.—Very similar in habit to the foregoing species, and frequenting the same waters. As vessels pass up and down the Yarra the Little Cormorants perched on the piles turn their white breasts to the gaze of the passengers.

181. Little Black Cormorant (*Phalacrocorax stictocephalus*), Bonaparte. — Occasionally seen at Heidelberg and other places on the course of the Yarra.

182. Australian Gannet (*Sula australis*), Gould. —One of the most interesting sights from the excursion steamers in Hobson's Bay is to observe

the Gannet flying about 100 feet from the surface of the water and suddenly dropping like a stone upon some unwary fish, splashing the spray to a height of 10 or 15 feet. They very seldom fail to secure their prey.

183. Black-throated Grebe (*Podiceps gularis*), Gould. — Frequently known as the "Dab-Chick." Although possessing very short wings and seldom seen to fly, these birds are found in most of our large swamps, from which they disappear as the water dries up. They are expert divers, and are seldom seen on land.

184. Little Penguin (*Eudyptula minor*), Bonaparte.—Although unable to fly these birds manage to swim from their breeding grounds at Phillip Island and various places in Bass Strait to the sandy beaches of Brighton and Mordialloc, where their loud croaking is heard at night. They are often caught in the fishing nets off Williamstown.

185. Fairy Penguin (*Eudyptula undina*), Gould.— These little Penguins are occasionally found at Phillip Island and in Bass Strait. They are similar in habits to *E. minor*, but smaller in size. They swim so rapidly under water as to be able to pursue and capture any small fish.

VICTORIAN ENTOMOLOGY.

BY C. FRENCH, F.L.S.

Like the Flora, the insect Fauna of Victoria may be said to be in some measure unique. With comparatively few exceptions, the representatives of the numerous genera do not occur outside Victoria. Whilst some, both of our genera and species, do extend into other colonies, notably New South Wales, Queensland, and South Australia, it is still more common to find insects from these colonies in various portions of Victoria, whilst only rarely do we meet with forms belonging to Western and Central Australia. Outside the orders Coleoptera and Lepidoptera, but little work has as yet been done towards the elucidation of the problems connected with the insect life of Victoria; nor does there even exist a general work treating of these two large orders. This is doubtless to be accounted for in large part by the fact that such a great number of specimens are sent direct to Europe and elsewhere, and hence the literature has become scattered over the whole scientific world, and being in many languages, it is rendered very difficult for anyone not in possession of, or having access to, a complete library of scientific works and periodicals, to work with safety and accuracy.

The absence, too, of a complete and well-named national typical collection is to be deplored, though this can be perhaps excused in a young colony like Victoria, where the lack of specialists in the various departments of entomology renders the systematic naming of specimens well nigh impossible. In this respect the botanist is better off than the entomologist,

since he can avail himself of the most complete herbarium of Australian specimens in the world.

The study of economic entomology—of the life history of the injurous or useful insects of our colony—is yet in its infancy, and although a little has been done by private individuals, as also in our National Museum, it cannot be said with truth that the subjects has obtained the consideration which it deserves. We hope, however, with the co-operation of all entomological workers, and with the advent of a new era at the National Museum, to be able to report ere long that this branch of natural history is in a more satisfactory state.

In looking over the literature of Victorian entomology, we are at once struck with the small number of species which are credited to us as being peculiar to Victoria. Although there are a large number of insects (other than those of the orders Coleoptera and Lepidoptera) described in European and other works, many of these works are almost out of print. Not only this, but many of the names adopted are obsolete, or nearly so, whilst others are in the French, German, Italian, or Russian languages, and, to the uninitiated, are next to useless.

The attention of the greater part of those who, in Victoria, have taken up the study of insects, has been confined to the large order Coleoptera, or Beetles, and in most cases special attention has been paid to certain groups, the members of which are remarkable for brilliancy of colour, grotesque form or large size, to the exclusion of minor, less attractive, but not less important groups, which have been sadly neglected, but we are pleased to find good Lepidopterists on the increase.

Taking first the Coleoptera, the *Buprestidæ* present examples of some of the most brilliantly coloured amongst insects, and although we cannot in Victoria

boast of such splendid species as are found in tropical parts, yet some of ours, though small, are as beautifully marked as any to be found elsewhere. We can muster, of *Buprestidæ*, some 150 species, the largest being *Stigmodera heros*, an insect destructive to the trees of *Melaleuca uncinata* in the Mallee district, the north-west portion of the colony. This insect has also been taken in South and Western Australia. The next largest are *Stigmodera villicollis* and *S. fortnumi*, both very fine beetles of great rarity. Each of these three measures about three inches in length, whilst the smallest, a species of *Aphanisticus*, only reaches the length of one line.

The Buprestidæ, whilst in the larval stage, are all more or less injurious to vegetation, owing to their boring habits. As a rule the perfect insect lives amongst flowers, and, with the exception of the genera *Chalcophora* (of which genus we have one species, *C. albivitta*, in Victoria), *Cyria*, and a few others, may be found on the flowers of our native and other plants. Australia altogether can boast of between eight and nine hundred species of this splendid family.

Next in importance we may regard the Longicorns, or long-horned beetles. These are more numerous in Victoria than the *Buprestidæ*, and are justly admired on account of their elegant form and singular habits. The Longicorns are all wood-feeders, and many are amongst the most destructive of our Victorian insects.

Foremost amongst these we may instance *Phoracantha tricuspis*, a large brown beetle, the larva of which is found in the timber of various kinds of gum trees. On a hot summer's evening the perfect insect may often be seen emerging from the tree in which it has passed the early part of its existence. Being on a visit once to the north-west part of the colony, my

attention was drawn to an insect which had made great havoc amongst the redgum trees (*Eucalyptus rostrata*), and upon splitting open a large limb, there in the centre lay a large swarm of a very common and well-known Longicorn, *Phoracantha recurva*, and, with the adult, numbers of the young larvæ. One of our largest Victorian species, *Cnemoplites edulis*, feeds almost solely upon the wood of the beach honeysuckle (*Banksia integrifolia*), and by the united action of its larvæ, together with those of a Buprestid beetle, the tree is soon destroyed.

It would be useless to enumerate the large number of species of this family, so we may pass on to the family *Cetonidæ*. This splendid group of beetles which contains in its ranks the gigantic goliath beetles of tropical Africa, are fairly numerous in Australia. In Victoria we have several pretty and rare species, one of the most beautiful of them being *Schizorhina australasiæ*, an insect whose wing cases are of a dark chestnut colour, with irregular bright yellow markings, somewhat in the form of a lyre. The largest and rarest of our Victorian species is *Schizorhina bakewelli*, a splendid insect of about an inch and a half in length, and of a bright, shining chestnut colour. This fine species is sometimes found lying dead, but I have taken one pair alive, and these were feeding on the exuding gum of *Acacia decurrens*, or black wattle. In all, fourteen species represent this genus in Victoria, the two commonest being *S. australasiæ* and *S. punctata*. The genus *Valgus* (*Microvalgus* of Kraatz) is also represented by one species, viz., *Valgus lapeyrousii*, of about one line in length. Many of these insects, when in the larval stage, do harm to crops, but the damage done by them is quite insignificant when compared with that of the following group, commonly known as cockchafers.

The group *Melalonthini* comprises a large number of species, the type of which may be said to be the well-known cockchafer of English fields and gardens. This is *Melalontha vulgaris*, not a very large insect, but a most destructive one to crops. In Victoria we have about eight species, all of which may be classed as destructive, the larvæ feeding upon the roots of cereals, etc., and the perfect insect stripping the *Eucalpyti* of their foliage.

Of the larger specimens of the great Lamellicorn group, we have none, but in N. Queensland there are two, *Xylotrupes* and *Oryctes*, both of which are large, clumsy and heavy insects of three inches in length.

The *Carabidæ*, which stand first in the natural arrangement, are pretty well known and described, the late Count de Castlenau, Baron Chaudoir, the Hon. Sir W. Macleay, Sloane and others having done good work in this direction. A large number of the splendid group *Scaritidæ* have been worked out and figured by the well-known English entomologist, J. O. Westwood, although most of these so described have come from the other colonies.

In Victoria we can muster a large number of *Carabidæ*, probably four to five hundred species, our largest being the fine *Hyperion schraetteri* (Castlenau), the only one of the genus. One of the smallest is perhaps a species of *Scopodes*, although there are several that are almost microscopic in there character, but of these the names are not always reliable.

A very singular group is the *Paussidæ*, the antennæ of these little insects being most peculiar, whilst their habits are more peculiar still. They are often termed "soldier beetles," as, on being taken up by the hand, they eject a kind of reddish powder, not unlike smoke, and hence the vernacular name. We have five species of this group in Victoria, but of *Pselaphidæ*, minute beetles that live in moss and in ants' nests, we have a great number; in fact, Victoria may be said to be somewhat rich in this latter group.

The *Elateridæ*, or "skip-jacks," are also largely represented in Victoria, and many of them may be considered to be injurious to vegetation. The largest of our native species is *Tetralobus cunninghami*, the male of which has pectinated antennæ. The great group of the *Curculionidæ*, or weevils, are numerously represented, and up to the present time not less than 1200 species have been described by Mr. Pascoe, Sloane, Blackburn, Lea and others, and of this number Victoria can muster at least 300 species. The *Tenebrionidæ* are also very numerous, and some of them are most destructive. The *Bostrychidæ* and *Scolytidæ* are, unfortunately, but too well known, both being borers of the most mischievous kind, apples, pears, and other fruit trees, as well as elms and various forest trees, having suffered considerably from their attacks.

The large group *Chrysomelidæ* is well represented in Australia, and Victoria has her fair share of these elegant and often highly coloured little creatures. There are many kinds which are most injurious, but others again are harmless; still all, or nearly all, are leaf-feeders.

The *Nitidulæ*, amongst which are many insects that destroy wattles, gums, and other timbers, are, upon the whole, not numerous, which for the colonists is a fortunate circumstance.

The *Staphylinidæ*, and the *Necrophoridæ*, are not numerous, although there is a goodly number of the minute species of the former to be taken upon flowers, etc.; the larger kinds, as *Creophilus*, living solely upon carrion, but the latter group, although to some extent useful as scavengers, are not often to be met with.

In the *Colydiidæ*, we have a group amongst which are several insects destructive to timber, etc., but they are not numerous in the colony.

The *Lucanidæ* (always favourites with collectors) are fairly well represented in Australia, but very few species occur in Victoria. The genera, *Lamprima*, *Nigidius*, *Rhysonotus*, *Lissopterus*, *Lissotus*, *Syndesus*, *Ceratognathus*, and *Figulus*, being the only ones found here. Without a doubt the new Lucanid, *Phalacrognathus muelleri*, introduced from N. Queensland, is the most splendid of the whole group, and it is allied to our well-known genus *Lamprima*, or golden beetle.

Victoria is not rich as regards the *Coccinelidæ*, or lady-birds, although we have many species, one or more of which is said to be of much benefit in keeping in check certain kinds of the *Coccidæ*, or scale insects, these latter, according to report, being destroyed by the larvæ of the lady-birds.

In the order *Lepidoptera*, we are comparatively poor in the *Rhopalocera*, or butterflies, the principal groups being the *Papilionidæ*, *Pieridæ*, *Nymphalidæ*, *Danaidæ*, etc.; and in the *Heterocera*, or moths, although we have a vast number of small and micro-lepidoptera, there are comparatively few that are large and fine, as are many of those from Queensland and New South Wales, notably the *Hepialidæ*, etc. Some of our largest diurnal moths are species of *Antheraea*, one of which, *A. eucalypti*, is very destructive to young gum trees, the eggs being laid by the female upon the leaves, the larvæ when hatched feeding most voraciously upon the tree. The moth is large and of a buff colour, with two eye-like spots on the wings. The larva is, when full grown, about four or five inches in length, and the markings on it are of the most beautiful colours.

The larvæ of a large number of Victorian moths are very destructive, more especially those of the

Tortricidæ, *Tineidæ*, *Noctuidæ*, etc., the well-known codlin-moth belonging to the former group. The large moth, *Endoxyla eucalypti*, is terribly destructive while in the larval state, to our common wattles, and many of the *Hepialidæ* (all wood destroyers), are plentiful in the colony. The well known *Leto staceyi*, of New South Wales, is one of the largest of these forms, measuring quite nine inches across the wings. In Victoria we have some very beautiful ones, some being of a bright green colour, but very destructive to the native timber, also to fruit trees.

The *Sphingidæ*, or hawk moths, are not well represented in the colony, and we have but four or five kinds, the beautiful species, *Chaerocampa australasiæ*, being destructive whilst in the larval stage to vines. The largest is *Cæquosa triangularis*, a splendid insect, measuring about six or seven inches across the wings, but comparatively rare in Victoria. In Queensland and New South Wales there are many fine species, some of the genus *Macroglossa* being very singular and interesting.

Our space being limited, we must leave the *Lepidoptera*, and pass on to the *Orthoptera*, a group which furnishes us with some of the largest and most grotesque specimens of insect life. The *Phasmidæ*, or "spectre insects," are few in Victoria, although some of them, as *Acrophylla*, *Cyphucrania*, and others are large and showy, the former sometimes attaining a length of 14 inches, and a width across the wings of 12 inches. This species is dark in colour, but the *Cyphucrania* is of a most beautiful and delicate green, white, and pink. There are other kinds, but they are smaller. The *Phasmidæ* are mostly vegetable feeders, whilst the *Mantidæ* (of which our common "praying mantis" may be taken as the type) subsist for the greater part on insects, which they capture with great dexterity. The

singular wax-like cocoons which we find attached to the heath shrubs about Brighton are those of the *Mantidæ*. To the order *Orthoptera* belongs also the family of the much-dreaded locust, as also the various kinds of grasshoppers that work such dire destruction in many parts of the colony. The *Blattidæ*, or cock-roaches, are fairly numerous here, and the common *B. orientalis* has been introduced, probably in ships' cargoes, and, like most other noxious insects, both native and introduced, seems to flourish but too well.

The mole-cricket, belonging to the family *Gryllidæ*, is also here, and does a considerable amount of damage to gardens.

Among the *Neuroptera* also must be mentioned the widely known *Libellulidæ*, or dragon flies, which are well represented in Victoria, many kinds being of large size, whilst others, also with beautiful blue and green bodies and transparent wing, are not uncommon. The most beautiful species occur, however, in tropical Australia. That great scourge of the gardener, the well-known Thrips, belongs to the *Thripidæ*, the much-dreaded Termites, or white ants, belonging to the *Neuroptera*.

Among *Neuroptera* may be mentioned the Ant-lion *Myrmeleon*, *Glenurus*, *Supholesca*, etc.

The *Hymenoptera* are very numerous in Victoria, foremost among them being the Ichneumonidæ, many of which group are exceedingly useful to farmers and fruit growers, as some of these insects deposit their eggs in the bodies of locusts, moths, and other noxious insects. The "Chalcid flies," as also the *Proctotrypidæ*, are also useful, these also depositing their eggs in the bodies of other small insects, more especially whilst in the larval state. Other kinds, as the *Cynipidæ* and the *Tenthredinidæ*, or saw-flies, are most destructive to vegetation, either by eating the epidermis off the leaves of fruit trees, or causing

galls by depositing their eggs on the trees. One of the largest of our saw-flies belongs to the genus *Perga*; and the well-known "pear-slug," *Selandria cerasi*, which is an introduction from America, is terribly destructive to the orchardist.

The *Mutillidæ*, the females of which are apterus, and have stings, the males as a rule being stingless, are a most singular group of insects, the females being often mistaken for ants. This group has been fairly well worked up, principally by British entomologists.

Of the *Formicidæ*, or ants, though Victoria is very rich in numbers, both of genera and of species, yet but little has been done in the scientific investigation of this large group. Our well-known and very pugnacious bull-dog ant belongs to the genus *Formica*. Many of our ants may be found attendant upon the *Aphidæ* and other *Hemiptera*, sucking from them the honey-like secretion common to those insects.

The *Sphegidæ* are fairly well represented in Victoria, many of them being of large size, and having their nests in the ground, their food being insects, often the larger *Cicadæ*, and also spiders. Most of them have very formidable stings, but are not nearly so pugnacious as the common hornet and wasp of Europe. Of the *Apidæ*, we have a good many kinds, many of our indigenous species being stingless, or nearly so; the common honey-bee has, however, increased with great rapidity, and "bee-nests" are frequently met with in holes of gum trees when travelling through the bush. The large order of the *Diptera*, or two-winged flies, are here very numerous, and up to the present time very little has been done towards the naming and systematic description of the Australian forms.

Our old friend, the common house-fly, in spite of fly-papers and other subtle methods adopted for his destruction, still holds his sway.

The Mosquito, *Culex*, is as energetic a nuisance as ever. The group *Brachycera* contains some large and most repulsive looking insects belonging to the *Asilidæ*, one of these being terribly destructive to bees, the unfortunate insect being followed whilst on the wing, and immediately seized and transfixed by the proboscis of the *Asilus*. Fortunately we have very few representatives of the group *Tabanidæ*, or gad-flies, the *Œstridæ*, or "box-flies," and our "March-fly," being about the best known of this section of the *Diptera*.

Of the *Hemiptera* (Heteroptera) we have many species of bright colour, whilst some of them, as *Dindymus* and other kinds, are very destructive to orchards. These are commonly known as "wood-bugs," our largest species being *Myctis symbolica*, a brownish-grey insect, with a white cross-like mark on the wing cases. Amongst the forms commonly known as "bugs," many of the indigenous species are as offensive as the now acclimatised common bed-bug, the *Cimex lectularis*.

Another sub-family, the *Nepidæ*, are also in our ponds and water-courses, some growing to a large size. The curious little "boat-flies," *Notonectidæ*, may, on a sunny day, be seen darting hither and thither through the water.

Of the *Hemiptera* (Homoptera), the *Cicadidæ*, or so-called locusts, with which they, however, have no natural affinity, and certainly no resemblance, are the most noticeable. The *Cicadidæ*, of which we have several kinds—the largest being usually the black one, *Cidada moerens*, the brown, as also the green one, being sometimes, however, quite as large, —live, whilst in the larval state, upon the roots of the *Eucalypti*, which they perforate with their beak-like mouths. The pupa are to be found clinging on to fences, trees, etc., and from these the perfect

insect is developed, the change taking place between the setting of the sun and the advent of darkness. A split forms along the back of the pupa, and out of this slit the perfect insect may be seen to emerge, at first with very short wings, which seem to harden in a very short space of time, and by sunrise the insect is ready to fly. This large Cicada is very interesting, as it undoubtedly is the cause of the so-called Manna, although the identity of the insect which "makes" it has been questioned. The noise made by the stridulations of these insects is sometimes quite deafening. Many smaller kinds occur also in our colony, but the *Fulgoridæ* are very few in number, and are small. Of the curious little *Membracidæ* or Frog-hoppers, we have a number of kinds, generally to be taken upon the young trees of the various kinds of *Eucalypti*, and the Gall-insects are being worked out by Mr. Froggat and others.

In Victoria the groups of the *Aphidæ* and *Coccidæ* are unfortunately but too common, the majority of them being introductions from Europe, America, and elsewhere, although the indigenous kinds are, without doubt, numerous.

I might perhaps enumerate the genera *Kermes*, *Pulvinaria*, *Eriococcus* as those most destructive to our native *Eucalypti*, whilst a great number of other kinds of trees are infested with *Aspidiotus*, *Lecanium*, *Frenchia*, *Icerya*, and a host of others, all of which are more or less destructive, and most difficult of eradication. The *Coccidæ* have been dealt with by Dr. Signoret, Maskell, and many others, and remedies have been devised and tested with more or less success.

I have thus briefly enumerated a few of the groups of each order, and, in conclusion, may state that, as a department of entomology has been created in Melbourne, we may reasonably hope for more light

to be thrown on the life history at least of many of the more important groups.

The third volume of "A handbook," with coloured illustrations of the more important insects, showing the various stages in their life histories, and indicating remedial measures, etc., is now in course of preparation, and will be issued by the Agricultural Department as soon as possible.

MOLLUSCA.

By G. B. Pritchard.

At first sight one is inclined to the opinion that the marine Mollusca are not very well represented in Victoria, for one may go to the beach at several parts of Port Phillip, Western Port, and elsewhere along our coast without obtaining or even seeing much for their trouble. Again, looking up lists, catalogues, and other works we find the amount of knowledge of the Victorian forms extremely meagre. In the last handbook published by this Association at its Melbourne meeting in 1890 the Mollusca were dealt with by Dr. Dendy, who indicated the occurrence of 264 species of Gasteropoda and 86 of Lamellibranchiata, as based upon Mr. J. H. Gatliff's "List of some of the Shells of the Marine Mollusca found upon the Victorian Coast," published in the "Victorian Naturalist" (vols. IV. and V.).

Since that time, however, our information has much increased, and I think I am well within the mark in stating that at present we know upwards of 500 species.

Still there remains a great amount to be done, for neither Port Phillip nor Western Port, let alone the outer parts of our coasts, have been systematically dredged for Mollusca.

The late Mr. J. Bracebridge Wilson largely increased our knowledge of the Mollusca of Port Phillip Heads by his dredgings, though no special attention appears to have been paid to this particular department. Special mention may, however, be made of the Chitons, only four of which are mentioned in

the previous account referred to; the material collected by Mr. Wilson and examined by Mr. Sykes has brought the number of species up to twenty-two, and, as a few additional species have been collected since that time, we may say that that group is very well represented.

Some dredging has also been carried out in Western Port by Mr. Gabriel, and by the rich harvest of new and rare species obtained by him, the advantages of systematic work in this direction can be at once recognised.

During the last few years, Mr. Gatliff and myself have been publishing a Catalogue of the Victorian Marine Mollusca which has now reached Part III, and already includes 219 species, most of the families showing a much larger assemblage of species than formerly recognised.

From these few remarks it may be seen that the paucity of species alluded to is in reality more apparent than real, and when once the habitat of the forms and the local peculiarities become known many very good collecting localities may be visited within easy reach of Melbourne.

For instance the neighbourhood of Black Rock beyond Sandringham should yield quite seventy species to a careful collector in a day's visit. Sometimes, however, unfavourable winds and tides make some of the best patches inaccessible and therefore relatively poor results follow, causing much disappointment to those who are not familiar with the locality. The Back Beach, Williamstown and thence along towards Altona Bay is usually another profitable collecting ground, and though portions of this locality are rather dirty, swampy, and unpleasant, it may be regarded as good for at least fifty species.

Hampton, between Brighton and Sandringham is another locality worth visiting.

Further afield Corio Bay, Outer Geelong Harbour, and Portarlington on the west side of Port Phillip, are all good for a very fair number of species; and on the eastern side, the Rye to Sorrento beach and thence to Portsea may be regarded as a particularly enjoyable and favourable hunting ground, many fine species being obtainable here with great ease, such for instance as *Terebra albida*, *Voluta undulata*, *Conus anemone* (many colour varieties and albino variety), *Cassis pyrum*, *Cypraea angustata*, *Ancilla marginata*, *Solen vaginoides*, *Trigonia margaretacea*, and many others, this district yielding upwards of two hundred species.

Then, taking Western Port into consideration, the western shore from the neighbourhood of Balnarring to West Head, Flinders, is one of the favourite and most profitable resorts, many of our finest and at the same time rarest species being procurable in this district. Proceding further eastwards, San Remo, Anderson's Inlet, Waratah Bay, Port Albert, and particularly Snake Island, will all repay a visit, also to the westward at some parts of the Puebla coast, Apollo Bay, Warrnambool, Port Fairy, and Portland.

Of course in advising localities for shell collectors many points have to be carefully considered by the collector himself, for some of the places recommended may be always fair to good, while the quality of others depend so much upon varying circumstances, especially tides and shifting sand, that at times these places are extremely disappointing. Then again it is not always sufficient to know that certain species live on the sandy stretches, others on muddy flats, others on the rugged rocky parts of the coast, and so on, but also their exact mode of existence and habits under these conditions. This knowledge will enable one to obtain the shore-line species with ease, then, for additional species, deeper water occurrences have

to be taken into consideration; for this one must be familiar with the coast-line, so as to be able either to pick out favourable spots for a long receding tide, and thus be able to obtain the forms alive or to fix on suitable beaches where the deeper water forms may be washed ashore with practically no wear or damage to the specimens; otherwise our information must be sought by accurate and systematic dredging.

On the rocky and cliffy parts of our coast many interesting forms can be easily obtained above high water mark, such for instance as *Littorina mauritiana*, *Sistrum adelaidensis*, *Acmaea costata*, *A. marmorata*, *Siphonaria diemenensis;* then about low water mark the limpet known as *Patella* or *Helcioniscus tramoserica* occurs in the utmost profusion, also any number of *Turbo undulatus*, *Monodonta zebra*, *Risella melanostoma*, *Cominella lineolata*, *Diloma odontis*, *Purpura textilosa*, and many others.

Of these the poor *Turbo undulatus* seems to have the most enemies, for, in addition to it being much sought for as a food for man, it may frequently be noted as supplying a meal to a great many of its carnivorous Molluscan associates, principal amongst these being *Purpura textilosa*, *Conus anemone*, *Fasciolaria coronata*, and *Cominella lineolata*. The latter species, though most frequently found in rock pools, is not uncommonly found crawling over and burrowing into the sand banks, and is a markedly voracious species, some of its other victims being *Phasianella australis* and *Monodonta zebra*. *Monodonta zebra* is a very widely distributed form, being also common in New South Wales and Queensland, and is very common on the yellowish limestone floor and reefs at low tide in the locality of Spring Creek, along the Puebla coast; their colour here appears to conform to their surroundings, longitudinal colour bands being entirely absent, as, when the shells are wet and

crawling about or stationary on the wet limestone, it is a striking fact that it is a very easy matter to overlook them. The question might reasonably be asked if the colour of their rocky habitat in any way tends to affect the extreme variation in colour of this variable species. Taking into consideration their occurrence in Port Phillip, we find at Black Rock and Sandringham, where we have dark brown and reddish rocks, the shell is commonly obtained with well-defined red markings and is of a generally darker hue. Occasional black and white banded examples may be obtained here also, but this typical zebra-marked form becomes the dominant and extremely common form going southwards towards Sorrento. Again, those specimens obtained along basaltic coast outcrops are of a generally dark or dull colour, causing some difficulty in their observation. As this species, next to *T. undulatus*, is perhaps the most eagerly sought for as food, both by man and many marine creatures, the above points may possibly have more than a superficial value.

Similar features can also be readily noted in *Risella melanostoma*.

In the rocky pools we find our large examples of *Fasciolaria coronata*, *Siphonalia dilatata*, *Conus anemone*, *Lotorium spengleri*, *Haliotis naevosa*, and other species, also a fine series of different Chitons. The home of some of our finest and rarest large shells, such, for instance, as *Voluta mamilla*, and *V. fusiformis* is off Cape Schanck, a very rugged part of our coast; these forms are not frequently obtained alive, but are occasionally procured from the crayfish pots set down by the local fisherman. Our other large species, such as *V. roadknighti* and *V. papillosa*, live off the Gippsland coast, and are sometimes washed up on the beach near Lake's Entrance, along

the Long Beach, and in the neighbourhood of Port Albert. Portland is the other important home of our large shells, *Lotorium australis*, *Cypraea umbilicata*, and others, in addition many forms appear, so far as our present knowledge goes, somewhat restricted to this locality, for instance, some New South Wales species which have not hitherto been recorded from other parts of our coast. Upon looking up the chart of depths of Portland area, we find the most considerable depths of any part of our coast, and this feature has apparently been long existent in this area, as evidence of this we have boring operations showing upwards of 2000 feet of marine tertiaries, which fact seems to indicate some more or less basin-shaped depression hereabouts through a long period of time. If the local peculiarities of molluscan occurrence prove upon further investigation to be real, it is not improbable but that the above remarks may have some important bearing on the matter.

On the various sandy stretches at low tide countless millions of the burrower *Mesodesma elongata* may be obtained anywhere, and usually large numbers of *Nassa pauperata*, *Natica didyma*, *Tapes galactites*, *T. fabagella*, *Tellina deltoidalis*, and several species of *Chione*, *Mactra*, *Meretrix*, and others. A little further out, below low water mark, to 3 or 4 fathoms the prevaling forms on the sandy bottom are *Nassa fasciata*, *Voluta undulata*, *Cardium tenuicostatum*, *Solen vaginoides*, *Chione laevigata*, *Philine aperta (sic)*, species of *Bulinella*, *Sigaretus*, *Pectens*, *etc.*

Amongst the Cephalopoda several very large as well as small species of *Octopus* are easily procured in Port Phillip, also what appear to me to be at least three or four species of *Sepia*, and many other forms of the Squid type. *Spirula australis* is not at all a common shell with us, and I have never

seen any trace of it either from Port Phillip, or Western Port, the part of the coast from which it can usually be obtained being the sandy beaches on either side of Cape Otway, to the neighbourhood of Lorne, on the one hand, and to Port Campbell on the other. At one time Argonauts or the Paper Nautilus shells were regarded as great rarities, but for a number of years now they have been fairly common at all seasons, having been obtained on almost every beach round Port Phillip as well as outside the Heads. Although the tests of a great many species are now known to us it is frequently a very difficult matter to make satisfactory identifications on account of the numerous old fashioned and meagre descriptions often without any figure or illustration whatever, and when accompanied by a figure it is not unfrequently of such a character as to be absolutely useless or at any rate extremely misleading.

Yet the anatomical characters of our Mollusca have been very much neglected, and about the majority we know absolutely nothing. As an instance of this neglect we can glance at one interesting group, namely, the Nudibranchs, and find that our knowledge of the Victorian forms is practically *nil*, though we appear to have a fairly large and interesting series.

As a field for work the Victorian Mollusca present many very interesting features and room for a large amount of original research.

Notes on the Land and Fresh-water Fauna of Victoria.

By Baldwin Spencer, M.A., C.M.Z.S.

So far as the Land and Fresh-water Fauna of Victoria is concerned the colony may be divided into two parts, one of which is formed by the fertile, well-watered and, for the most part, well-timbered country lying between the sea and the Dividing Range, while the other lies to the interior of the Range, and forms part of the drainage area of the Murray and its tributaries. In times past it is probable that the Dividing Range was considerably higher than it is at the present time, but, whether this be so or not, the presence of these mountains has brought about a great difference in the climate of the country which lies on the one hand between them and the sea and on the other stretches away inland towards the more or less arid plains and desert country of the interior of the continent.

So far as the fauna is concerned the result is that there is a clearly marked distinction between the coastal and the inland region of Victoria, the latter merging imperceptibly into that of the general dry interior where animal life has to accommodate itself to seasons of drought alternating with short periods of heavy downpour. The fauna of the coastal country on the other hand merges northward into that of coastal New South Wales and westward into that of South Australia, but the most striking feature is the close relationship between this coastal fauna in Victoria and that of Tasmania.

There was a time during comparatively recent geological periods when what is now Bass Strait formed dry land and when the present island of Tasmania was but part of a large promontory extending southwards from the south-east corner of the continent. Across the eastern side of this land mass there stretched a mountain range of which the highest peaks, in the region of what is now Bass Strait, are represented by Wilson's Promontory and the Kent and Furneaux groups of islands, while on the west there was high land, now represented by King Island, just to the north of which a large river entered the sea, draining the country from Cape Otway on the west to Wilson's Promontory on the east.[1] It is consequently but natural that coastal Victoria and Tasmania, which once formed part of a land stretching continuously from south of the Dividing Range to beyond the limits of Tasmania, should have a closely similar fauna, for the Bass Straits are of too recent formation to have allowed of the differentiation of any important forms in the southern island since its separation from the mainland, though at the same time, it has prevented the crossing over of certain animals, such as the dingo.

Geological formations in the south of Victoria and the north of Tasmania indicate that during Eocene times there was an arm of the sea stretching across an area, part of which is now occupied by Bass Strait, and it is quite possible that subsequently to this there was an elevation of the land followed again in late Pleiocene times by a depression giving rise to the present strait.

We are not as yet in a position to state the earliest period at which man was present in Tasmania, but

[1] Howitt. A.A.A.S., Sydney, 1898. p. 739.

such evidence as we have in regard to the lost Tasmanian race indicates the fact that its ancestors must have reached what is now the island when the latter was connected with the mainland, for they do not appear to have had any idea of building boats such as could cross even Bass Strait. In culture they were lower than the present Australian race, and the members of the latter never attained, in the south of the continent, the stage of building boats capable of doing more than cross the calm reach of a lake or river.

If the Tasmanians ever possessed this capacity it is a remarkable thing that they had completely lost it by the time that white men visited the island, and we may regard it as fairly well established that they never built sea-going boats, and so must have crossed on dry land. Now we know that in Victoria such animals as the dingo, extinct forms of Marsupials like the Diprotodon and gigantic kangaroos existed during late Pleiocene times, but they never got into Tasmania, which was just as suitable for them to live in as Victoria was, and so we are fairly safe in concluding that Bass Strait could not have been formed since late Pleiocene times and that it was the existence of this barrier which kept them from entering the island.

We will now deal briefly with some of the more interesting of the animals, commencing with the highest group, the Mammalia. At the present day Australia is the only part of the world in which are found representatives of all the three main divisions of the Mammalia. These three are known as the Monotremata or Prototheria including only the Platypus and Echidna, the Marsupialia (or Metatheria) including the pouched animals and the Eutheria or higher forms including all the remaining mammals. So far as can be told, the groups seem to have been

developed in the order named, and Australia was separated off from the rest of the mainland masses before the higher forms were developed, and, therefore, we only find very few representatives of them, such as the bats, which can fly across water, rats and mice which are ubiquitous and seem to have some special facility for getting about from place to place, and, lastly, the dingo. How this came into Australia is a moot point, but it is very hard to believe that it came otherwise than as an attendant upon man, and it is the only animal which has been domesticated by the Australian aborigine. Be this as it may, though it never got across to Tasmania, it has been in Victoria for a long time, for its remains have been found in company with those of Marsupials long since extinct.

Amongst the Rodents the largest is the water rat (*Hydromys chrysogaster*), of which there are two varieties, one with a deep orange coloured and the other with a dirty white under surface. This is a shy, handsome animal, living on banks of creeks and feeding partly on vegetable matter and partly on shell-fish and crustaceans. Of smaller Rodents we have, north of the ranges, two or three species of true mice (*Mus greyi, gouldi*, etc.), but the most interesting of our indigenous Rodents are undoubtedly the jumping, or, as they are called from a close resemblance to certain African forms, the Jerboa rats. These are only found to the north of the Divide, and are characterised by the length of their hind limbs, on which they jump along like a diminutive kangaroo. In open country, with hawks constantly on the look out for small animals, it is probably an advantage to these animals to be able to jump. Anyone who has ever tried to catch an ordinary rat and a jumping rat will realise that it is more easy to pounce upon a beast which runs steadily than upon one which progresses by leaps and bounds. The most interesting

of our jumping rats, all of which belong to the genus Conilurus, is the nest building rat, which constructs out of sticks a large beehive shaped nest, from 3–4 feet in diameter and 2–3 feet in height. In the nest each family has a separate compartment, which is lined with grass. It is built around a small shrub so that the base of the latter is gradually enclosed, the lower branches being firmly intertwined with the twigs used in making the nest which is so strong as to be able to serve as a defence against predatory animals.

Amongst bats the best known form in the so-called "flying fox" (*Pteropus poliocephalus*), which belongs to the group of Pteropine bats and is one of the greatest pests in orchards. This bat is found over large parts of Australia spending the day in dense scrubs and only coming out at dusk in search of food, returning to its safe hiding place at daybreak.

The Monotremes are represented by both Echidna (popularly called the porcupine) and Platypus. The former, owing to its burrowing habits and capacity for living in both moist and dry climates, is still widely met with, while the Platypus is much more restricted in its range though it may still be seen swimming about in the quiet reaches of streams which are not much frequented. Amongst some of the most interesting discoveries of recent years in regard to our Australian fauna have been those of the facts that the Monotremes lay eggs like birds and reptiles do, though subsequently the young are nourished like those of all mammals by means of milk glands, and that when only partly grown the Platypus has true teeth, though in its adult condition these are replaced by horny plates which function as teeth. The true teeth are also of a peculiar form and are closely similar to those of certain extinct mammals which once lived in other parts of the world. Probably the

Echidna and Platypus are to be regarded as surviving, but much modified relics of very ancient forms of mammals which have only been preserved in Australia.

Amongst the Marsupials or pouched mammals we have representatives of five out of the six families found in Australia, and of 24 out of 37 genera.

The Marsupials are divided into two large groups, the Diprotodontia and the Polyprotodontia. The first named have two large incisor or front teeth in the lower jaw like those of a kangaroo, and not more than six incisors altogether in the upper jaw, and they are all vegetable feeders. In Australia there are three families in this group.

(1.) Macropodidae. Of this family the kangaroo, belonging to the genus Macropus, is the typical and largest example. With the settlement of the country the bigger forms, such as the great red kangaroo (*M. rufus*), the great grey kangaroo (*M. giganteus*), the black faced kangaroo (*M. melanops*), are becoming more and more scarce, though the smaller forms, commonly called wallabies, such as the rufous bellied wallaby (*M. billardieri*), and the scrub or black tailed wallaby (*M. ualabatus*) are still frequently met with, the former more amongst the lowlands, whence it spreads across the islands to Tasmania, and the latter usually amongst the forests and scrub on higher ground.

As a general rule the kangaroos are ground animals, though there are cases on record of some species being seen climbing amongst the boughs of trees, the trunks of which slant sufficiently for the animals to climb up. Photographs have been taken of *M. billardieri* sitting on the bough of a tree high up above the ground in the attitude adopted by the well-known tree-kangaroo (*Dendrolagus*), which does not occur south of Queensland.

Of the rock wallabies we have only one species in Victoria (*Petrogale xanthopus*). To the north of the Divide specimens of one of the small group of nail-tailed kangaroos, the brindled kangaroo, are met with (*Onychogale frenata*). These animals are characterised by the presence of a curious hard little knob at the end of the tail.

Widely scattered over the colony are examples of the brush-tailed kangaroo rat (*Bettongia penicillata*) the tail of which is prehensile and used for carrying grass employed in the construction of its nest, which is built in a burrow dug out by the animal. The manner in which the grass is carried is well shown in one of the mounted groups in the National Museum.

(2). Phalangeridae. This family is fairly well represented in Victoria. Most of the animals are arboreal in habit and some have become adapted to flying, or, to speak more correctly, gliding through the air from tree to tree. The most abundant form and at the same time the species of marsupial which is most widely spread over Australia is the so-called common opossum (*Trichosurus vulpecula*). This appears to be able to adapt itself to various climatic conditions, and may be found in the thickly timbered, well watered forest lands of Tasmania and the coastal regions of the mainland, or amongst the lines of gum trees which border the dry watercourses of the arid interior. The Tasmanian variety, which is called the sooty opossum and was formerly described as a distinct species (*T. fuliginosus*), is distinguished by the rich rufous colour of the fur. Owing to the slaughter of the animal for the sake of its fur it was threatened with extinction, but the Tasmanian Government wisely protected it for some years, and as the animal frequents the forests amongst the wilder and more inaccessible mountain ranges of the west, it is to be hoped that it may long survive despite the demand which there is for its fur.

Another very common form is the ring-tailed opossum (*Pseudochirus peregrinus*), smaller than the former, and inhabiting scrubs, amongst which it builds nests. The closely allied Tasmanian species (*P. cooki*) differs from the mainland form in the darker colour of its fur.

Of the flying opossums we have in Victoria the greater flying opossum (*Petauroides volans*), the fur of which is very beautiful and varies in colour from pale grey to black. In these flying, or gliding, forms there is a membrane, covered with fur, which stretches across from the fore to the hind limb, but which is not, as in the true flying mammals like the bat, associated with any special modification of the bones of the fore limb. The result is that, unlike a bird or bat, the animal cannot really fly but can only glide through the air from a higher to a lower point. It cannot raise itself in the air from the ground, but must first mount to some point of vantage, such as the high branch of a tree, from which it will glide to a lower one.

In the genus Petaurus we have the yellow-bellied flying opossum (*P. australis*), and the squirrel opossum, and in the genus *Acrobates*, the pigmy flying opossum (*A. pygmæus*), the smallest and one of the most beautiful of our marsupials which is only about three inches in length. It is a curious fact that none of our flying opossums are found in Tasmania, which seems to indicate that they were developed on the mainland after Tasmania was separated from it, and as species of them are found in New Guinea we must conclude that the latter was in communication with Australia after Tasmania was, for all the facts with which we are acquainted seem to show that the Australian Diprotodontia were developed within the limits of the early Australian continent which for a considerable length of time Tasmania formed only a southern extension.

A very interesting marsupial found in Victoria is one which was described by Sir F. McCoy under the name of *Gymnobelideus leadbeateri*. It has the general structure of Petaurus but is quite devoid of the membrane which in the latter stretches across between the fore and hind limbs. The only specimens of this rare little animal which have been found are the two originally described and a third which has recently, after a lapse of thirty years, been received from the original locality, Bass River, Gippsland. The animal is a nocturnal one, spending the daytime in a hollow branch and is very restricted in its range but is of peculiar interest, as acccording to Mr. Thomas, it is to be regarded as closely allied to the ancestral form of the flying Phalangers belonging to the genus Petaurus. Allied to these forms we have one species of the little dormouse-phalanger (*Dromicia nana*) which is found rarely in New South Wales and Victoria and more commonly in Tasmania. It is a terrestrial animal with no flying membrane and, being mainly nocturnal in its habits, is only very rarely met with in such well wooded parts as the Blacks Spur and Gippsland Ranges.

Lastly we have the common Koala or native bear (*Phascolarctos cinereus*) a harmless leaf-eating animal which spends the night time amongst the boughs and the day usually in some hollow branch of a gum tree though unfortunately its sluggish habits when it does venture forth in daylight render it an easy prey to the gun.

(3). Phascolomyidae. This family is represented by only one species, the wombat (*Phascolomys mitchelli*) the large burrows of which are met with amongst the Ranges, though the animal itself, being for the most part nocturnal, is not often seen. It is the most heavily built of our marsupials, with front and hind limbs of almost the same length and with only the

rudiment of a tail and has its teeth built on the model of those which are characteristic of the true Rodents or gnawing animals. The teeth never form roots but grow continuously during the life of the animal, the two front ones in each jaw having the hard enamel only on their outer surface so that as they bite against one another a sharp chisel-like edge is formed. The animal feeds on grass and roots.

The members of the second division of the Marsupials, the Polyprotodontia are distinguished by the presence of eight front teeth in the upper jaw and six in the lower; they are all flesh eating, the canine tooth being well developed.

All of the forms found on the mainland are of relatively small size, but in Tasmania there still exists what is called the Tasmanian "wolf" or "tiger" (*Thylacinus cynocephalus*) which is by far the largest of the Polyprotodontia, reaching the size of a large dog or wolf. It owes one of its common names to the presence of well marked stripes on the back. Though not now found on the continent its remains have been discovered there along with those of the "native devil" (*Sarcophilus ursinus*), which also exists at the present day only in Tasmania, and the dingo, and there can be little doubt but that the extinction of the two animals on the mainland has been associated with the presence of the dingo, which never reached Tasmania. The only remains yet known of the Thylacine and Sarcophilus on the continent are from Victoria, so that for some reason these animals appear to have been confined to the south-east corner of the original Australian continent.

(1). Peramelidæ. The members of this family which are commonly called Bandicoots agree with the Diprotodonts in having two toes on the hind foot enclosed in a common skin; the teeth however resemble those of the Polyprotodontia though, as in so

many of the former group, the hind limbs are decidedly longer than the fore. Their food consists mostly of earthworms, roots and bulbs, and while burrowing in search of these, they often do considerable damage even in settled districts. All of the three genera belonging to the family are represented in Victoria.

Of Peramel·s we have the striped bandicoot (*Perameles bougainvillei* var. *fasciata*) which only occurs to the north of the Divide. The long-nosed bandicoot (*P. nasuta*) is widely distributed and is our commonest form, though the short nosed bandicoot (*P. obesula*) is also common and is very widely distributed over the continent and Tasmania, extending right up to the tropics and probably further north still in Central Australia where, for example, it is the common bandicoot of the Macdonnell Ranges.

The genus Peragale is represented by one species, the rabbit bandicoot (*P. lagotis*), which has the characteristic tapering nose of a bandicoot, with very long soft and silky hair and a tail with a terminal white crest which is much prized by the natives as an ornament. It inhabits a burrow at the end of which it makes a nest and feeds partly upon roots and bulbs and partly upon insects and worms. At the present day it is not often seen and is only met with to the north of the Divide, whence it spreads over the interior of the Continent.

The third genus Chœropus only includes one species which, in consequence of the form of its front paws, is called the pig-footed bandicoot. It is a small graceful animal, about the size of a large rat, and is nocturnal in its habits, building a nest of grass and twigs in shallow hollows scooped out in the ground. It is only found in the warmer and drier parts of the colony to the north of the Divide, and is at the present day one of the rarest of our marsupials.

(2). Dasyuridæ. The best known of these forms are the so called "native cats" belonging to the

genus Dasyurus and characterised by their white spotted fur, the general body colour varying from a light to a dark brown or even black. They are all nocturnal in habit, and though not so large or fierce as the Tasmanian "devil" (*Sarcophilus*) have apparently, owing to their arboreal habit, been able to survive when the latter has become extinct in competition with the dingo. One species, the black-tailed "cat" (*Dasyurus geoffroyi*), which is characterised by the presence of a great toe, absent in other species, is found only to the north of the Divide. The common "native cat" (*D. viverrinus*) is met with over the whole of Victoria, and the "tiger cat" (*D. maculatus*) only in the southern part, while both of the two latter are found in Tasmania. The remaining Dasyuridæ are small in size and are usually spoken of as Marsupial rats and mice. Of these the most common forms are the following:—The brush-tailed pouched mouse (*Phascologale penicillata*) is the largest of the genus found in Victoria; it has a dark grey fur, and owes its popular name to the presence of a strongly marked black brush on the end of its tail. It is very destructive in the poultry yard, and together with the yellow-footed pouched mouse (*P. flavipes*) is widely distributed. A rare form only found to the north of the Divide is the lesser tailed brush pouched mouse (*P. calura*) distinguished by the fact that the proximal part of the tail is red-brown in colour, while the terminal part has a brush of black hairs.

Closely allied to Phascologale is the genus Sminthopsis containing small forms popularly called marsupial mice and distinguished from the former genus by having a much narrower hind-foot, though the two genera are very closely allied. The commonest forms in Victoria are the common pouched mouse (*S. murina*), the white footed mouse (*S. leu-*

copus), and the thick tailed mouse (*S. crassicaudata*), which is distinguished by its fat and often incrassated tail. This species sometimes appears, for some unknown reason, in large numbers, and suddenly disappears. It makes a little nest for itself out of small pieces of grass, etc., under the shelter of stones, and here the female brings forth her young, there being sometimes as many as twelve of these in the pouch at the same time. The pouch is simply an open bag, which increases in size with the growth of the young, but never forms so distinct a structure as it does in many other forms, such as the kangaroo for example, where the forwardly directed opening is small in comparison with the depth of the pouch. These little animals, which are no larger than a small mouse, though they habitually run on all fours, often assume the characteristic attitude of many of the marsupials, sitting up on their hind legs and jumping for a considerable height and distance. They are both herbivorous and carnivorous; in confinement they are difficult to keep as they have a habit of eating one another, though whether they do this under normal conditions when living in the scrub is not known.

Lastly, in this family we have the small, jumping, pouched mouse (*Antechinomys laniger*), which in Victoria is only found to the north of the Divide. It is characterised by the great length of the hind legs, which are much longer in proportion to the size of the body, the latter being only as large as in the common mouse, than in any other Polyprotodont. The animal is strictly nocturnal in its habits. At night time it comes out in search of insects, and is wonderfully active in its movements, jumping for perhaps a yard or two at a time. It is, however, only very rarely met with in Victoria, though it may be more frequently met with on the dry, stony plains

of the interior of the continent. The pouch is only poorly developed, and there are six teats.

Amongst Reptiles,[1] there are in Victoria representatives of the three orders of Lizards, Chelonians, and Snakes, the Crocodile not, at the present day, extending further south than Queensland.

Of Chelonians there are two species of tortoises, one (*Emydura macquariæ*), the short-necked tortoise, being found in the rivers to the north of the Divide, while the other (*Chelodina longicollis*), the long-necked tortoise is found in the rivers of South Gippsland, as well as in those to the north of the ranges.

Amongst Lizards, with the exception of one or two small skinks, there are few peculiar to the colony. The general character of the lizard fauna may be judged from the fact that, so far as at present known, we have of the family Geckonidæ, 6 species; of the family Pygopodidæ, or legless lizards, 5; of the Agamidæ, 7; of the Varanidæ, 2; and of the Scincidæ, 27.

The Geckos are especially characteristic of the northern and western districts, and are nocturnal in habit, hiding during the daytime under bark or stones or in the crevices of the rough bark of trees, like the Hakea, and coming out at night in search of insects. In all of them the tail is very liable to break off when the animal is frightened or irritated, and a new one, often differing much in appearance from the old one, is developed.

Amongst them we have *Gymnodactylus milliusii*, the dorsal surface of which is coloured brown, with light transverse bands; the tail has a very noticeable shape and may be divided into three sections; there is first of all a short stump, followed by an abruptly swollen median part, which is nearly as broad as the

[1] Birds are dealt with in a separate article.

body, and rapidly tapers into the third and terminal part. The toes are slender. *Phyllodactylus marmoratus* is a dull purplish-brown or grey coloured animal, the mottlings on the dorsal surface rendering it similar to the bark of the trees in colour, under and in the crevices of which it may be found hiding in the northern parts of the colony. This species belongs to the group of Geckœs in which the ends of the toes are swollen, there being two swellings under the distal end of each toe, the claw being very small.

The Pygopodidæ are more widely distributed over the colony, and are remarkable for the absence of fore-limbs and the slight development of hind ones, which only appear as little flaps by the side of the vent, so that the animal has a superficial resemblance to a snake, for which it is often mistaken. None of them reach a large size, a full grown *Pygopus lepidopus* measuring between one and a half and two feet, and of this length two-thirds will belong to the tail.

The general body colour varies from bluish-grey to brown, and there may be lines of black spots running longitudinally. This species, and also *Lialis burtoni*, in which the hind limbs are very small, are found in the more northern districts, and are the only representatives of the two genera. A closely allied genus (Delma) is represented by two species of which one, (*D. frazeri*) is found a few inches beneath the ground widely scattered over the colony, while a second (*D. impar*) is more common in the southern parts, and has not as yet been found outside Victoria. In these three genera while, as said, the general form of the body is remarkably snake-like, yet the presence of external ears and eye-lids, amongst other structures, shows at once that they are not snakes. In the genus Aprasia, not only are the hind limbs still smaller and only to be detected on close examination,

but the ears are concealed. The single species (*A. pulchella*) is confined to Australia.

The Agamidæ include forms such as *Amphibolurus muricatus*, one of our common Melbourne species, which may be found climbing trees in sandy districts near the coast, and which, though a harmless fly-eater, has received the name of "blood-sucker." Another species of the same genus (*A. barbatus*) popularly called the bearded or few lizard, the first of the two names being given to it on account of the growth of long slender spine-like scales round the throat. When annoyed or frightened, the animal swells out its body, raises its frill or beard, and hisses.

It is more abundant in the northern parts, and varies to a large extent in colour from a dull, dirty brown to a light red. In the well-watered parts of eastern Gippsland and spreading thence all up the eastern coast of the continent, an interesting semi-aquatic species of lizard (*Physignathus lesueuri*) is met with. When disturbed, it at once dives into the water from logs and stones on which it basks in the sunlight.

The Varanidæ include our largest species, though in Victoria only two of the latter are met with. The commonest form, usually called the "Iguana," or "Goanna" (*Varanus varius*), or the lace lizard, inhabits forest country both to the north and south of the Divide, and seems to be equally at home climbing trees or swimming in the water, to which it takes without any hesitation. It is a voracious animal, eating small mammals and birds (often doing considerable damage in poultry yards) and in fact any animal food, dead or alive, which it can secure. In the dry Wimmera district a variety is met with in which the black body is crossed by broad yellow bands. In the same part, and often far away from water, a second species (*V. gouldi*) is met with; its

colour is lighter than than that of the lace lizard, being usually a yellow or reddish-brown.

The Scincidæ include the larger number of our species, many of them such as *Liolepisma metallicum*, commonly found under logs, *L. guichenoti*, living amongst herbage on damp ground, *Siaphos maccoyi*, found under logs in damp parts, *Hinulia lesueurii* and *H. quoyi*, found under logs and stones in flats and gullies, are relatively of small size. In all of these the body is covered with imbricate scales, which may be either quite smooth or keeled, and the head is covered with shield plates symmetrically arranged. A very common form is *Egernia whitii*, which occurs all over Australia and Tasmania. It varies in length from six to ten inches. The colour of the body varies to a most remarkable extent; the whole upper surface may be of a dull fawn colour with no, or only the very faintest trace of, any darker longitudinally running bands or lines of spots, or these may be very strongly marked with alternating lines of bright spots, or again in warm sandy parts the whole dorsal surface may have a warm brick-red colour. Amongst the larger species we have the blue-tongued lizard (*Tiliqua scincoides*), which, like most lizards, lays eggs, and *T. nigrolutea* which is in general structure closely similar to the former but is viviparous, bringing forth twelve or fourteen young at a time. Both of these are found in many parts of Victoria, but while the former extends far away to the north over the continent the latter is essentially a southern form passing across into South Australia and Tasmania. In the western district and passing into the centre we have *T. occipitalis* with a very noticeable dark patch between the eye and ear. In more especially the western and northern parts, though it is also met with near Melbourne, the "stump tail" or "shingle back" lizard (*Trachysaurus rugosus*), is found, which

is remarkable owing to the fact that it brings forth one young alive at a time, of a very large size.

Amongst the Amphibia we have representatives of three families Cystignathidæ, Bufonidæ, and Hylidæ. But up to the present time only 17 species of frogs in all have been described from Victoria. In the Cystignathidæ our commonest forms are *Limnodynastes tasmaniensis* frequenting marshy ground and *L. dorsalis*. The latter occurs all over Victoria, small specimens being met with burrowing in sandy soil near to the sea coast out of which they come in search of insects at night, larger ones being met with up country, lying quietly during the daytime in holes which they excavate for themselves under logs. Still larger specimens come from the north-east coastal districts. In species of this genus there is a large flat tubercle on the inner side of the hinder feet which is of use in burrowing.

Crinia is represented by five species of which the most commonly met with, under logs and stones in in the scrub and gullies, are *C. signifera* and *C. victoriana*. These little frogs lay their eggs in damp, sheltered spots under logs and stones often some little distance away from water.

Heleioporus is represented by one species (*H. pictus*), which is not infrequently met with near to Melbourne and is distinguished by its stout build and the presence of a black patch on the metatarsal tubercle.

Of the Bufonidæ we have three representatives of the genus Pseudophryne the most common form met with near to Melbourne and in the Gippsland district being *P. semimarmorata*, while, lastly, in the Hylidæ, or tree climbing frogs, provided with suckers at the ends of their toes, by far our most common form round Melbourne is *Hyla aurea*, the beautiful gold and green bell frog the loud "clunk, clunk" of which can be heard without ceasing all

night long in the neighbourhood of any pool or marshy ground. When held in the hand or frightened it gives vent to a loud and piercing squeal like that of a small child. Though this species belongs to the genus Hyla it has abandoned its tree climbing habits and the suckers on the ends of the toes, though present, are very small while at the same time the foot is well webbed.[1] Other species met with in damp spots are *H. peronii*, *ewingi*, and *lesueuri* which are all of much smaller size than *H. aurea*.

Amongst the fishes (freshwater) the most interesting point to notice is the sharply marked distinction between those of the rivers which flow to the south into Bass Strait and those flowing into the Murray system. The Dividing Range appears to have formed an insuperable barrier to the passage of fish. Further still we may note that, with one doubtful exception, all of the genera present in Southern Victoria are represented in Tasmania while not one of those confined to the north is.

Amongst the more interesting of our northern forms may be mentioned first the common Murray cod,[2] which is really a perch (*Oligorus macquariensis*), and secondly the oat fish (*Copidoglanis tandanus*), the sole representative in Victoria of the Siluridæ. Of the Clupeidæ we only have one species (*Chatoessus richardsoni*) belonging to a genus very common in the water-holes of the central part of the continent where its close allies are commonly known as the "bony bream." Among the southern forms we have the Gippsland perch (*Lates colonorum*), the ludrick (*Girella simplex*) from the same locality, and the

[1] It may be mentioned that in the early Tadpole stage of this and other species, though external gills are present they are very poorly developed in comparison with those which are present in the case of species such as Rana temporaria, etc.

[2] Introduced into the Yarra.

bream (*Chrysophrys australis*), though these are not strictly fresh-water fish. The tupong (*Pseudaphritis bassii*)[1] is not infrequently met with both in Australia and Tasmania; while in some streams, such as the upper reaches of the Yarra, the black fish (*Gadopsis marmoratus*) is, or was, plentiful; this occurs also in the upper reaches of tributaries of the Murray, being the only species of fish common to northern and southern Victoria. It is never, however, found along with the Murray cod, which always exterminates the black fish. Two species of mullet (*Agonostoma diemensis* and *A. lacustris*) are common to Victoria and Tasmania or King Island; the same is true of the little Yarra herring (*Prototroctes maraena*), and of the eel (*Anguilla australis*); of the several species of fresh-water "trout" the best known are perhaps *Galaxias truttaceus*, *G. ocellatus* and *G. attenuatus*, the first and last of which are said to be found in Tasmania; the number of varieties of this genus, which is of especial interest as revealing a South American affinity in the fish fauna, is very great.

Among the lampreys we have *Mordacia mordax* common to Victoria, New South Wales, and Tasmania, the genus being common to south-east Australia, Tasmania and Chile; *Velasia stenostomus*, common to Victoria, South Australia, Tasmania, and New Zealand, the genus being met with in Chile; *Geotria australis*, characterised by the presence of a large gular sac, and common to the same parts as in the case of the preceding species, the genus being common again to Australasia and South America. Amongst the Amphibia, in the case of the Cystignathid frogs, we have an affinity with South America just as in that of the fishes and lampreys.

[1] Pseudaphritis bassii, Cstl., and Aphritis urvillii, C. and V., are stated to be identical.

The Invertebrate land and fresh-water fauna is of very considerable interest, but space will only allow of our referring to some of the more important members, and indeed, in some groups, such as the Arachnida and Mollusca there remains much to be done.

Amongst the Arthropoda,[1] apart from the insects separately dealt with, we find certain interesting members of the Crustacea. At certain seasons, after heavy rainfall, even pools by the roadside will be found to swarm with a species of Lepidurus, which has a well marked shield on its back and a large number of flattened legs, which move with a kind of wave-like motion and are coloured red with blood. In the interior of the continent the genus is replaced by a closely allied one, Apus. The growth of these animals, which may reach a length of perhaps one and a half or two inches, is phenomenal; they seem to make their appearance, fully grown, almost suddenly in pools occupying slight depressions in ground which until the rain fell was perfectly dry, with no sign of animal life. It appears that the animals in question lay eggs with very hard shells, so that the vitality of the egg is not destroyed when the pools dry up and the adults all die. The eggs can be carried about by the wind and simply remain quiescent until heavy rains fall and conditions, probably of temperature amongst other things, are suitable, and then the eggs develop and the young come out and grow with great rapidity. There is no doubt but that the various species of Lepidurus which have been described as occurring in different parts of Australia, Tasmania and New Zealand, and have received different names, are all referable to one species (*L. viridis*).

[1] Insects and Mollusca are dealt with in separate articles, as are also certain of the fresh-water animals.

Closely allied to these forms, but differing from them in the absence of a shield and red blood, is a somewhat shrimp-like form, with a very transparent body, called Branchipus. This also is found in pools after heavy rains and only appears, just like Lepidurus does, at certain particular times, being found sometimes in one spot, sometimes in another, according to where the eggs have been carried when the pool in which they were laid dried up, and according also to where conditions are favourable.

There are several species of crayfish, the best known being the "yabbie" (*Astacopsis bicarinatus*), which is commonly found in water-holes, but not apparently in actually running water. By its burrowing it often does very considerable damage to dams. The only way to deal with it is to introduce perch, which are very fond of "yabbies." The latter can accommodate themselves to dry conditions by simply burrowing down and retreating into a small cavity in which water can be retained for a long time, especially as a "cast," sometimes a foot high, at the mouth of the burrow, prevents evaporation. The specimens of this species from various parts of the continent are all referable to the one species, whether they come from Victoria, New South Wales, Queensland, or Central Australia. In the Murray is the much larger spiny-crayfish (*A. serratus*), which is represented in the rivers of South Victoria by a closely allied variety. The colour varies to a large extent; in the New South Wales form it may be dark, almost black, or bright brick-red, while the Victorian form is usually a light prussian blue, the softer parts of the joints being tinged with light red.

Right away from water-holes, and especially prevalent in Gippsland, are found two or three species of "land crabs," which in reality are not, and have little resemblance in the form of their body to, true crabs.

They are closely allied to the crayfish and live in burrows, which break down after a time, and give rise to the "crab-holes" so often met with in the bush. One species, usually described as *Engæus fossor*, is common to Victoria and Tasmania, but does not occur either north of the Divide or in New South Wales. Each species of crayfish and land crab, and also of one or two other kinds of land and fresh-water Crustaceans, has, living parasitically upon its shell, a distinct species of a curious and very small Trematode worm (*Temnocephala*), which, in the case of the common "yabbie," can easily be seen moving about with a loop-like motion of its body just as if it were a little leech.

Amongst other Crustaceans we have forms which have taken more completely to a land life, such as the little *Talitrus sylvaticus*, which is found hopping about on its side under almost every trunk turned up in the scrub. In the Otway Forest there is an interesting terrestrial form living in burrows and reaching the length of two inches. It is, in certain respects, intermediate in form between the Amphipods, in which, as in the little "hopper" just described, the body is flattened from side to side, and the Isopods, in which, like the common wood louse, the body is compressed from above downwards. In this form (*Phreatoicopsis terricola*) the front end of the body is flattened from above downward, and the hinder end from side to side. Recently two more interesting species have been described, occurring in fresh water at Thorpdale, Gippsland. One of these represents a new genus (*Phreatoicoides gracilis*) the name of this and the previous genus indicating the affinity of the animals to the members of the genus Phreatoicus which have been met with in subterranean waters in New Zealand, and in pools on Mount Kosciusko and Mount Wellington. The second is a species of

Niphargus, and both this and the previous species are of especial interest, owing to the fact that though living in open pools they are quite blind, like many of their allies which are subterranean or cave-living animals.

The Myriapoda, including the millipedes and centipedes, have not as yet been satisfactorily determined, though they are abundant. One of the commonest forms amongst the centipedes, which are characterised by having biting mouth parts armed with a sharp poison claw and by the possession of one pair of legs for each segment of the body, is the large Scolopendra (?), usually of a greenish or brown tinge, which is to be met with under almost any log in the scrub. The bite of a large specimen is capable of producing very serious results. The millipedes, which are not provided with a poison claw and have their body more rounded, each segment being provided with two pairs of legs, are much more sluggish in their habits and are exclusively vegetarians. The most interesting of our Myriapods is the beautifully coloured Cermatia, which, unlike most of them, runs about rapidly during the day-time; its long slender legs move with a rapidity so great that it is impossible to follow the wave-like movement which passes along the series of legs, and if any attempt be made to capture the animal, they are thrown off with ease, and remain, jerking about, long after their former owner has reached a place of safety. Possibly this habit may be of advantage to the animal, as its enemy may be slightly disconcerted or may be attracted by the movement of the dismembered limb. Unlike other Myriapods, Cermatia is provided with well developed facetted eyes.

Perhaps our most interesting Arthropod is Peripatus, which is evidently a surviving relic of ancient times, and in the structure of its body shows certain

features in common on the one hand with the segmented worms, and on the other with Myriapods and Insects. It has the excretory organs of the former and the respiratory organs of the latter. In general appearance it is like a small velvetty caterpillar, only it has short, stump-like, claw-bearing legs all along its body (fourteen or fifteen in number); by the side of the mouth is a pair of oral papillæ, at the apex of each of which opens a slime gland. When the animal is irritated a thin stream of a sticky secretion, which rapidly hardens, is thrown out; it is said that this is shot out at insects on which the Peripatus feeds, the former becoming entangled in the thread. Peripatus is to be found only rarely in Victoria, hiding away in or under rotten logs in moist parts, such as the Gippsland gullies and scrubs. In colour it varies from a deep purple-black to a light fawn-brown, and very often the body is ornamented with a distinct lozenge pattern. There appear to be two species, (1) *Peripatus leuckartii*, in which there are fourteen or fifteen pairs of walking legs, and the animal is viviparous; this occurs in Victoria, New South Wales, Tasmania and West Australia; (2) *Peripatus oviparus*, which, as the name indicates, lays eggs. This species is found in New South Wales and Victoria.

In earthworms Victoria is fairly rich, forty-three species having as yet been described, though there are many not yet named. In the neighbourhood of settlement the introduced European species has completely ousted the native forms, which rapidly disappear as the land becomes cultivated. The most interesting of our Victorian forms is the Giant Gippsland Worm (*Megascolides australis*), which lives in burrows in the rich soil of gullies, and may reach the astonishing length of five or six feet. Victoria seems to be the home of the two genera, Diporochæta, the

species of which are usually small forms, at most eight or ten inches in length, with a large number of setæ in each segment, and Megascolides, which contains larger forms, each of which has only four pairs of setæ in each segment. Occasionally an interesting little phosphorescent earthworm may be seen giving out light much like a glow-worm.

Under logs in damp spots are often found numerous examples of the interesting land Planarians, all of which were formerly placed in one of two genera, Geoplana and Rhynchodemus, though the former series have now been grouped in different genera. These are soft bodied animals, elongate (from less than an inch to six or even eight inches in length), with the mouth on the under side of the body. There is great variation in colour, some are dark green above and cobalt blue beneath, others are bright yellow, or, on a yellow ground, are ornamented with longitudinal stripes of green or brown, the colour remaining fairly constant for the species. Though soft bodied they can protect themselves, even against such an apparently powerful enemy as a centipede, by means of their remarkable power of putting out a curious slimy secretion, which they pour over the bodies of insects, such as beetles, and so render them incapable of biting or of movement. When this has taken place the Planarian puts out from its under surface a muscular proboscis, and so, penetrating some soft part between the hard joints of the insect, sucks in the juices of its helpless prey.

Another interesting form is the land Nemertine—a small, soft bodied, almost slug-like worm (*Geonemertes australiensis*), which, when irritated, can throw out from its anterior end a long white proboscis.

Unfortunately the bush fires of recent years have been so extensive and severe that, in the scrubs and gullies where formerly Earthworms, Peripatus, land

Planarians and Nemertines could be found with ease, not a trace of them can now be seen, and it will take many years before our gullies are re-stocked, indeed, it is very likely that many of our species, which were very local in their distribution, are now extinct.

In damp spots the land-leech is met with. There are so far as at present known representatives of two genera, Geobdella with five rings in each segment and Philaemon with four rings. The former does not appear to come further south than New South Wales, while the latter is common to that colony, Tasmania and Victoria. Both genera agree in the possession of only two biting jaws instead of the three which are present in the medicinal leech. Our Victorian species (and that of Tasmania also) is *Philaemon pungens* another species of the genus being present in New South Wales. All of these little animals, many of which are not more than an inch in length, and almost thread-like when extended, have the habit of biting and blood sucking, which renders them so peculiarly objectionable. By means of a curious loop-like action the animals can travel along at a fair rate, and seem to be able to detect the presence of a suitable victim from some little distance; they are provided with curious kinds of eyes, and when travelling along often pause and turn about the front end of the body, upon which these are placed, in different directions. The leech often attaches itself unknown to its victim, and possesses glands which pour into the wound a fluid which has the the power of preventing the blood from coagulating, so that the latter will continue to flow for some time after the leech is removed.

In conclusion, it may be noted that our Victorian land and fresh water fauna reveals two features of considerable interest. In the first place we have a very marked affinity between the fauna of Southern

Victoria and Tasmania, indicating that at a comparatively recent period there was no sea strait separating the two, while it is equally clear that the Dividing Range must for very long have formed a barrier, which, to a large extent, has shut the southern fauna off from that of the interior. Taking Australia as a whole we have three well marked zoological areas (1) a northern and north-eastern coastal, extending as far south as about the Clarence River and including also New Guinea—to this the name of Torresian may be given; (2) a southern-eastern coastal area, including Southern Victoria and Tasmania, which may be called Bassian, and (3) the whole of the interior, together with West Australia and almost all South Australia, to which the name Eyrean may be applied. The fauna of Victoria thus belongs partly to the Bassian and partly to the Eyrean; the former element it has in common with Tasmania, and the southern part of coastal New South Wales, and the latter in common with South Australia, and the interior of New South Wales. In the second place we have, as shown in the case of certain mollusca, fishes, lampreys, and the marsupial fauna, a marked affinity between the south-eastern corner of Australia (including Tasmania) and South America.

BOTANY.

By Charles A. Topp, M.A., F.L.S.

In the following brief description of the Victorian Flora I propose to mention the most noticeable botanical features of some of the localities which will probably be visited by members of the Australasian Association for the Advancement of Science. No attempt will be made to give an exhaustive enumeration of the plants occurring even in the localities selected, as both the limit of space and the character of the Handbook would render such an attempt inappropriate and impracticable.

I shall endeavour then to characterise the prevailing botanical features, first of the shores of Port Phillip and of the district in its immediate vicinity, where there are still remains of the native vegetation; next, I shall describe, in a similar manner, the Flora of our ferntree gullies, such as may be found in the Dandenong Range, and on the Main Dividing Range, running into the Watts River and other mountain streams; and, thirdly, a short account will be given of the interesting alpine Flora occurring in the north-eastern mountain system of the colony, between Omeo and Harrietville, on the peaks and spurs of Mounts Feathertop, Bogong, and Hotham.

Almost the whole of the eastern shore of Port Phillip, from Brighton to Point Nepean, is fringed by a belt of coast tea-tree (*Leptospermum lævigatum*), which extends from within a few yards of high-water mark generally for 50 or 100 yards inland, but in some places spreads inwards for half a mile or more. Occasionally rising above ths nearly level tops of the

tea-trees may be seen, sometimes isolated, sometimes several together, the drooping, feather-like foliage of the sheoaks (*Casuarina quadrivalis*), or the stiff, erect branches of *C. suberosa*. In the neighbourhood of Frankston and Dromana these trees once crowned many a hillock and sand-ridge, but they are now much less numerous, large numbers having been felled for many years past for firewood. Close to the beach, and along the gullies and streams running into the bay, the sea-coast and common native honeysuckles (*Banksia integrifolia* and *B. marginata*) not infrequently occur, and attain a height of 40 or 50 feet. More inland, the graceful foliage of the native cherry-tree (*Exocarpus cupressiformis*) imparts some brightness and variety to the landscape, and small and straggling specimens of the genus Eucalyptus, such as *E. viminalis*, with occasional box-trees (*E. melliodora*) form the timber trees of the open grassy glades behind the belt of tea-tree. On some portions of the coast, as at Brighton and Cheltenham, the fringe of *Leptospermum* is succeeded by a tract of heath land, consisting of a considerable variety of flowering bushes and shrubs, chiefly of the orders *Leguminosæ*, *Myrtaceæ* and *Epacrideæ*, interspersed among which bloom in the spring many terrestrial orchids and lilies. These moors form the chief collecting grounds of Melbourne botanists. The shrubs and bushes consist of the *Leptospermum scoparium*, and *myrsinoides*, *Ricinocarpus pinifolius*, *Acacia suaveolens*, *juniperina*, *longifolia*, and *oxycedrus*, *Casuarina distyla*, *Banksia integrifolia* (dwarf form), and in swampy tracts of the fragrant *Melaleuca ericifolia* and *squarrosa*. The following Papilionaceous bushes are common:—*Daviesia ulicina*, *Aotus villosa*, *Pultenæa paleacea*, *Dillwynia cinerascens*, and *ericifolia*, *Platylobium obtusangulum*, *Bossiæa cinerea*, and *Hovea heterophylla*.

In the spring many species of orchids will be found in bloom, such as *Pterostylis concinna*, *P. nutans*, *P. vittata*, *Acianthus exsertus*, *Corysanthes pruinosa*, *Cyrtostylis reniformis*; these occur abundantly, growing under the shade of the tea-trees. On the more open heath are found *Thelymitra ixioides*, *T. aristata*, *T. carnea*, *T. flexuosa*, *T. antennifera*, *Diuris pedunculata* and *sulphurea*, *Prasophyllum elatum*, *Pterostylis barbata*, *Lyperanthus nigricans*, *Caladenia patersoni*, *latifolia*, *carnea*, *deformis*, and *Glossodia major*. The lovely but evanescent purple flowers of *Patersonia glauca* and *longiscapa*, and the bright blue corollas of *Chamæscilla corymbosa* afford a pleasant contrast to the prevailing whites and yellows. Of Liliaceous plants, besides the last mentioned, *Wurmbea dioica*, *Burchardia umbellata*, *Bulbine bulbosa*, *Thysanotus tuberosa* and *patersoni*, *Arthropodium strictum* are of frequent occurrence. *Hibbertias* are represented by *H. densiflora*, *H. stricta*, *H. fasciculata*, and more rarely by *H. acicularis*.

The interesting family of *Droseraceæ* shows many specimens of *D. glanduligera*, *auriculata*, *peltata*, *whittakerii*, *menziessi*, and occasional ones of *pygmæa* and *binata*. The other carnivorous order in Victoria, *Lentibularineæ*, is represented not infrequently by *Utricularia dichotoma* and *lateriflora*, growing in swampy ground, and more rarely by *Polypompholix tenella*, with its tiny lilac flowers. Of the *Epacrids*, *Styphelia humifusa* spreads over the sand, and yields sweetish berries, the delight of children; the pungent-smelling, green-flowered, prostrate *S. serrulata* is also common, the well-known *Epacris impressa* is abundant all over the moors, though the red-flowered variety is now scarce near the sea coast. *E. obtusifolia*, with less showy flowers, is much more restricted, being confined to particular patches known to local botanists; in the swampy hollows the pretty pink racemes of

Sprengelia incarnata catch the eye in the spring time. Of the bushy *Epacrids*, *Styphelia richei* occurs amongst the tea-tree close to the sea shore, and *Brachyloma daphnoides* is abundant on the moors. Twining over and round the bushes will be found the leafless stems of *Cassytha glabella*, or *melantha*, and the lovely creeper, *Comesperma volubile*, the only representative of the *Polygaleæ* which occurs in all the Australian colonies.

Visitors from the mother colony will find the great orders *Proteaceæ* and *Rutaceæ* playing a much less conspicuous part in the Flora of our coasts than on the shores of Port Jackson and the neighbouring inlets. No *Petrophila* or *Lambertia* is to be found within the limits of our colony; only one *Persoonia* occurs, except in the north-east and east, this (*P. juniperina*) grows sparsely amongst other bushes on the moors. No *Grevilleas* occur on these moors, though *G. alpina* is abundant on the foot hills of the Dandenongs. One or two dwarf *Hakeas* (*H. nodosa* and *pugionifomis*) occur near the coast. Of Rutaceous plants the only common one near the coast is the well-known *Correa speciosa* or native fuchsia, while the less ornamental *C. alba* occurs as a straggling bush on low cliffs close to the sea shore only at particular spots, as at Frankston and Sorrento. No representatives of the lovely *Boronias* and *Erioste-mons*, which add so greatly to the beauty of the wild flowers of Sydney Harbour, grow near the shores of Port Phillip.

Of grasses the commonest are *Anthistiria ciliata*, *Stipa teretifolia*, *semibarbata*, and *flavescens*, *Sporobolus virginicus*, *Agrostis solandri*, *quadriseta*, *Aira caryophyllea*, *Danthonia penicillata*, *Cynodon dactylon*, *Chloris truncata*, *Poa cæspitosa*, *P. syrtica*, *Festuca litoralis*, *Dictichlis maritima*, *Bromus arenarius*, *Eragrostis brownii*, *Agropyrum scabra*, and *Arundo*

phragmites. Of *Pteridophytes*, *Azolla filiculoides* occasionally occurs in ponds and streams; *Marsilea quadrifolia* is also rarely found in swampy tracts, *Phylloglossum drummondi* grows in one or two spots near Brighton. *Selaginella uliginosa* is abundant in wet places on the moors.

Ferns are not common near the coast except the ubiquitous bracken (*P. aquilina*). The coral fern (*Gleichenia circinata*) is pretty abundant in swamps and gullies; the sedge-like *Schizæa dichotoma* is sometimes found in similar places, and the little *Lindsaya linearis* is common on the moors.

Leaving now the sea coast and grassy pastures for the mountain gullies which separate the spurs of the Dandenongs, or of the Main Divide, an entirely different aspect is given to the scene. Here the comparatively dwarf specimens of *Eucalyptus* are replaced by the gigantic *E. regnans* and *amygdalina*, and by the sombre blackened trunks of *E. obliqua*, while under their shade, and in the bottoms of the water courses, a considerable variety of glossy and dark leaved trees and flowering shrubs affords an agreeable contrast to the dull greens of the gums. As examples of these may be mentioned *Prostanthera lasiantha* and *rotundifolia*, *Senecio bedfordi*, *Pomaderris apetala* and *elliptica*, *Cryptandra hookeri*, *Aster argophyllus*, *Atherosperma moschatum* (native sassafras), *Drimys aromatica* (native pepper), *Hedycarya cunninghami* (native mulberry), *Acacia melanoxylon* (blackwood or lightwood tree), *Acacia decurrens* and *dealbata*, *A. myrtifolia verticillata*, *A. leprosa*, *Pimelea axiflora*, *Myrsine variabilis*, *Pittosporum bicolor*. Under the double shade afforded by the shrubs and small trees, and the giants of the forest, and watered by the mountain streams, the tree-ferns expand their palm-like crowns, while their stems become clothed in the vivid greens of the filmy ferns and mosses. It is

scarcely necessary to say that the chief gully tree-fern is the *Dicksonia billardierii* (*antarctica*), the other tree ferns, *Alsophila australis* and *Cyathea cunninghami*, preferring the more open mountain slopes. In the shadiest watercourses, however, the gigantic fronds and massive trunks of the *Osmunda barbara* (*Todea africana*) give variety to the scene. In the drier and more open gullies the tree-fern stems are brown and rough, with numerous rootlets, but in the moister and remoter ravines nearly the whole of this brown is concealed by the lovely greens of epiphytal ferns and of mosses; chief among these are *Hymenophyllum nitens* and *javanicum*, *Trichomanes venosum*, and *humile*, *Polypodium pustulatum*, *australe* and *grammitidis*, *Asplenium flaccidum*, *Aspidium capense*, while on the more open water-courses the richly coloured fronds of *Lomaria capensis* are mingled with the dark green of *Lomaria discolor* and *lanceolata*, and of *Blechnum cartilagineum*, and in the more open forest the large light green fronds of *Davallia dubia*, and the scaly stalks and robust fronds of *Aspidium aculeatum* are conspicuous. The shining vestiture of green, in which the fern trees of the moister forest glens are clothed, is largely due to the delicate leaves of the lovely mosses, such as *Cyathophorum* and others.

The alpine and subalpine Flora of Mounts Hotham and Feathertop, and of the Dargo and Bogong plateaux, with their stunted trees and bushes, mossy peats and prostrate heath plants, presents a strong contrast to the long and lofty trees and umbrageous glens of the mountain valleys.

The only gums are *Eucalyptus sieberiana* (spurious ironbark), *E. pauciflora* (one of the white gums), and *E. gunnii* (cider Eucalypt); these gradually becoming more and more stunted, disappear on the highest ridges. The myrtle family contributes two other low

trees or bushes, *Kunzea muelleri*, confined to alpine regions, and *Callistemon salignus*, familiar on the banks of the Yarra. *Drimys aromatica* and *Pimelia axiflora*, which have been already mentioned as found in the ferntree gully districts, also occur on these high plateaux. Other plants, familiar to residents of Melbourne and its suburbs, occurring in the Alps are *Ranunculus lappaceus*, *Daviesia ulicina* and *corymbosa*, *Indigofera australis*, *Helipterum incanum*, *Craspedia richea*, *Wahlenbergia gracilis*, *Candollea graminifolia*, *Euphrasia brownii*, but many of the plants, though of familiar genera, will be new species to the dweller on the low lands, and he will be struck by the fact that they are found blooming in January, long after the flowers of their generic associates of the plains have faded; such, for instance, are *Ranunculus anemoneus*, *millani*, and *gunnianus*, the first-named the handsomest of our Victorian buttercups, with large white flowers, *Drosera arcturi*, with comparatively large white flowers, *Brachycome nivalis*, *Epacris petrophylla*, etc.

Of plants belonging to genera not met with on the low lands may be mentioned *Caltha introloba*, *Scleranthus uniaroides*, *Aciphylla glacialis*, *Orites lancifolia*, *Abrotanella nivigera*, *Gaultiera hispida* (with *Wittsteinia vacciniacea* of Mount Baw Baw, the only representatives in Australia of the true heath family), *Nageia alpina* (the only representative of the conifers on our mountain ranges).

It will be observed that nearly all our alpine plants belong to genera and orders characteristic of the Australian continent, and that comparatively few are identical with species growing in the colder countries of Europe, Asia, and America. A considerable number are common to Victoria and Tasmania, and are not found elsewhere. The following species found in our Alps grow in the colder countries, or in the highlands of most of the continents:—Winter cress, or Yellow Rocket (*Barbaræa vulgaris*), Rock-cress (*Arabis glabra*), Bitter-cress (*Cardamine hirsuta*), Pearlwort (*Sagina procumbens*), Lady's Mantle (*Alchemilla vulgaris*), Thyme-leaved Veronica (*Veronica serpyllifolia*), *Portulaca oleracea*, Water Chickweed (*Montia fontana*), *Carex canescens*, and *C. acuta*, Fingered Panic (*Panicum sanguinale*), *Trisetum subspicatum*, Sheep's Fescue (*Festuca duriuscula*), and a few others.

THE CLIMATE OF VICTORIA.

BY R. L. J. ELLERY, C.M.G., F.R.S., F.R.A.S.

Victoria, the south-eastern colony of Australia, lying within the 35th and 38th parallels of south latitude, possesses a somewhat more temperate climate than might be expected from the isotherms which exist in similar latitudes in other parts of the world. This fact is doubtless due to the extensive sea board and polar aspect of its southern boundary. The range of temperature is, nevertheless, greater than in New South Wales, Queensland, and parts of South Australia, still the mean temperatures are comparatively low. From thirty-two year's observations the mean annual temperature of Melbourne is found to be 57·4; the highest temperature in the shade recorded 112·2, and the lowest 27·0; the former on January 14th, 1892, and the latter on July 21st, 1869. The mean monthly temperatures are as follows:—

Jan.	Feb.	March	April	May	June
67·1	65·9	62·1	58·6	53·6	50·0
July	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
48·0	50·0	52·6	57·5	63·1	65·5

The average number of hot days, or days when the shade temperature is 80·0 and over, is 29; 90·0 or over, 15; 100·0 or over, 3·26. The average number of nights the thermometer falls to 32·0 or under is 2·76.

An unpleasant, though by no means an unhealthy feature of summer weather is the *hot north wind*, which occurs in front, or to the east, of advancing areas of low barometic pressure. Commencing after a moderately warm day or two, with light south-east or easterly winds, it usually sets in with a rising thermometer, and, increasing in strength, it often blows with considerable force. The air now becomes very dry indeed, and the wind raises dust from every road and other places where the soil is loosened by traffic. The dust and heat become very unpleasant, but the excessive dryness of the air renders the high temperatures, which often reach to from 90·0 to 100·0, or even over, quite tolerable, and to many not at all unpleasant. On such occasious the humidity of the air is frequently as low as 14 per cent. (saturation=100). Although the northerly winds, which are warm in summer and very cold in winter, are prevalent winds, a true hot wind is not of very frequent occurrence, and is certainly less frequent than in former years. Reckoning all north winds that reach a temperature of 90·0, or over, hot ones, it is found the average frequency is 9·5 per annum. As regards the prevalence of winds from the various points of the compass, the following shows their relative frequency:—

	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calm.
Spring	16·0	9·4	15·2	16·8	16·5	9·8	3·7	11·2	1·4
Summer	7·7	4·1	9·5	20·4	24·1	19·2	5·6	8·1	1·3
Autumn	16·1	7·6	12·2	12·6	14·9	14·1	5·6	15·2	1·7
Winter	28·5	13·0	14·9	10·8	6·3	5·0	2·7	17·3	1·5

Very strong winds are not frequent, and such high velocities as are sometimes recorded on the east coasts of Australia, seldom or never occur in Melbourne, or indeed in any part of Victoria, the highest recorded being 72 miles per hour.

The rainfall is about equal to that of similar latitudes in other parts of the world, and varies with locality from 8 inches to 60 inches per annum, the former being the record on the inland plains bordering on South Australia and the Murray, and the latter in the Alpine districts to the north-east of Melbourne. The average annual rainfall in Melbourne is 26·06 inches, falling on 135·9 days.

Evaporation in summer time is excessive, and in January and February reaches 6·40 inches per month, while the annual amount is found to be 41·10 inches.

Thunderstorms, although not of frequent occurrence, are often very severe, and sometimes disastrous, chiefly in consequence of intense rainfall causing floods, but occasionally also from the effects of lightning.

The driest months are generally January and February, and the wettest October and November,

The weather which prevails over Victoria generally is certainly very variable, especially during the summer on the south side of the Dividing Range; to the north of the Ranges, and along the valley and plains of the Murray, it is however, much less so.

The following may be accepted as an ordinary cycle of summer weather in Victoria :—Commencing with two or three days fine weather, clear sky, or at most scattered clouds, light southerly or south-easterly winds, becoming each day lighter and more easterly, with slightly increasing temperature and falling barometer; about the third or fourth day the wind gets northerly, temperature still rising, the sky clear or more or less covered with light cirrus clouds.

The wind gets a little west of north, and the cloud formation changes, and heavy cumulus and nimbus appear in the north-west and west; the north wind decreases in strength or drops to a calm, which is soon followed by a shift of wind to the west south-west, sometimes with thunder and more or less rain, but often with only a threatening of showers. The temperature rapidly falls, sometimes many degrees in a few minutes, and either the weather rapidly clears up with south-west winds getting southerly, or perhaps at first there is a continuance of westerly winds with showery and squally weather, or heavy rain for six to twelve hours, the wind gradually changing to the south and getting fine, thus completing the cycle, the whole round occupying from three to six or seven days. This may be also regarded as the ordinary cycle of weather in the southern parts of this colony, modified very considerably by the season of the year.

COMMERCE AND MANUFACTURES.

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I. Commerce.

The economic conditions of Victoria have undergone so great a change since the Australasian Association for the Advancement of Science met in Melbourne in 1890 that a considerable modification of the section of the Handbook devoted to Commerce and Manufactures is rendered necessary. In order to afford a clear view of the subject, the course of commercial and industrial development during the interval of ten years will be briefly described, in continuation of the sketch of the previous growth of Victorian commerce.

In the first Handbook, three periods of the history of Victorian commerce were described. To these a fourth period has now to be addded. The four periods may be resumed as follows:—

I. The primitive, or commerce undisturbed by local manufacturing of any kind. This period roughly dates from the foundation of the colony in 1837, when the first statistical records showed that imports amounted to £115,379 and exports to £12,178, to the year 1860, when imports amounted to £15,093,730, and exports to £12,962,704. During these twenty-four years the gold discoveries took place, so that the

period may be sub-divided into two, the earlier of fourteen years, and the later one of ten years, during which the trade of the colony assumed large proportions in consequence of the production and export of gold, and in consequence also of the inflow of a considerable population with wants to be supplied.

II. Commerce growingly affected by local manufacturing. This, the second period, extends approximately from 1861, with imports £13,532,452 and exports £13,828,606, to 1883, with imports £17,743,846 and exports £16,398,863. The most notable feature of this period was the departure of the colony from free trade principles and the introduction of a protective policy, largely designed by its authors to afford a diversification of employment. Apart from this feature, the general conditions of the colony underwent a process of consolidation, and a certain amount of British capital was introduced into the colony for purposes of Government expenditure in the construction of railways, etc., but this inflow of capital did not assume excessive proportions.

III.—Commerce largely affected by local manufacturing, but, at the same time, receiving a great impetus from borrowings on a comparatively gigantic scale. Dating approximately from 1884, when imports amounted to £19,201,633, and exports to £16,050,465, this period may be considered as having ended with the year 1891, with imports £21,711,608, and exports £16,006,743. The eight years were characterised by the free introduction of English capital through many channels, including the borrowings of Government and other public bodies for the purpose of railway construction, harbour improvements, and other public works; the borrowings of banks and squatting companies for the purpose of extending their colonial business, and the investments of British capitalists and institutions

seeking a new outlet for their funds. So large was the inflow of external capital in proportion to the amount of internal capital employed in carrying on the industries of the colony, that a great part of the employment of labour came to depend upon the continuance of the introduction of British capital with yearly regularity. The natural industries of the colony itself made hardly any progress, while the metropolitan population rapidly increased until it reached an excessive and unhealthy proportion to the total population of the colony. The dangers arising out of too great independence upon the goodwill of the British capitalist had become apparent to many observers, but it is doubtful whether anybody anticipated such a disastrous realisation as afterwards took place.

IV.—Commerce during a period of contraction, followed by the renewed development of natural resources. Although the year 1892 (imports £17,174,545, and exports £16,006,743) retained in a diminished degree some of the characteristics of preceding years, it may be considered as the first of a series in which the colony had to endure a reaction from what had proved to be unsound developments, a reaction accompanied and intensified by causes beyond the control of either statesmen or business people, but accompanied also by the direction of the efforts of the population to re-building the industrial life of the colony on sound and substantial lines. In the world-wide contraction of credit which followed the Baring crisis of 1890, there was first a slackening and afterwards an almost total cessation of the willingness of British capitalists to continue their investments in Australia. Public borrowings became difficult to carry through, and private borrowings ceased. Two great effects followed. The employment of labour directly and

indirectly for the purpose of constructing public works was cut off, and the greatest disorganisation in the labour market followed. In the second place, the relations between the import and the export trade of the colony were completely reversed. During the period of borrowing, the importation of goods, representing the form in which British capital reached the colony, assumed large proportions, and far outstripped the export trade, which suffered from the neglect of the development of rural industries. The cessation of the inflow of capital involved a loss of all that portion of the import trade to which it had given rise, and the necessity of providing for the remittance of interest to London reduced the value of imports for a time to a point below the value of exports. The extreme swing of the pendulum took place between 1889 and 1894, as will be seen from the following statement of imports and exports in each year :—

	Imports.	Exports.	Excess of Imports.
1889 -	£24,402,760	£12,734,734	£11,668,026
			Excess of Exports.
1894 -	£12,470,599	£14,026,546	£1,555,947

The sudden necessity of relying wholly upon its own resources after having learnt to lean upon a profuse expenditure of borrowed money threw an enormous strain upon the financial organisation of the colony, the strain being increased by the fact that a great mass of bad speculation had to be liquidated; and under the pressure the banking crisis of 1893 took place, immensely aggravating the difficulties with which the colony had to deal. Nor were the slings and arrows of outrageous fortune at an end. Deprived of external support, and face to face with

internal disorganisation and collapse, the Victorian population turned with energy to the task of exploiting their natural advantages, only to meet with fresh difficulties. In the contraction of credit following the Baring crisis of 1890 a general decline in the prices of commodities took place, the decline being most marked in the case of raw products, such as those from the sale of which in Europe the Australian colonies draw the greater part of their national income; and while Victorian producers were steadily enlarging the volume of production, they found that in many cases there was no corresponding increase in the aggregate value of what they had to export. How serious were the effects of this fall in prices may be seen from the statement that while the total quantity of wool exported from Victoria (including Riverina wool in transit), was almost the same in 1891 and in 1895, the figures being 163,779,290 lb. in 1895, against 164,805,907 lb. in 1891, yet the declared value had shrunk from £7,165,092 in 1891 to £5,151,153 in 1895. In the case of wheat, again, an increase in the exports from 2,846,944 centals in in 1891 to 3,344,238 centals in 1894 was accompanied by a decrease in the declared value from £909,636 to £660,718. The effects of the fall in prices were made more onerous by the fact that a large proportion of the undertakings of the colony were subject to a charge, more or less fixed, in the shape of interest on borrowed capital, ranging from the interest payable by the Government on loans contracted for building railways down to the interest payable by the settler on his mortgage. Following upon the fall in prices come the cycle of dry years. The pastoral industry of Victoria suffered less than that of other colonies, but even in Victoria the loss inflicted has been heavy, and Victorian commerce has suffered from the injury sustained by Riverina. Owing to the small harvests

the export of Victorian wheat and flour was suspended for nearly the whole of three years in succession. The butter export trade, which has grown up within the last ten years, was greatly contracted during the same period. The effect of bad seasons was witnessed in the high prices of food, which rendered the lot of the town population a harder one, without yielding much benefit to the country producers.

While the process of clearing away the relics of an unhealthy development was taking place, a new growth was in progress, partly in the form of more careful and vigorous attention to the older industries of the colony, and partly in the form of the introduction of new industries; and notwithstanding the difficulties of low prices and drought which had to be faced, the persevering efforts which have been put forth have been crowned with success. As regards the older industries, it needs only to be remarked that the pastoralists have improved their methods, that the wheat-growers have steadily increased their area, and that the gold-mining industry has furnished larger yields as prospecting has been more extensively engaged in and as improved methods of working have been introduced. Among the newer industries which have assumed importance during the last ten years the chief is the butter export trade. Owing to the position of the colony in the southern hemisphere, the production of butter is at its maximum at the time of the year when the production in Europe and America is near its minimum, and by means of refrigerated steamers Victorian butter can be landed and sold in London on the most favourable terms. In addition to these advantages, which Victoria enjoys in common with the other Australasian colonies, the natural advantages of Victoria enable it to produce a superior quality, Victorian butter standing at the head of the trade in chilled, as distinguished from

fresh, butter in England. The export trade in Victorian butter is not confined to the United Kingdom, but extends over a wide area, including South Africa and the East, in addition to other Australian colonies at certain times of the year. The growth of the trade will be seen from the following statement of exports during the past ten years :—

VICTORIAN BUTTER EXPORTED.

	Quantity. lb.	Value. £
1889	1,029,742	37,799
1890	1,627,405	60,377
1891	4,691,785	228,173
1892	7,098,233	355,941
1893	14,005,350	573,932
1894	23,684,164	898,379
1895	25,660,782	978,687
1896	22,170,790	874,710
1897	22,194,467	886,012
1898	18,678,606	736,325

After 1895 the natural development of the industry was arrested by the drought, but during 1899 the production has again become a large one. The growth of this industry deserves particular attention, as it was the means by which the agricultural community were enabled to maintain their position at a time when the prices of cereals had become ruinously low. Another new industry so far as Victoria is concerned is the frozen meat trade, but this trade has not become of the same importance, merely from a Victorian point of view, as it would be if the commerce of Australia as a whole were under discussion, for the greater part of the Australian frozen meat is exported from New South

Wales and Queensland, and that portion which is shipped from Melbourne has its origin mostly in Riverina. The following is a statement of the export of frozen meat from Victoria (including Riverina produce in transit) during the past seven years :—

FROZEN MEAT EXPORTED FROM VICTORIA.

	Quantities.		Values.	
	Mutton. Centals.	Beef. Centals.	Mutton. £	Beef. £
1892	11,794*	——	12,403	——
1893	54,031*	——	74,866	——
1894	111,715	59	126,553	74
1895	175,831	1,904	190,828	2,713
1896	191,453	142	178,227	161
1897	137,739	5,800	124,431	4,954
1898	125,611	8,338	110,867	10,020

Frozen rabbits and hares have also been made the subject of an export trade, the total value in 1898 being £56,461. With a larger cultivation of fruits, an export trade is being gradually built up, both in dried fruits produced at Mildura and exported to other colonies, and in fresh fruits for shipment to England. Other minor industries might also be referred to, and although for various reasons a number of the enterprises that have been entered upon have not been successful, yet the efforts of those who have engaged in them deserve grateful recognition, inasmuch as they were based on the true principle that the prosperity of the colony, to be stable, must rest upon the development of its own natural resources, and not, as in the latter part of the third

*In 1892 and 1893 the exports of frozen beef, if any, were not stated separately.

period of Victorian commerce, upon the support of a flow of capital from outside. Upon these lines, a comparison of Victorian commerce for the year 1898, or what would be still better, for 1899, with that for 1888, is in every way to the advantage of the later year.

The gross figures relating to imports and exports since 1837 may be summed up, according to the division of the sixty-two years into four periods, as follows :—

	Imports.	Exports.	Excess of Imports.	Ratio of Excess of Imports to Exports.
	£	£	£	%
First period, 1837 to 1860 (24 years) -	133,088,758	121,780,515	11,308,243	9·28
Second period, 1861 to 1883 (23 years) -	342,741,969	330,098,494	12,643,475	3·83
Third period, 1884 to 1891 (8 years) -	167,839,480	110,610,151	57,229,329	51·77
Fourth period, 1892 to 1898 (7 years) -	102,179,525	102,907,809	728,284	—

The great difference between the third period, when imports exceeded exports by nearly 52%, and the fourth period, when imports fell short of exports to the extent of 0·70%, exhibits at a glance the character of the change which has taken place in the trade of the colony. The two sides of the account during the last seven years almost exactly balance one another, but consideration must further be taken

of the fact that probably at least £2,500,000 per annum has had to be remitted to England in payment of interest on public and private indebtedness, while on the other hand Victoria derives income from investments in other colonies, and has during the seven years made sales of securities, principally mining shares, to English investors. In making comparison with earlier years, it has to be remarked that during about seven or eight years of the second period no record of wool received from Riverina was kept, and consequently the figures are subject to modification.

In examining the official statements of imports and exports for 1898, nearly the same difficulties in arriving at just conclusions as existed in 1888 will be found. To a large extent these difficulties arise from the necessity of each colony treating its own commerce without reference to the commerce of Australia as a whole. It is to be hoped that one of the results to be derived from federation will be the reorganisation of statistical methods on such a basis as will render them more comprehensive and at the same time more easy to utilise. Taking the figures for Victoria as they stand, however, a companion of the totals for 1888 and 1898 is as follows :—

	1888.	1898.
Gross Imports - - -	£23,972,134	£16,768,904
Less Re-exports - - -	3,497,130	4,093,363
Net Imports - - -	£20,475,004	£12,675,541
Exports of Produce and Manufactures of the colony (including all articles partly or wholly made up of imported materials)	10,356,633	11,778,883
Excess of Imports - -	£10,118,371	£896,658

A further analysis of the figures, however, is necessary. In 1888 large discrepancies were observable between the official statements of wool imported and exported, but such discrepancies do not appear in the 1898 figures. In the case of gold, however, the same cause of error is still at work, for out of gold, bullion and specie to the amount of £5,921,775 exported in 1898, all but £22,639 is set down as Victorian produce, on the ground merely that the sovereigns were minted and the bullion cast into moulds at Melbourne. As the imports of gold bullion and specie in 1898 amounted to £2,634,993, the difference of £3,286,782 alone can be regarded as Victorian produce. The difference in 1888 was £2,731,474.

In the previous Handbook a comparison was instituted between the net imports and the exports of Victorian produce and manufacture in 1878 and 1888, the figures being analysed according to a system of classification resembling as nearly as possible that of the Board of Trade, and the figures for 1898 will now be added. The statements which follow will present:—I. Net imports (*i.e.*, imports less re-exports), and II. Exports of Victorian produce and manufactures only:—

I.—Net Imports (*i.e.*, Imports less Re-exports).

	1878. £	1888. £	1898. £
I.—Animals (living)	590,564	1,904,807	629,758
II.—Articles of Consumption—			
A. Food—			
1 Cereals and Breadstuffs	422,573	265,319	12,571
2 Sugar	966,700	853,854	651,202
3 Other Vegetable Productions for Food, including Preparations	165,063	391,901	308,055
4 Dairy Products ...	5,075	42,500	68,705
5 Animal Food Products and Fish	124,192	241,690	85,045
B. Drink—			
6 Tea, Coffee, Cocoa, etc.	346,348	511,237	202,064
7 Intoxicants, etc. ...	466,753	845,867	350,735
C. Sundries—			
8 Tobacco and Cigars ...	45,407	233,221	136,546
9 Sundry Articles for Household Consumption	79,710	126,620	47,308
Total	2,621,821	3,512,209	1,862,231
III.—Minerals, etc.			
1 Coal and Coke	358,998	625,149	260,610
2 Sundry Crude Metals and Minerals ...	42,702	37,168	67,858
Total	401,700	662,317	328,468
IV.—Chemicals, Drugs, etc. ...	188,386	295,777	293,724
V.—Oils, Paints, etc.	264,374	373,209	261,093
VI.—Crude Vegetable Products	160,656	169,246	212,022
VII.—Crude Animal Products ...	126,542	217,693	260,922
VIII.—Building Materials—			
1 Cement, Marble, Stone, etc.	76,666	189,226	51,586
2 Timber	509,912	1,388,931	329,900
Total	586,578	1,578,157	381,486
IX.—Manufactured Articles—			
1 Textile and Other Manufactures (including Materials) for Personal Wear ...	2,639,623	3,768,478	2,726,232
2 Finished Metals, Machinery, Manufactures of Metals, etc. ...	1,087,930	2,442,631	1,142,329
3 All other Manufactured Articles	1,242,943	2,866,293	1,626,156
Total	4,970,496	9,077,402	5,494,717
X.—Government Stores, Personal Effects, Travellers' Samples, and Sundries not enumerated above ...	226,493	380,121	351,914
Grand Total of Net Imports (Gold, Bullion, Specie and Wool not included)	10,137,610	18,170,938	10,076,335

The foregoing table shows that large decreases have taken place under nearly every heading between 1888 and 1898. Some of the principal decreases are as follows:—Living animals, £1,275,049 (67%); sugar, £202,652 (23%); drink of all kinds, £704,305 (52%); coal and coke, £364,539 (58%); timber, £1,059,031 (76%); textile and other manufactures for personal wear, £1,042,246 (27%); finished metals, machinery, manufactures of metals, etc., £1,300,302 (53%). The decrease in value does not in every case represent a corresponding decrease in quantity, for it would be found on investigation that the prices of many articles have declined, and that the rigid economy enforced during the period of depression has led to the use of lower qualities of goods.

In grouping the figures relating to exports of Victorian produce and manufactures, the same form is followed as that adopted for the imports.

II.—Exports of Victorian Produce and Manufactures.

	1878. £	1888. £	1898. £
I.—Animals (living)	432,246	269,004	153,290
II.—Articles of Consumption—			
A. Food—			
1 Cereals and Breadstuffs	341,167	950,659	446,412
2 Sugar	139,688	50,617	132,940
3 Other Vegetable Productions for Food, including Preparations	124,163	171,978	169,094
4 Dairy Products ...	67,350	69,843	740,608
5 Animal Food Products and Fish	90,810	36,192	148,737
B. Drink—			
6 Coffee, Cocoa, etc. ...	7,852	5,624	5,454
7 Intoxicants, etc. ...	13,074	61,244	78,760
C. Sundries—			
8 Tobacco and Cigars ...	35	—	1,141
9 Sundry Articles for Household Consumption	26,961	23,279	32,763
Total	811,100	1,369,436	1,755,909

	1878. £	1888. £	1898. £
III.—Minerals, etc.—			
1 Coal and Coke	486	496	1,453
2 Sundry Crude Metals and Minerals... ...	67,598	3,354	17,701
Total	68,084	3,850	19,154
IV.—Chemicals, Drugs, etc. ...	12,602	13,837	37,834
V.—Oils, Paints, etc.	21,717	3,083	12,809
VI.—Crude Vegetable Products	117,808	188,811	152,205
VII.—Crude Animal Products ...	157,443	401,412	400,777
VIII.—Building Materials—			
1 Cement, Marble, Stone, etc.	9,037	12,767	7,001
2 Timber	28,768	10,059	11,215
Total	37,805	22,826	18,216
IX.—Manufactured Articles—			
1 Textile and Other Manufactures (including Materials) for Personal Wear ...	275,029	163,330	169,947
2 Finished Metals, Machinery, Manufactures of Metals, etc.	131,942	113,830	299,932
3 All Other Manufactured Articles (including Leather)	410,161	293,589	559,268
Total	817,132	570,749	1,029,147
X.—Government Stores, Personal Effects, Travellers' Samples, and Sundries not enumerated above	84,424	67,426	69,810
Grand Total of Exports of Victorian Produce and Manufactures (exclusive of Gold, Bullion, Specie, and Wool)	2,560,361	2,910,434	3,649,151

Comparing 1898 with 1888, the most important increase is shown by dairy products, £670,765, an increase due to the new butter export trade. Increases are also shown by finished metals, machinery, manufactures of metals, etc., £186,102; leather, £103,560; animal food products and fish, £112,545; sugar refined in Victoria, £82,323; metals and minerals, £15,304 and other articles. The decreases include cereals and breadstuffs, £404,247; crude

vegetable products, £36,606; and crude animal products, £635. As regards the decrease in the exports of cereals and breadstuffs, it must be remarked that, owing to the harvest failure, 1898 is not a fairly representative year. The exports of Victorian wheat and flour during 1899 amount approximately to close upon £1,500,000 sterling.

Assuming the correctness of the official statement of the proportion of wool of Victorian produce exported, and reckoning the exports of Victorian gold at the difference between the total exports and the imports, the following statement of the aggregate value of exports of Victorian produce and manufacture in 1898 may be presented:—

Wool - - - -	£2,229,596
Gold - - - -	3,286,782
All other Articles - -	3,649,151
Total - -	£9,165,529

The distribution of Victorian commerce, so far as is indicated by the official figures, may be compared as follows:—

Imports from	1878.	1888.	1898.
United Kingdom -	£7,389,239	£10,851,667	£6,195,134
Other Australasian Colonies and Fiji	5,625,589	8,561,938	7,670,126
Other British Possessions - -	1,453,772	1,356,801	736,350
United States - -	595,713	1,112,520	883,472
Other Foreign States	1,096,767	2,089,208	1,283,822
Total -	£16,161,080	£23,972,134	£16,768,904

These figures can only be accepted with great caution, though it is due to the Customs authorities to state that they have made great improvements in their methods. As regards imports from the United Kingdom and from the Continent, it is probable that the later figures show more accurately the countries of origin, though the exigencies of transport business still render the task a difficult one. The imports from New South Wales include a quantity of goods transhipped at Sydney from abroad. The purely intercolonial imports include the transit trade in wool received both overland from Riverina and by sea from various colonies for shipment at Melbourne, the total value in 1898 being £1,808,492; and the arrivals of Western Australian gold, to the value of £2,183,893, for coinage at the Melbourne Mint.

The distribution of exports affords the following comparison:—

Exports to	1878.	1888.	1898.
United Kingdom -	£6,458,484	£8,050,056	£6,740,420
Other Australasian Colonies and Fiji	4,854,129	4,318,631	6,642,230
Other British Possessions - -	3,536,642	422,058	746,198
United States - -	23,941	361,434	67,561
Other Foreign States	52,511	701,584	1,675,837
Total -	£14,925,707	£13,853,763	£15,872,246

Here again appearances easily break down under a little investigation. The exports to "other British possessions" in 1878 consisted largely of gold entered for Ceylon, the first place where the mail steamers touched. A somewhat similar inflation took place in 1898 under the heading "other Australian colonies," as gold coin for the United States, sent overland for shipment at Sydney, was entered as an export to

New South Wales, the amount being £2,654,000. The increase of direct communication with the Continent has altered the character of the returns to a larger extent perhaps than the real alteration which has taken place in the trade.

It is impossible to conclude the present article without expressing gratification at the alteration and improvement during the past ten years in the bases upon which Victorian commerce rests. The unhealthy state of things which prevailed in 1888 has been followed by a severe reaction, in which almost every possible form of misfortune has been experienced. The natural vitality of a young country, and the pluck and brains which have been applied to the task of reconstituting the economic foundations of the colony have at last met with success, and with her industries in a state of renewed prosperity, Victoria can now look forward to the future with confidence.

II.—Manufactures.

Like every other branch of Victorian industry, the manufactures of the colony have had to sustain the severest trials during the past ten years. The advantages enjoyed by Victoria in establishing manufactures are to be found in the temperate climate and in the circumstance that much of the immigration in earlier years was from the artisan classes of the United Kingdom. In addition, there was for many years a strong public feeling in favour of encouraging local manufactures by means of protective duties, though it may be doubted whether any real advantage has been gained by even a few of the industries which it was intended to benefit by this policy. The two drawbacks to the development of Victorian manufactures on a large scale, to which reference was made in the last issue of this Handbook still exist; these drawbacks being, first, the limited field for the disposal of the productions of the

numerous competing factories; and, second, the want of a population sufficient to allow of that minute subdivision of labour which is found necessary in manufacturing on a large scale for the world's requirements.

Unique, or almost unique in modern times, is one of the conditions under which a substantial part of Victorian manufacturing is now conducted. The disasters through which the colony passed caused much distress amongst the operatives, both in the way of loss of employment and reduction of wages; and great complaints of "sweating" arose. The result was that a Factories Act was passed, in which Parliament not only applied to local conditions the principles which have guided the British legislature on the same subject, but also established Boards for the fixing of wages in certain trades. An experiment of this kind requires a long period of working—certainly not less than ten years—before its direct and indirect consequences can have time to develop themselves at all fully, and as time goes on, the actual operation of the plan will no doubt furnish ample opportunities for scientific study.

Statistical information as to the "Manufactories, Works, etc.," of Victoria is published annually by the Assistant Government Statist, and the last statement appeared on September 26, 1899, as a supplement to the *Government Gazette*. The definition of a factory, as agreed to in 1896 by the statisticians of Victoria and New South Wales, is given as follows:—"All establishments employing four hands or upwards in the manufacture of articles either for the trade or for stock or for individual orders must be returned; also all establishments with less than four hands, where machinery worked by steam, gas, electric, water, wind, or horse power is used; as well as industries of an unusual or interesting character." The total number of hands employed is estimated at 54,778 against

56,271 ten years previously; and the number of factories at 2869 against 3154, the average number of hands per factory being 19 against 18. The proportion of small factories is considerable. The particulars furnished in 1899 are as follows:—

Establishments Employing	Number of Factories.	Hands Employed.
Under 4 hands - -	460	1,467
4 hands - - -	323	1,292
5 to 10 hands - -	1,044	7,329
11 to 20 hands - -	491	7,168
21 to 50 hands - -	326	10,152
51 to 100 hands - -	138	9,499
101 hands and upwards -	87	17,871
Total - -	2,869	54,778

The approximate total value of machinery and plant is £4,500,727, which compares with £5,565,325 ten years ago. The returns may be summarised as follows:—

Class A.—Partial or Crude Treatment of Raw Material.

	No. of Establishments.	No. of Hands.	Approximate value of Machinery and Plant.
			£
Foods (malt)	13	110	14,450
Building (lime)	7	77	3,140
Animal Matters (bone-milling, tanning, &c.)	120	1,903	137,847
Wood and other Vegetable Substances (bark-milling, chaff-cutting, corn-crushing, forest saw-milling, &c.	281	2,124	141,286
Oils and Fats (boiling-down, tallow rendering)	17	79	4,640
Metals and Minerals	5	71	14,650
Total, Class A	443	4,364	316,013

Class B.—Finished Articles of Consumption.

	No. of Establishments.	No. of Hands.	Approximate value of Machinery and Plant.
			£
Foods, Animal (bacon, meat freezing and preserving, butter, cheese, &c.	227	1,857	358,350
Foods, Vegetable (including flour, oatmeal, jams, sugar-refining, &c).	128	4,159	537,895
Foods, Mineral (salt)	5	63	2,120
Foods (drinks and narcotics)	221	3,255	403,275
Textiles	23	1,307	198,855
Dress, &c.	508	15,347	130,681
Furniture	112	1,559	47,160
Building	125	1,581	110,920
Apparatus for transportation—			
(a) By Road (coach, lamp, cycle, saddlery, &c.) ...	221	2,249	46,175
(b) By Rail (railway workshops)	9	1,641	161,850
(c) By Water (ships, graving docks, &c.)	9	137	54,900
Animal matters, not otherwise classified (leather goods)	11	128	3,885
Wood and other Vegetable Substances	103	2,084	181,825
Oils and Fats, Animal and Vegetable (including soap)	34	510	105,095
Metals and Minerals—			
(a) Machine, tools and implements	240	5,799	490,530
(b) Other articles	86	1,252	62,850
Gold, Silver, and Precious Stones (exclusive of Mint)	37	434	14,130
Ceramics, not otherwise classed ...	8	433	18,300
Production of heat, light, and energy	61	921	719,088
Explosives, ammunition, &c. ...	4	123	36,570
Art, Science, and Letters (including printing)	223	5,067	456,690
Miscellaneous	31	508	43,570
Total, Class B	2,426	50,414	4,184,714
Grand Total	2,869	54,778	4,500,727

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