HANDBOOK OF MELBOURNE.

FOR THE USE OF MEMBERS OF THE

AUSTRALASIAN ASSOCIATION

FOR THE

ADVANCEMENT OF SCIENCE.

MELBOURNE MEETING, 1890.

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PREFACE.

THE object of this Handbook is to give an epitome of the History, Commerce and Manufactures, Meteorology, and Flora and Fauna of Melbourne and the Colony of Victoria generally, together with a brief outline of the habits and distribution of the aboriginal inhabitants.

Limits of space necessitate brevity in the various chapters; but, as this is probably the first occasion on which any such series dealing with the Colony has been brought together, it is hoped that the Handbook may prove of value to members of the Association, for whose especial use it has been compiled.

MELBOURNE,

January, 1890.

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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 age-long 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 lands 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 settlement. 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; the first to float on its winding stream. He had, in an open boat, accompanied by the now veteran, but then 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 over his stock 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 alignment. 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 since 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 license fee of £10 per annum, they had the right to depasture on Crown lands as many sheep each as they 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 of 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 little 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; it took three days to contain the 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 15 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 10 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 hundred-weight 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, the richest goldfield the world has ever seen. 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 time had now 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 license 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 feeling 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 chose 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 has fallen off a little, and the production of gold is a vanishing quantity, but on the solid basis of agricultural, pastoral, and manufacturing activity, the position of the colony promises everything satisfactory for the future.

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 those 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 30 years of existence, with a volume of papers for

nearly every year, wherein much valuable work is conglomerated with much that is not valuable.

This has always been the central scientific body of this colony, but in all probability a larger body of work of permanent value has been performed by smaller and more specialised societies, such as the Microscopical, the Field Naturalist, the Geographical, the Acclimatisation Society, and so on.

But the science work of the colony will probably be best done in the future, when its own natives attack indigenous problems, after having been duly prepared for the task by the rapidly growing science department of the University, and it is not an extravagant hope to expect that the Australasian Association for the Advancement of Science will have a powerful influence in determining in that direction the ambitions and energies of many of those born in the colonies.

THE GEOLOGY OF MELBOURNE.

By G. S. Griffiths, F.G.S.

The site of Melbourne and its suburbs affords to the geologist much that is of interest, for it is composed of formations which have been assigned to many different periods.

The flat between the city and Emerald Hill is an old river valley, filled up with Post-pliocene clays, merging upwards into recent alluvium. The Flinders-street Station stands, in part, upon the edge of a Pliocene lava flow. A much older, that is to say, a Miocene lava, lies under Collins-street West, whilst Silurian sandstones—far more ancient—supply the foundations for Collins-street East. At least two extinct volcanoes raise their isolated cones within twenty miles of the General Post Office. Within a yet shorter distance—exposed in the banks of a small tributary of the Saltwater river,—there is a Tertiary limestone abounding in various shells, the tests of sea-urchins, and other remains of the animals which once lived in a sea which has retreated from the locality; whilst a walk of about half an hour's duration from the Kew tramway terminus will take the visitor to the outcrop of a quartz reef, which once yielded to the miner gold at the rate of half an ounce to the ton.

Melbourne owes its geological richness partly to the circumstance that it stands upon the margin of

an old continental area. For long ages Australia has been in a state of slow vertical oscillation, and its lower lying portions have frequently been dipped beneath and raised above the sea level. With these movements the coastal line changed its position, sometimes very considerably, so that the site of Melbourne often disappeared beneath this secular tide. When this occurred sands and clays were deposited; and when at other periods it was left high and dry and far inland, then the runlet and the creek became busy all over its surface, softening and removing the sedimentary beds of other epochs.

Another leading feature of its geology is that the metropolis stands upon the extreme eastern edge of a most extensive series of lava flows. Twice at least the channels of the Yarra and the Saltwater River, the Merri and the Darebin Creeks, have been filled to their brims with basalt, and as often the streams have cut new courses down the old valleys. Emerald Hill is a low rise of Miocene lava, which rests upon, and so has preserved, the sandy beds of a shallow estuary. The same description applies to the basalt at Spencer-street Station, and also to that of the hill at the Flemington Racecourse. The younger and later series of lavas may be seen at Richmond, filling in an ancient river channel, and the rugged walls of the great quarries there expose excellent sections which show the large number of flows which made up the mass.

The fundamental formation exposed in the area is of upper Silurian age, and it consists of contorted and often vertical beds of sandstone, shale, and coarse slate. This formation outcrops on both sides of the Moonee Ponds Creek from the lower gorge of Passco Vale to the Royal Park, and thence across the University grounds, through Fitzroy, parts of Collingwood, Richmond, and the Eastern Hill.

Another, and a larger area, comes in from the eastwards. Heidleberg is on its north-western flank, Oakleigh is on its south-eastern, and a narrow strip leaves the main body near to Kew, straggles towards Prince's Bridge, and terminates in the hill upon which Government House stands.

St. Kilda is built upon an oblong hill of Silurian, which, lying apart, emerges like an island from the younger marine beds which engirdle it. These latter superficial Tertiaries stretch from Albert Park to Frankston, and thence easterly far into Gippsland.

The geology of the metropolis cannot be well described without some reference to the geological history of the colony, and, therefore, I will sketch its broader outlines, illustrating the events as much as possible by reference to deposits occurring near to the city.

The Paleozoic.

The earliest glimpse which we get of the past of what is now known to us as the Colony of Victoria, reveals the region as an indistinguishable part of an ocean of moderate depth, with its expanse almost unbroken, excepting towards Tasmania, by any land. The floor of this sea was being slowly covered with deposits of mud, clay, and sand, and to a very limited extent by limestone.

At this remote period it is probable that the earth's bulk was shrinking with comparative rapidity, and as this proceeded the sedimentary beds, which formed its outermost solid envelope, had in many regions, of which this was one, to pack their incompressible materials into a continuously diminishing area. The tangential thrust thus set up solved the difficulty by crumpling up the strata, and in parts piling up the fractured pieces until a sheet, which originally may have covered a space 200 miles wide, accommodated itself to one of only 130 miles. Strata, once horizontal, are now to be seen as huge slabs of stone, packed end on end, and agglutinated together by pressure, so that they stand side by side, like the rows of slates in a builder's yard, or the folded leaves of a closed fan. The tremendous pressure incidental to this proceeding, combined with a differential rate of movement of the particles, has made these rocks more or less schistose, but it has not been sufficient to effect that more extreme alteration, known as metamorphism, whereby limestone is converted into marble, and clay into jasper, except in two limited regions, one lying to the north of Casterton, and the other in the counties of Bogong and Benambra.

The waters of this ocean supported various lowly forms of life, and these have left traces of their existence in the muds and sands in which they died. Thus we find graptolites, the fossilised remnants of a kind of sea-pen; a small crustacean *(Hymenocaris salteri)*; some cuttle fishes *(Cephalopoda)*; various molluscs, and also a seaweed *(Spirophyton caudaphasiani)*. These fossils have enabled Professor M'Coy to fix the age of their formation as lower Silurian.

Such deposits as indicate a shore-line, namely, conglomerates and breccias, are very rare, being known to occur only at Spring Plains and Maldon, and in these places on a small scale. From this circumstance it is inferred that the ocean was an open one, in which the beds referred to marked the limited shores of islets.

In what direction then are we to look for those land surfaces, the rain-wash of which supplied the clays and sands which made up these extensive sea-bottoms?

We have not the materials which would enable us to answer this question with any degree of confidence, but it is significant of an ancient and persistent coast-

line, and, therefore, of more or less dry land, that the northern parts of Tasmania contain great beds of conglomerate, grit, and sand, which repeat themselves frequently throughout the vast epoch which extended from the Cambrian to the Carboniferous. One such boulder-bed occurs on the River Don, with a dip to the north, as to deeper water, though this may be due to subsequent changes in the levels. Another appears at Beaconsfield, beneath lower Silurian clay-slates and limestone. Others form bold ranges at the Penguin, or rugged dangerous reefs along the coast, thence to Table Cape.

No lower Silurian deposits occur very near to Melbourne, but they form the bedrock of the colony to the west of the metropolis, and they reappear again in North-eastern Gippsland.

The next stage revealed to the geologist shows to him this sea-bed converted into dry land, and greatly wasted by erosion, after which the eastern portion of the region sinks and is added to the ocean again. It is possible that the North-eastern Railway line marks approximately the western shore line of this upper Silurian sea; at all events its beds do not now pass many miles to the west of that line, though they may have done so once, and then have been removed.

These sedimentary beds do not differ in character, or in degree of corrugation, greatly from those of the preceding age. Conglomerates are more plentiful, as might have been expected on the assumption that there was more land in the vicinity. Limestones also are more abundant, and they occur in larger beds. One such stratum occurs at Lilydale, which is easily visited from the city. Others in Gippsland are of interest, as they contain that graceful fossil known as the stone lily (*Encrinites liliiformis*), a deep-sea polyzoon. The bedrock of Melbourne is of this

age—the upper Silurian—corresponding to that of the typical May Hill sandstone. A good section can be seen in the Moonee Creek Valley, to the west of Brunswick, where there are exposed beds containing a plentiful supply of such fossils as *Orthoceras Favosites*, *Uraster*, *Lingula*, *Orthis*, *Pentamerus*, and various gasteropodous molluscs.

In the railway cutting at South Yarra the beds yield crustaceans (*trilobites*), and the rocky outcrop in Latrobe-street, opposite to the Library, is also fossiliferous.

Another excellent section is exposed in the deep-road cutting on the east side of the Johnson-street bridge, a spot readily accessible by tram. It shows a sharp anticlinal fold of these old sea-beds.

These Silurians, both upper and lower, contain the auriferous lodes which have made Victoria famous. The golden wash-dirt is the hard, heavy, greatly concentrated residuum of large masses of these rocks, broken down, triturated, and assorted out by flowing water, the weightier dropped to the bottom, the lighter carried to the sea. In these operations the agent has been the running stream in one place, and the grinding surf in another; and, consequently, the wash-dirt of the miner is sometimes an old river bed and sometimes an old sea-beach. Probably, in nearly every case, the auriferous matrix is of Silurian age; but in most the materials themselves received their final sifting and settlement in late Tertiary and Pleistocene times.

Towards the close of the Silurian period, the area now marked by the Australian Alps began to be elevated. The sea bed was uparched in a broad fold, and the plateau thus formed is supposed to have extended without a break from New Guinea to Tasmania. As the land emerged the sea waves cut a flat shelf into the soft sandstones and shales, thus

giving to the broken edges of the crumpled strata a measure of levelness which no agency known to us could effect, except the horizontal crosscut of marine erosion.

The Upper Paleozoic.

The next stage in the development of this region is this elevatory movement, prolongeduntil all of the present land surface of Victoria stood at an altitude considerably greater than it does now; whilst in the extreme eastern end of Gippsland a range of lofty and singularly active volcanoes, probably not much inferior in bulk to the Andes, buried an extensive locality deep under their ejections. Mr. A. W Howitt, F.G.S., who discovered their sites, describes them as being wasted to the very foundations, whilst percolating mineral waters—for ages hot, though long cold—have transmuted their layers of tufa and lava into quartz-porphyries and felspathic agglomerates.

After a long period the land sinks again, and once more the ocean steals up into the mountain glens, and converts their re-entering curves into lochs and bays, and their salient bluffs into capes and promontories. Meanwhile the still active volcanoes load the encroaching waters with emissions, which fall to the bottom in muddy clouds.

The region sinks still more—the lochs deepen—the volcanic fires cool slowly down, and eventually the craters themselves become silent. With the progress of these changes the littoral waters grow clear and habitable to corals and other lime-secreting animals which cannot live in turbid seas. These thereupon immigrate and build up calcareous strata over the now consolidated deposits of igneous origin.

These formations—the igneous lower Devonian and organic middle Devonian—remain now only in small isolated patches in the extreme south-east

quarter of the colony. To what further extent they may also have once overspread other parts we have no means of knowing.

The limestone contains corals and molluscs, and also the remains of an interesting and nearly extinct group of fishes, representatives of which Hugh Miller first unearthed in the Old Red Sandstone of Cromarty Bay. These ganoid fishes, distantly represented to-day by the gar-pike and the sturgeon, had their bodies plated with bony armour, often bright with shining enamel and quaint with natural device—star-like rays, knobs like the nail-heads on a castle door, and fluted lines.

It is noteworthy that between the last of the beds of this system—the middle Devonian—and the first of the next one—the upper Devonian—there is the same marked unconformability that has been noted between the same two parts of the system in Great Britain. We can confidently infer that between them there was a period during which the region was elevated and eroded.

To this condition of things another era of greater depression followed, and the downward movement continued until more than 5000 feet deep of water and sea silt overlay the lowlands. Nevertheless the Dividing Range was then so lofty that its peaks, or broad table-lands, still towered far above the waves. But ages of weathering stripped them of such quantities of debris, that when this was river-born into the sea, the accumulation upon the sea bottom measured thousands of feet in depth over large portions of what are now the lowlands of Victoria. Of this great deposit only two vestiges remain. One of these extends from near Bairnsdale to Mansfield, and was accumulated in what was a long trough between two mountain spurs. It represents the silt of another deep sea-loch. The uppermost

beds of those that have outlived the weathering of the long period which has elapsed since their elevation are still 5300ft. above the sea level. In some of them Mr. G. Sweet has recently discovered near Mansfield a rich deposit of the ganoid fishes, before referred to, also the tattered and frayed leaves of cycads and ferns, these last doubtless having been washed into the sea by the rivulets which must have entered the bay on every side, after draining the steep mountains which overlooked its waters.

The highest and youngest beds of this series are found on the course of the Avon, and they contain tree trunks, which have been identified as the scaley-barked lepidodendron, a fossil which enables Professor M'Coy to determine the deposit as a passage-bed between the Devonian and the Carboniferous.

The other deposit of this age, above referred to, constitutes the Grampians. They are built up of 2000ft. of massive false-bedded sandstones, as hitherto found, barren of fossils, resting unconformably upon older rocks. The component material is ground much finer than that of the Mansfield basin, from which it is inferred that it is a deep sea-travelled deposit, whilst the conglomerates and breccias of the latter remain close to the cliff-edge whence they were derived.

With the Avon lepidodendron beds we leave the Devonian, and pass over the threshold of the Carboniferous epoch, but at this point, when we might expect to encounter coal-bearing beds, we seek for them in vain. At this stage in our history we experience a blank. Coal beds have either never been formed in this area at this period, or, having been formed, have subsequently been entirely removed. Mr. Murray expresses the opinion that there was a see-sawing movement of the surface of south-eastern Australia, as a result of which Victoria was upraised

and New South Wales depressed. A consequence of such a movement would be that in Victoria erosion and removal would be favoured, and deposit would be prevented, whilst in New South Wales deposits of sandstone, shale, vegetable humus, and eventually of limestone—such a series as actually does occur—would be forming in every submerged valley within the line of sinking coast.

This view receives some support from the geology of Tasmania, as described by Mr. R. M. Johnson. That island yields evidences of subsidence and deposit in the region south of us, precisely similar to the conditions prevailing to the north. Tasmania sank until its broad tract of dry land was converted into an archipelago of three larger and many smaller islets. The encroaching waters deepened from north to south, as this theory would require, so that while shallow-water Carboniferous deposits repose on the edges of Devonian schists in the Mersey valley, deeper sea deposits were formed in the Derwent district, remnants of which occur from the present sea-level up to an altitude of 2500ft. on the flanks of Mount Wellington. The reasonable deduction seems to be that in the Carboniferous epoch Victoria was upraised relatively to the areas north and south of it.

It is necessary to remark here that Professor M'Coy differs from his fellow geologists, in that he assigns the coal deposits of Newcastle to an age subsequent to that now under consideration.

However these questions may eventually be settled, this at least is certain, that between the date of the Avon sandstones and the next stage of which we have any records in Victoria, there is a great gap.

The Mezozoic Period.

As one result of the elevation of the region which, without doubt, closed the Paleozoic period, a long,

wide, and shallow trough was eroded across the southern portion of the colony between the main watershed and the present coast line, and rudely parallel with them. The axis of this depression passed across the sites of Casterton, Warrnambool, the Barabools, Portarlington, Mordialloc, Buln Buln, Sale, and Bairnsdale.

With the incoming of the Mezozoic this valley was occupied in its deeper parts by sheets of fresh water, into which numerous rapid streams brought immense quantities of sand and pebbles and vegetable debris, so that eventually it became filled up to a depth of at least 2500ft. with beds of a lacustrine character—conglomerates around the margins, and sandstones and shales where the waters deepened. Between many of the sandy layers there is an abundance of the compressed carbonised remains of land or aquatic plants. These in places amount to coal seams. In the Otway district they are almost always very thin. About Cape Patterson they are thicker, but the district having been greatly faulted, the value of the seams is much impaired. In the basin which lies between Anderson's Inlet and the Latrobe Valley there are seams now being opened up which promise to be of excellent quality, and in one or two instances as much as 5ft. thick. Only two forms of animal life have been discovered as yet in these extensive deposits, both being those of fresh-water shell-fish (unio).

It appears to be likely that during this period the elevatory movement, before referred to, united Victoria to Tasmania, and added to both a tongue of land which projected—there are reasons for believing as much as 700 miles—further into the Southern Ocean. By this movement the Victorian localities, just described as occupied with lacustrine deposits, instead of being at or about sea-level, were considerably above it. They

were, in short, a series of lakes situated upon a great table-land, upon which they shifted their beds from point to point as the hollows silted up. There must have been a very abundant rainfall during this period, as fresh-water lake deposits of this age abound over many parts of Australia. They are extensively developed in Tasmania, and the chief point of difference between these and our own is that the coal seams of the former are both more numerous and much thicker, on the average, than those found on this side.

One of our lakes extended northwards to Bacchus Marsh, and its bed appears to be one of the oldest of the series. Mr. Wilkinson considers that it is the equivalent here of the Hawkesbury sandstone—another lacustrine deposit—and of the Trias of Europe. The beds of the Wannon, the Otway, and the Gippsland Ranges, are of a rather late date, having been assigned to the Jurassic.

Although the site of Melbourne was, in all probability, covered with an extension of these lake-beds, not a vestige of their remains can be seen, and the only part of the metropolitan area in which they could now be, is buried deep under the Tertiaries upon which Williamstown is built.

During this period a wide, shallow sea parted eastern and western Australia, and eventually on this sea-bottom, as it became elevated, brackish and then fresh-water beds of cretaceous age were accumulated. These have yielded to the collector ammonites, and belemnites, and archaic lizards, turtles and saurians. Their porous beds are to-day, under geological direction, yielding up stores of water to the artesian tube.

To return to our own colony, a lapse of time saw this great valley filled to its brim with sand and silt; the lakes are changed into flat, wide, high, alluvial

plains, and the same streams that provided the materials for their beds, eventually cut gulleys, cañons, and valleys through them, thus in time impressing a new and different contour upon the country.

In all the irregularities thus carved in the Mezozoic lake bottoms, the beds of the next period were to be deposited,

The Tertiary Period.

With this epoch all the lower lands again disappear under water. A rugged indented peninsula represents the mainland. Off its coasts are islands, the sites of which are to-day known as various mountains:—The Otway Ranges and the Grampians; the weird sandstone crags of Arapiles, and the granite peaks of Wilson's Promontory, and of the You Yangs. The Dandenongs, a worn-down remnant of a Paleozoic volcano, form a bluff promontory, standing out into the sea. The ocean flows freely up the Murray plains, passing beyond Wodonga, and branching up the Goulburn, the Ovens, and many another of the valleys which flank the northern slope of the divide. At the same time it submerges most of Southern Gippsland.

The only relics of the earlier—the Oligocene—part of this period are certain scanty patches of fossiliferous sandy clays with septarian nodules, found in several distantly separated localities—Muddy Creek, near to Hamilton; on the south-west flank of the Otway coast ranges; in the vale of Bacchus Marsh; and also low down in the face of some of the cliffs of that part of Port Phillip Bay which lies between Frankston and Schnapper Point. Deposits of the next succeeding age, the Miocene, are much more widely spread. They underlie most of the plains

between the Murray and the mountains, and the mountains and the sea. Cliffs of chalk, snowy white as those of Albion itself, though not as boldly high, overlook the head of Portland Bay. They are built up of the hard parts of minute deep-sea animals; the shells of globerigina and orbulina, the siliceous spicules of sea urchins; of branches of coral, and nodules of flint. Beds of this age, of very similar composition, form the cliffs of the Lower Murray, of the Otway coast, and of the north-west coast of Tasmania. Concealed by younger formations, they pass under the southern end of Port Phillip Bay, and under the Werribee Plains. They are found at Bacchus March, and they touch Flemington. Mount Mary, a small volcanic cone, between Melbourne and the You Yangs, has in its sloping strata masses of rock which are replete with Miocene marine fossils. These have been derived from old sea beds lying far beneath their present position. The vent of the volcano passed through these, and during the explosions masses were torn out and hurled more or less vertically, so that they fell back close to the crater, and, rolling down the slopes, came to rest where they now lie.

A depth of some 700ft. of water covered the site of Melbourne during some portion of this period. Before the sea had quite retired, volcanic eruptions took place upon a large scale. The valleys of the Yarra, the Moorabool, the Leigh, and of numerous other streams were filled with lava and ashes, and in some parts these deposits are still hundreds of feet in depth.

At last the sea retreats, and with this change the emergent surfaces are again subjected to the denuding action of the atmosphere. About this time, or perhaps a little later, a great change began to come over the climate; the rainfall

increased exceedingly, and was associated with a lower temperature. Frost did its disintegrating work upon the uplands, and the rain-wash swept the loosened debris into the streams. In consequence of these conditions the erosion of the higher levels and the accumulation upon the lower ones was excessive.

Most of the deposits of Miocene age, whether aqueous or igneous were swept back into the Pliocene sea to form beds of that age. For scores of miles up the Yarra shreds and patches of Miocene lava over remnants of Miocene gravels and sands attest at once the great extent of the original lava flow, and the severity of the scour which subsequently removed it so completely. Emerald Hill, Batman's Hill, and North Melbourne Hill are all portions of an ancient estuarine deposit of the Yarra, which have been preserved solely by the old basaltic rock which sealed them up. The lava of the Kangaroo ground (a locality just without the suburban radius) is another well-known deposit, dating from the same time.

In the wake of the receding ocean there followed fresh-water or brackish lakes, and the abundant storm waters of this rainy period swept down into these shallow sheets great quantities of vegetable debris. These deposits, alternated with layers of sand or clay, and the organic matter being thus protected against active oxydisation, fermented slowly, and formed the thin seams of lignite which lie beneath Williamstown, and the great beds of brown coal which have recently been discovered at Mirboo.

After another time-lapse of considerable length the land again sinks, and this time to a greater depth than the last, the data available showing that the metropolitan area must have been quite 1000ft. beneath the waves. As a result the coast line

hugged the mountains nearer than ever, and the land-surface shrank immensely, until all that was to be seen of Victoria was a rugged Morea-shaped peninsula, and the highest ridges of the New South Wales Cordillera, still peeping above the waters, formed the stem to which this area was articulated.

During this immersion the mountains were much loftier than those which stand upon the same foundations to-day, and the abundant streams which descended from their peaks discharged into the sea vast quantities of sediment which, settling down upon what are now the lower hills, the higher valleys, and the plains of Victoria, filled them and levelled and obliterated their inequalities with successive beds of gravel, boulders, sand, and clay. When afterwards the ocean retired for the last time, the land-surface around Melbourne must have presented a contour which was very different to that which it now has, for not a rock of Paleozoic age could have been visible. The sediments just referred to overlaid and concealed every previous land mark, and long-continued erosion was necessary to excavate and reveal the ancient features. But as the land rose the soft sea-beds dissolved into mud and disappeared. On the north and east of Melbourne, at the Royal Park, the Eastern Hill, the higher parts of St. Kilda, South Yarra, Toorak, Malvern, Hawthorn, and Kew, the old Silurian land surface has been relieved of its covering, and exposed once again to daylight. But the environs which lie to the west of the lower Yarra—that is, those which still stand but little above sea-level, have been less eroded, and still carry much of their Pliocene loading. Beneath the basalt and the alluviums of Williamstown and the Werribee Plains, of Yarra bank and the West Melbourne swamp, and far below the sea-level there lies masked and buried an

ancient land surface of Silurian rocks, in continuation of and corresponding to that which appears across the river. If the present elevatory movement lasts long enough atmospheric agencies and the sea will, between them, remove these comparatively recent encrustations. The thickness of sediment that has been removed from the higher localities may be inferred when we take notice of how much remains upon the lower. Near Williamstown a bore has been put down 300ft. through alternating beds of sand and clay, lava and shelly limestone, lignite and gravel, without ever reaching the Silurian. At Mentone the boring rod went through marine beds, often rich in fossils, for 600ft.; at Portarlington for 1500ft., and at Winchelsea for 2100ft. With respect to some of these, however, it must be remembered that a portion of the lowermost deposits will date back to the Miocene and Eocene, and even to the Mezozoic. The wide extension of these submergent conditions in the Pliocene is noteworthy. Across the Straits in Tasmania we find at Longford, in the old lake-beds which filled the Mersey valley, 900ft. of alluvium; and north of us, in Riverina, deep accumulations of sand, silt, and gravel have levelled up out of recognition the hills and dales which existed early in the Tertiary epoch.

As the sea retired from the mountains the coast line expanded, and the watercourses lengthened their beds by advancing their mouths over the reclaimed sands. As a result of this operation, the estuarine deposits of one period become the meadow-land of the next, and everywhere round Victoria, over its lowlands, fluviatile beds succeed to marine ones.

Towards the close of this period another great outburst of volcanic activity occurred, and before it died out wide areas on the west side of the colony

were covered with basalt. From Casterton to Colac, from Portland to the Werribee Plains, on the north of the Dividing Range, as well as on the south of it, these emissions encrust the surface. Rivers which had cleared their courses, first of Miocene lava, and then of Pliocene mud, had them once more obstructed by the ejections of this last series of eruptions. But in time they, too, ceased; and thereafter, down to the present, the erosive forces were to preponderate. The Yarra to-day flows in a new channel, cut out of and along its ancient valley, and immense quantities of Pliocene mud and lava still conceal the earlier windings of the stream.

Whilst these geological and geographical developments were in progress other correlated changes had been transpiring. I have already referred to climatic alterations which took place during some part of the time between the close of the Miocene and that of the Pleistocene. Differences of opinion exist between authorities as to the precise measure of these vicissitudes.

Mr. Wilkinson is satisfied that there was a period of bleak intensely wet weather in New South Wales during the Pleistocene. Professor Tait and others believe that the evidence establishes the occurrence of a Glacial epoch at a somewhat earlier date. Professor Hutton admits that the climate grew exceedingly cold, but he accounts for this by local causes, such as a great elevation of the region whereby the local rainfall and snowfall were augmented and the snow-line lowered.

However these questions may ultimately be decided, that the climate was exceedingly wet and cold for a long period is allowed, and this greatly affected the flora and fauna of Australia. Warmth-loving animals and plants retreated equatorwards, where they could; where they could not, they either

perished or deteriorated. The saurians left our rivers for ever; the gigantic kangaroos, wombats, and native bears were replaced by smaller forms, and many species became extinct. During the Miocene the prevailing flora was characterised by plants belonging to the laurel family, whilst forests of oak, elm, beech, and araucarias were plentiful. These had disappeared by the beginning of the Pleistocene, when the eucalyptus took their place. This family of trees came to us last from Western Australia, then almost a separate land dominating the southern part of the Indian Ocean, but cut off by torrid deserts and shallow seas from Eastern Australia. With the completion of these changes, physical and biological, Victoria attained to its present geographical form and features. Minor oscillations have since loaded its margins with thin beds of Post-pliocene sands; the mountains have been lowered by denudation, the rivers have cut their channels deeper. With the evaporation of the Central Australian lakes the climate has grown dry and hot; but no other alterations of moment have occurred, unless we refer to the arrival of man on the scene.

This, then, is the story of Victoria's development, in meagre outline, as the facts have been deciphered by the labours of Selwyn and M'Coy; of Wilkinson, Howitt, and Murray, and their colleagues; and as delineated on our geological maps by Couchman.

THE ABORIGINES OF VICTORIA.

By Lorimer Fison, M.A.,

Honorary Member of the Anthropological Institute of Great Britain, Honorary Member of the Anthropological Society of Washington, &c.

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, &c.—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. It is necessary to state here that I am making use of information diligently collected by my friend and fellow-worker, Mr. A. W. Howitt, whose name ought to be at the head of this article rather than my own. For the accompanying sketch map I am 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, as far as Wangaratta; south-westward to a little beyond Geelong; and north-westward beyond Daylesford.
3. The *Wotjo*.—From the Kulin boundary to the north and west there was a great group of tribes, whom 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 these nations. Those to the north of the Wotjo had the class-divisions Kilpara and Mukwara, which extend far into New South Wales, up to the country of the Kamilaroi tribes.

To the north of the Kurnai on the Alpine tablelands, and extending down the Mittamitta, the Kiewa, and the Ovens River as far as the Buffalo, were tribes called the Theddora and Kandangora. I have not classed these among the Victorian natives because they belonged to the Murring of New South Wales.

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 number of local divisions, which Mr. Howitt and myself 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 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 Mr. Howitt has 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. Bunwurung	Not ascertained	Bunjil	Mordialloc
,,	,,	Bunjil	Cape Schank
,,	Yalukit	Waa	St. Kilda
,,	Not ascertained	Bunjil	Sandridge
2. Woiwurung	Urundjeri	Waa	Kew
,,	Buluk	Waa	Cranbourne
,,	Ngaruk	Bunjil	Dandenong
,,	Kurunjang	Bunjil	Werribee
,,	Gunung	Bunjil	Mt. Macedon
3. Thargunwurung	Nira	Waa	Kilmore
,,	Buthera	Bunjil	Seymour
,,	Yawung	Waa	Alexandra
,,	Waring	Bunjil	Muddy Creek
,,	Yirun	Bunjil	Benalla
4. Jajauwurung	Kurnung	Waa	Daylesford
,,	Galgal	Bunjil	Kyneton
,,	Learga	Waa (?)	Sources of Campaspe
,,	Kalk-kalk	Waa (?)	N.W. of Kyneton
,,	Wuringhera	Waa (?)	Near Galgal clan
,,	Tonemburlang	Waa (?)	Upper Loddon
,,	Leauragura	Bunjil	Smeaton
,,	Kri	Bunjil	Mt. Blackwood
5. Not ascertained	Bulungkara	Bunjil	Wangaratta
6. Wudthawurung	Wudthawurung	Bunjil	Geelong
7. Nguraiwurung	Ngurailum	Not ascertained	Murchison
,,	Benbendora	Bunjil	Mooroopna

Woi, Thargun, Bun, Wudtha, and Ngurai, are, some of them certainly, and probably all of them, simply different forms of the negative. Thus the Woiwurung are "The people who say 'Woi' for 'No.'" This nomenclature from the negative is common among the Australian tribes, *e.g.*, the Kamilaroi, or Kumilrai, the Wiraithari or Wiradjeri, &c., 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 Woiwurung 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; 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 Tribes, the Kroatungalung (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 valuable 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 valuable 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 classes themselves were major totems.

The Kulin classes were Bunjil (eaglehawk) and Waa (crow): those of the Mara were Gamutch and Krokitch (identical with the South Australian Kumait and Kroki). All these have been established beyond doubt by Mr. Howitt as the equivalents of Kilpara and Mukwara of the Darling district; of Dilbi and Kupathin, the two primary classes of the Kamilaroi, which sub-divide into Ipai, Kumbo, Muri, Kubai; and of the Queensland Mallera and Wuthera, which also split into four sub-classes. These four sub-classes, with their peculiar line of descent, were not found in Victoria, unless possibly along the Murray frontage to the north of the Kulin.

The Kurnai had not the two primary divisions, though there is evidence that they had them in former times. All their males were Yirung (emu-wren), and all their females were Djitgun (superb warbler). It may be noted that these male and female totems extend among tribes far to the northward, along the east coast, and are additional to those indicating the various social divisions. They are found also in the other Victorian nations.

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

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

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. I 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 tinted 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 major totems, and of many, if not of most, of the minor 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 Waa man was Bunjil, his child was Waa, like himself. Thus, the Urundjeri people, for instance, were all Waa, 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—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, 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 Woiwurung tribe, where a famous quarry, from which stone axes were obtained, was claimed as the property of a family whose headman was one Bilibeleri. 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 give the husband an

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

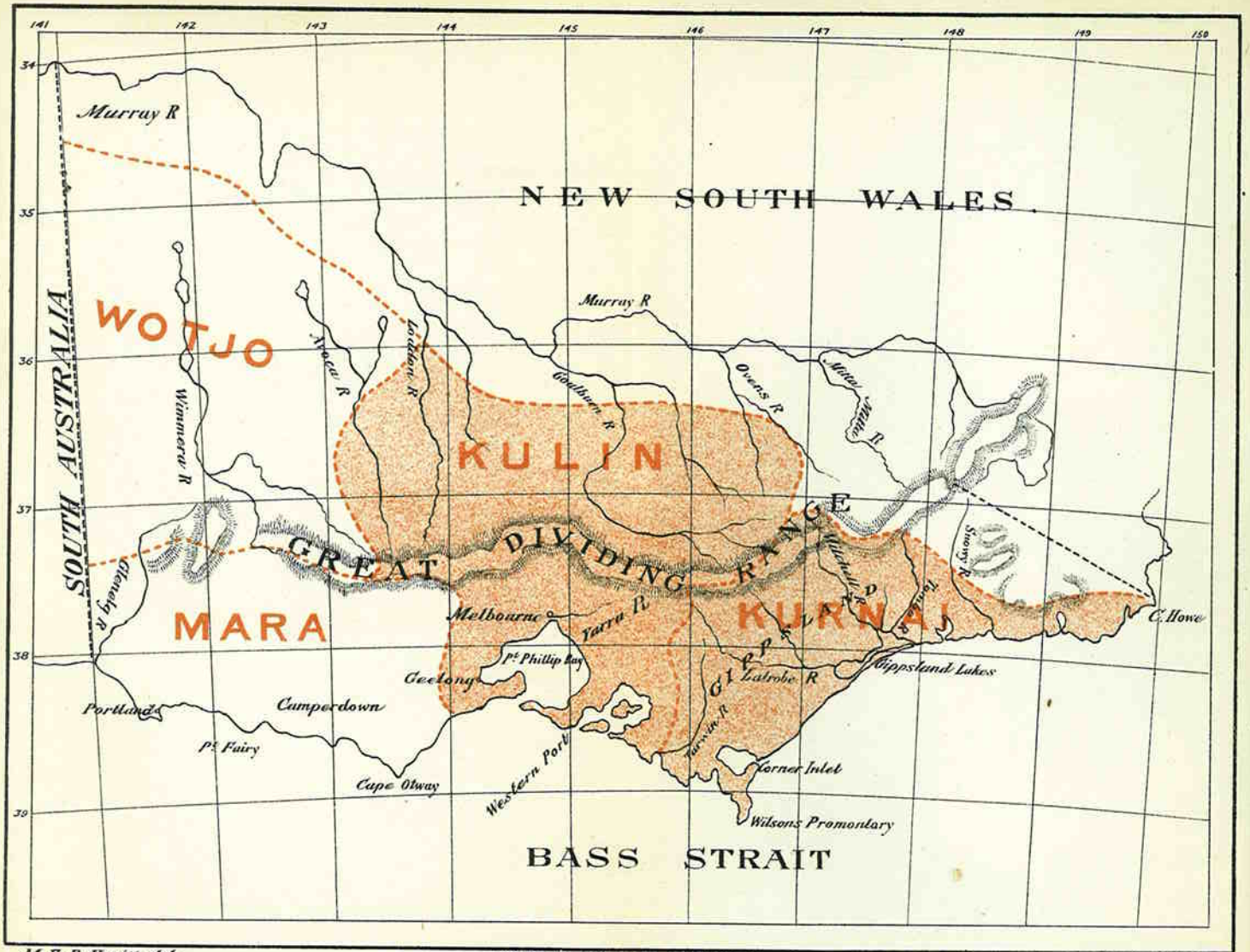
exclusive right over his wife, or wives. Elsewhere, under the older order, we find a more or less restricted communal right, which asserts itself over that of the individual, the right of the individual being, at all events occasionally, over-ridden by that of the totem-group to which he belongs. This was not so among the Kulin and the Kurnai; and they had nothing even distantly resembling the Pirauru custom of Cooper's Creek, which is a form of group-marriage, exactly 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. Hence, the only possible form of marriage was elopement, the ordinary forms by betrothal, or exchange, being out of the question. 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.

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



M. E. B. Howitt. del.

SKETCH MAP OF VICTORIA

Shewing the Aboriginal Nations.

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

Spectator Pub. Co. Melbourne

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.*

My friend, Mr. Howitt, who, having been claimed by the Yantruwunta, of Cooper's Creek, as a defunct Lizard come to life again, is looked up to with awe as a great Past Master of the Mysteries, sent round the sacred *tundun* (bull-roarer) some years ago, and the remnant of the Kurnai gathered at his call, and performed the ceremony in his presence. A most interesting account of it from his pen, and another of the Kuringal (Initiation) of the Murring, the New South Wales neighbours of the Kurnai, who also performed their initiation ceremonies at his bidding, may be found in the Journal of the Anthropological Institute for 1885.

*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.

ZOOLOGY: VERTEBRATA.

By A. H. S. Lucas, M.A., B.Sc.

Introduction.

The Vertebrate Fauna of Victoria is not markedly distinct from that of the rest of Australia. The colony is not separated from New South Wales and South Australia by impassable or even difficult barriers. The actual boundary line between Victoria and New South Wales, from the sources of the Murray to Cape Howe, and that between Victoria and South Australia, from the Murray to the coast along the 141st meridian, are purely artificial, and do not coincide with any natural physical lines of demarcation. The great drainage area of the Murray and its tributaries forms but one natural region, and animals which have passed the Darling at Bourke can easily cross the Murray at Echuca. We thus possess a number of forms which are characteristic of the more inland country, and are visited occasionally by other forms which we can scarcely claim as permanent denizens of the colony.

The Great Dividing Range has proved a more serious obstacle to the migration of species, partly from the height of the mountains and breadth of the chain, and partly from the modifications which are thereby occasioned in the climate of the more southern portion of Victoria. It thus comes about that north and south Victoria show greater differences in their assemblages of species than are met with on the two sides of the Murray.

The Tasmanian Fauna again is conspicuously distinguished by the presence of the Tasmanian wolf and the Tasmanian devil, but in many other respects shows a close connection with the Fauna of southern Victoria, often a closer connection than subsists between the forms on the north and on the south side of the Dividing Range.

Mammalia.

Of the higher, placental, orders of mammalia, we possess representatives of the Bats, Rodents, Carnivora, and Cetacea, while certain species of *deer have become fairly established.

Insectivorous bats appear to be plentifully distributed, but the species do not seem to have been determined, with the exception of *Molossus australis*. In Gippsland the great fruit-eating bats, the so-called flying floxes, *Pteropus poliocephalus*, abound, and with the planting of orchards and gardens they should be much better provided for than when in the old days they depended on the fruits of the scrub-forest.

Thanks to their fecundity, the rodents are now paramount amongst the feral mammalia. In the Western District the rabbits have indeed threatened some of the squatters with extinction. "In fact, you see them everywhere, black, white, red, and the common grey ones." At Colac advantage was taken of their abundance to establish a factory for tinned rabbits. Slight changes in their habits have been noted. They are said to swim across streams, and to associate, in their burrows, with cats. The production of hybrids between cat and rabbit, however, rests upon very insufficient evidence. The rabbits furnish valuable supplies of food to the native eagles and hawks. Around Melbourne they are not much of a nuisance, and furnish mild sport for the

*Especially the Sambur deer of Ceylon.

metropolitan sportsmen. The hare has been very successfully introduced by the Acclimatisation Society; the animals have multiplied so freely that a close season is no longer necessary or enforced, and the price of a hare in Melbourne is just about half the price in London.

In Victoria we have examples of water-rats, long-eared rats, short-eared rats, and mice. The beautiful golden-bellied beaver rat, *Hydromys chrysogaster*, has been found, though sparingly, in the Goulburn, and other of our streams. European water-rats have taken possession of the banks of the Lower Yarra. From virgin streams we have records of the dusky-footed water-rat, *Mus fuscipes*. Our long-eared rats include the pretty little species of Hapalotis, *H. albipes*, *H. Mitchelli*, and *H. conditor*, all found in the Murray province. Of the short-eared rats, we have *Mus novæ-hollandiæ*, and others. But work remains to be done to determine with precision the various species of our indigenous and introduced rats and mice. The foreign species swarm in the towns, and bid fair to carry the boycott of the native forms to the extent of extermination.

The Carnivora proper consist of the dingo, or native dog, and two species of seals, and, we may add, the fox. The dingo is to be found in all parts of the colony where the conditions are favourable, where sheep are ready to hand, and where the country furnishes dense enough cover. They are abundant in the Mallee scrub of the Wimmera, and are a source of great annoyance to the Gippsland farmers. Foxes have spread from the Werribee centre, and are often known by their attacks on poultry as far as Camperdown in the west and Christmas Hills on the north.

Seals were, in the early days of Australasian settlement, very abundant on the shores and on the

islands of Bass's Straits. Such names as Sealer's Cove, in Wilson's Promontory, and Seal Island, which was given to an island near to Phillip Island, and also to another off the east coast of Wilson's Promontory, attest the abundance of these creatures in former times. Doubtless, any of the forms which lived on the islands would be driven now and again by storms and currents to our shores. But it is difficult nowadays to make sure of some of the species which have now quite disappeared from our seas. Péron described the earless seal, *Phoca proboscidia*, as living in great numbers on King Island, where he stayed for a time. This huge animal, 20 to 30 feet long, with its singularly long snout, sufficiently resembled the elephant for the name, Bay of the Elephants, to be given to the harbour they most frequented, and of which Péron gives a very interesting view in his Voyage. Gould speaks of the cowled seal, *Arctocephalus lobatus*, taken at Houtman's Abrolhos, and Rivoli Bay, South Australia, as being also probably one of the Bass's Straits seals. However, the only strange visitant from more southern seas, of which we have secured specimens for the National Museum, is the eared *Stenorhyncus leptonyx*, a rather large animal, reaching 10ft. in length. Professor M'Coy describes it as a most voracious devourer of fish, and occasionally of marine birds. And but one seal is left as a resident on our rocky shores, as also on those of the islands of the Straits, the eared sea-bear, *Euotaria cinerea*. This was first described by Quoy and Gaimard from animals they obtained in Western Port, though the distinctiveness of the species had been pointed out previously by Péron. In the "Decades" Professor M'Coy gives Trooper Ardill's account of the habitat and habits of the sea-bear, as observed by him, still (as now) occupying the

quarters it occupied at the time of the visit of Quoy and Gaimard. Excellent specimens can be seen in the National Museum, obtained from the Seal Island, off the Nobbies, Phillip Island.

Of the Cetacea we can fairly claim but one permanent species, the yellow-sided dolphin, *Delphinus novæ-zealandiæ*, which can be seen tumbling in tumultuous motion in Port Phillip, as in the waters off the south coast. Almost any of the southern whales *might* be stranded on our shores. Professor M'Coy secured, for the Museum, the skeleton of a magnificent specimen, 90 feet long, which was stranded at Jan Juc, outside Port Phillip Heads, in August, 1867. His energy and labour have been expended fruitlessly, for the colony has been unable to provide a shed for the protection of this valuable skeleton from the action of the weather, and members of the Association will, no doubt, be astonished at even its present state of preservation, after 22 years of "all this rain-water out of doors." Another specimen of this whale, *Physalus grayi*, M'Coy, came ashore near Geelong. Another whalebone whale, *Balæna australis*, taken in Portland, has furnished a skeleton to the Museum.

There are examples in Victoria of most of the families of marsupials. Of the *Dasyuridæ* we have several species of *Phascogale*, *P. penicillata* (found more or less all over the colony), *P. lanigera*, and *P. calura* (both from the Murray); and of *Antechinus*, *A. flavipes*, *A. albipes*, *A. swainsoni*, and *A. leucopus;* and the three species of *Dasyurus*—*D. viverrinus*, the native cat, *D. maculatus*, the tiger cat, and *D. geoffroyi*. Of the cats the last is the rarest. The native cat is found to be still destructive of the eggs and young poultry of farmers just beyond the suburbs of Melbourne; and, indeed, the great persistence of the species may be judged from the fact that living

specimens are occasionally met with in the University grounds. As the common sparrow extends itself, the birds, with their easily accessible nests, should furnish a new and handy supply of food to the native cats.

The common bandicoot, *Perameles nasuta*, is also well established, and not easily disturbed by the new conditions of advancing civilisation, and burrows for potatoes with as much zest as it ever showed for native roots. Dr. Bennett says that the bandicoots themselves are excellent eating, which may prove to be a compensation to the selector. I have seen them as near to Melbourne as Malvern. Boys hunt them with terriers. Some other species, *P. obesula*, *P. gunnii*, *P. fasciata*, have been recorded, the two former being pretty common, and another Peramelid, *Chæropus castanotis*, in the Murray district.

We have several species of Phalangistidæ. The native bear, *Phascolarctus cinereus*, is still in the Gippsland forests, in spite of the large numbers shot for their skins, and the still larger number shot out of pure mischief. More easy, harmless, unresisting game never presented itself to the unskilled sportsman; and a man who can go and shoot bears for the fun of it, should feel at home with a gun among a flock of sheep. A white variety is obtained now and then. We have also several kinds of the fur-bearing, leaf-feeding "opossums." The short-eared opossum, *Phalangista canina*, is characteristic of the higher country, while the common opossum, *P. vulpina*, is characteristic of the lowlands. The ring-tail, *P. viverrina*, is pretty generally distributed. A yellow-furred Mallee opossum replaces *P. canina* in the Mallee scrub. Specimens of *Dromicia gliriformis*, Dormouse Phalanger, are preserved in the National Museum from Mordialloc and Muckleford. Mr. D. Le Souef informs me that it is occasionally met

with in South Victoria, that he obtained one at Gembrook four years ago. Several of the arboreal forms, which possess membranous patagia, or expansions of the skin of the sides, to enable them to make short flights from branch to branch, are found in Victoria. The largest and most abundant is the great flying opossum, or flying squirrel, *Petaurista taguanoides*, found in all the forests to the east and north-east of the colony. Mr. Tisdall saw hundreds of them at Templestowe some twenty-five years ago. We have also *Belideus australis*, *B. breviceps*, and *B. notatus*. Professor M'Coy has described a peculiar form from the Bass River, South Gippsland, which he has designated *Gymnobelideus leadbeateri*. In the scrub, also, scarcely rare, but difficult to observe and to obtain, is the charming little opossum mouse, *Acrobates pygmæus*, the smallest of our marsupials.

The wombat, *Phascolomys platyrhinus*, can still be obtained in the less frequented parts of Gippsland. It is perfectly incapable of maintaining its hold on a district in the presence of civilised man, and when one comes across its burrows, it is but rarely that they are found to be tenanted. Both black and grey varieties have been found all over Victoria in the timbered mountainous districts.

We have, or have had, several kinds of kangaroo and wallaby. Before man, with his sheep, dog, and gun, they are each year driven further into the scrub, and deeper into the forest. The great grey, or old-man kangaroo, *Macropus major*, has been hunted all too successfully from the Gippsland Lakes to the South Australian border, from the Goulburn River to the Mallee. He is still to be met with in considerable numbers in the neighbourhood of Casterton, and also near Rosedale. From Lake Albacutya and the surrounding country the black-faced kangaroos can be obtained, *M. melanops*. This

is considered a distinct species by Gould, but not by Waterhouse. Specimens of the so-called sooty variety of the old-man, *M. fuliginosus*, have been procured for the Victorian National Museum from the junction of the Murray and the Darling. As similar visitors from the central plains the Museum possesses examples of the pretty little bridled kangaroos, *Onychogale frænatus*, and its ally, *O. lunatus*. Mr. Le Souef reports that the former are fairly numerous in the Mallee country to the north-west of the colony, and are there known as Pademelon. Near Swan Hill captures have been made of the South Australian red kangaroo, *Osphranter rufus*; and at Mount Hope of the hare kangaroo, *Lagorchestes leporoides*. Amongst the scrub of the southern lowlands the little red-bellied, or stump-tailed wallaby, *Halmaturus billardieri*, is common, while in the more wooded and less accessible spurs of Cape Otway, Wilson's Promontory, and Gippsland, the much larger and darker brush-tailed wallaby, *H. ualabatus*, is often disturbed by the bushman. Gould records the red-necked wallaby, *H. ruficollis*, from the Port Phillip district. The Tasmanian wallaby, *H. bennettii*, is generally considered as a variety of this species, and this form is also found, though infrequently, in Gippsland. It is not improbable that the brush-tailed rock wallaby, *Petrogale penicillatus*, may be discovered in the rocky fastnesses of the Grampians. The Victorian kangaroo rat is *Bettongia cuniculus*. Our definitely Victorian Macropidæ include then this Bettongia, *Macropus major*, *M. melanops*, *Onychogale frænatus*, *Halmaturus billardieri*, and *H. ualabatus*.

Victoria boasts the possession of both genera of monotremes. The echidna, *Echidna hystrix*, has nearly the whole colony for its habitat, burrowing alike in the Murray Plains, in Gippsland, and,

though now more rarely, in the Melbourne district. It is most plentiful in the Eastern counties. The hairy Tasmanian variety, *E. setosa*, while the only kind met with in King Island, is not found in Victoria. Like the English hedge-hog, the echidna will probably persist, from lack of rivals in its peculiar mode of life. The platypus, *Ornithorhyncus paradoxus*, is still pretty plentiful in the quiet reaches of undisturbed streams. A young male was brought to me about two years ago, taken alive in the Yarra at Kew. In the National Museum we possess an artistic case, showing with great beauty and fidelity the nature of the haunts and habits of this remarkable animal.

Birds.

In response to my request, Mr. A. J. Campbell has kindly furnished the following information on birds peculiar to Victoria, birds of economic value, and on questions of the migration and geographical distribution of our Avi-fauna. Mr. Campbell has devoted his life to the study of ornithology, and has, probably, by far the best practical acquaintance with our birds in their native haunts of any one in the colony. He has also contributed notes on some of our more conspicuous birds from his own observations in the bush :—

Birds Peculiar to Victoria.—Victoria forms such a small portion of the Australian continent that it may be expected very few birds are peculiar to its territory. Only one species of the remarkable lyre bird *(Menura victoriæ)*, and the beautiful honey-eater *(Ptilotis cassidix)* have not yet been found beyond its boundaries, being confined to the great timber tracts of the eastern portion of the colony. It may be mentioned, however, that one or two, such as the cautious wren *(Hylacola cauta)* and the rufous-

headed bristle-bird *(Sphenura broadbentii)* possess a somewhat restricted range, and in addition to the western part of Victoria, have only been reported from South Australia—probably from the Lower Murray scrubs, which belong physically to Victoria as much as the neighbouring colony.

Birds of Economic Value.—These are principally game birds—geese, ducks, pigeon, and quail. But frequently bustards, stilts, plover, coots, &c., are exposed for sale in the market; sometimes wattle birds and parrakeets, and even grebe. . Ducks, during the season, realise about 3s. 6d., but when scarce, 6s. 6d. per pair wholesale. Erratic seasons of drought in Queensland and the far interior regulate the Melbourne market. The dry season of 1887-8 appeared to force the birds southward, when 98,737 pairs of miscellaneous wild fowl found their way through the market, whereas the following season—one of plenty of moisture—only 40,936 pairs fell under the auctioneers' hammers. Again, take a private instance, an enthusiastic sportsman in 1888 shot, within a radius of 50 miles of Melbourne, 833 brace of quail; this year his bag did not exceed three brace. Nearly 20,000 petrel's *(Nectris brevicaudus)* eggs are annually (in November) taken from the burrow-nests on Phillip Island, Western Port. They form an excellent article of diet, being large and devoid of pronounced or fishy flavour, and are sometimes vended in Melbourne as ducks' eggs. Notwithstanding the great raid upon the nurseries, there is no apparent diminution in the number of the birds, or in the quantity of eggs gathered each season.

Migration.—It is to be regretted that no systematic observations have been kept, as in Europe and America, on this subject. Snipe *(Gallinago australis)* arrive from northward about the full moon of September, and almost simultaneously are heard the

cheerful notes of the first reed warblers *(Calamoherpe australis)*. The advance guard of the cuckoos also put in an appearance the same month. Later on follow the kingfisher *(Halcyon sanctus)*, bee-eater *(Merops)*, caterpillar-catcher *(Lalage)*, &c., and lastly fly-catchers, notably *Myiagra rubecula*, *M. nitida* and *Ithipidura rufifrons*. All, with the exception of snipe, breed in Victoria, returning northward as the colder months approach. With regard to nomadic or wandering birds, a few species regulate their movements by the supply of food. For instance, wood swallows *(Artamus superciliosus)* arrive at intervals of about three years, and are generally preceded by plagues of locusts or caterpillars. Then the uncertainty of flowering eucalypts keep the various lorrikeets *(Trichoglossi)* on the wing. Last February and March they were crossing Melbourne in a north-easterly direction. There are also a few species from extra Australian limits, such as curlew and whimbrel *(Numenius)* and other waders, all from the northern hemisphere. Swifts (*Chætura caudacuta*) sometimes appear in numbers towards the end of the summer.

Geographical Distribution.—Of the 337 recorded Victorian land birds there are a few cosmopolitans or real "globe-trotters"—the grey plover (*Charadrius helveticus*), knot (*Tringa canuta*), curlew sandpiper (*T. subarquata*), glossy ibis (*Ibis falcincellus*), egret (*Herodias alba*), &c. But of the total (337) about half, roughly speaking, extend to northern Queensland, which number in turn diminishes to about a third on reaching New Guinea. Western Australia may be included in the habitat of between 140 and 150 Victorian varieties, while Tasmania includes 120, and New Zealand about 20—chiefly waders.

NOTE.—All game, ornamental, and useful birds are protected by law in Victoria for stated seasons, some of the more important perpetually.

Remarkable Species.—Three or four are conspicuous above all others, and are peculiarly Australian, namely, the lyre bird, Mallee fowl, and bower birds. The lyre bird (*Menura victoriæ*) inhabits the dark, dank, heavily timbered tracts of Gippsland. It is one of the most remarkable birds in the world, resembling a lanky domestic fowl, with strong legs and immense claws. The general colour is dusky-brown. The male only is adorned with the elegant lyre-shaped tail, an appendage about 30in. long. The food consists of beetles, centipedes, snails, &c., and occasionally bush mice. Lyre birds are the shyest of all shy birds, the slightest noise causing them to disappear as if by magic. During certain months of the year, in the mornings and evenings, the aisles of the forest resound most delightfully with the melodious liquid songs of the male birds. In addition to his natural notes, he is a most wonderful mocking creature, imitating to the very semitone the vocality of any of his feathered compeers, whether the solemn "mo-poke" of the owl, the coarse laughter of the great kingfisher, the crack of the coach-whip bird, or the higher pitched notes of smaller fry. He is equally at home with other familiar forest sounds—the grunting of the koala, the howling of a dingo, the ring of the selector's axe, or the grating of his saw—all are perfectly reproduced in the throat of this most singular feathered mimic. On one occasion a tramp, hearing a saw in an adjacent gully, descended to ask the woodsman for a few matches, when, to his chagrin, the tramp found that a bird had duped him. All songs and sounds are usually poured forth with all the bird's soul on little permanent mounds of earth, which he scrapes up, and upon which, brimfull of elation, he capers, struts, and reflects his beautiful tail. Only one egg, the colour of the parents' own

feathers, is laid a year. The sole task of incubating it devolves upon the female. Exceedingly romantic situations are selected for nests, sometimes in hazel or musk tree scrub, or cleft between noble fern-tree trunks, or upon the ground at the source of some secluded gully with steep banks on either hand, and where long, graceful fronds, meeting above, completely subdue the charming picture, while the air is charged with the sweet and powerful aroma from blossoming sassafras trees.

To the dry, arid Mallee scrub of the Western District is a radical change of scene. There the so-called Mallee hen, or native name, Lowan (*Leipoa ocellata*) loves to dwell. Its curious natural economy is replete with interest. In disposition shy, timid, and seldom seen. It much resembles in shape and size a greyish, mottled, domestic turkey, but is smaller, more compact, and stouter in the legs. Food consists of berries, seeds, insects, and tender shoots of plants. Perhaps the most striking characteristic of the Mallee hen is that it does not incubate its eggs after the manner of other birds, but consigns them (12 to 16 in number) to a large mound of sand, swept up by the aid of the birds' wings and breast, where the eggs are hatched by the action of the sun's rays, together with the heat engendered by decomposing vegetation placed underneath the sand. This native incubator is sometimes equal to a displacement of about 150 cubic feet. The temperature by Fahrenheit indicates about 93deg., or about 10deg. lower than an artificial incubator. Two eggs a week are deposited.

The bower birds are genuine ornithological novelties. Victoria possesses two—the satin bower bird (*Ptilonorhynchus violaceus*) tenanting the eastern portion, and the spotted (*Clamydodera maculata*) the north-western. Both their extraordinary bowers

are constructed in unfrequented parts of the scrubs. The birds appear to tread down upon the ground a platform about 6ft. or more in circumference of fine twigs, sticks, and grass, then in the centre they erect two parallel walls, about 9in. apart, of long twigs firmly secured in the matted base, gradually tapering upwards and meeting, or almost so, about 2ft. above. Great taste for the beautiful is displayed by the birds in decorating their playhouses with the bright plumes of their cousins, notably parrakeets ; also with other attractive objects such as shells, bleached bones, and, since civilisation has encroached upon their domains, smooth pieces of glass, buttons, and even coin of the realm. These fanciful bowers are used by the birds simply as "spooning" or flirting arbours, and are not the nests, as many persons suppose. The respective nests are somewhat loose structures, always placed in low trees or thick bush, as the case may be, containing three or four eggs. The spotted bower birds' eggs being of remarkable beauty. Bower birds are frugivorous, consequently the hand of every orchardist is against them.

Reptilia.

Victoria possesses representatives of the orders of chelonians, lizards, and snakes. The Gippsland crocodiles are of newspaper creation merely.

Of chelonians, the Murray tortoise, *Chelymys macquaria*, is very common in the Murray and its tributaries, from the south as well as from the north. It is not found in the rivers flowing into the sea on the south coast of Victoria. On the other hand, the long-necked river tortoise occurs in those of South Gippsland, as also in the more northern Australian rivers.

Our knowledge of the Lacertilian fauna is incomplete. Professor M'Coy has described and figured in his "Decades of Victorian Zoology" single species of five genera of limbless snake-lizards, *Delma*, *Lialis*, *Aprasia*, *Pseudodelma*, and *Pygurus*; two geckos, *Phyllurus miliusii*, and *Diplodactylus marmoratus*; three species of blue-tongued lizards, *Cyclodus nigro-luteus*, common in the south; *C. gigas*, more abundant in the north; and *C. occipitalis*, of which only two or three specimens have been seen in the Western District; the stump-tailed lizard, *Trachydosaurus rugosus*; and the still more rugged *Egernia cunninghami*; two species of "blood-sucker," so absurdly designated, *Grammatophora muricata*, and *G. barbata*; *Tympanocryptis lineata*; two varanids, the common lace-lizard, *Hydrosaurus varius*, and *Monitor gouldi*; and the Gippsland water-lizard, which Professor M'Coy considers to be a variety of the Queensland *Physignathus leseurii*. The difficult assemblage of forms grouped under the generic title of *Hinulia* remains for discrimination and illustration. The group is a dominant one, and, as usual, free variation renders the number of forms sufficiently marked to be worthy of a separate description inconveniently great.*

Professor M'Coy has similarly illustrated most of our snakes. Our list includes three blind snakes, *Typhlops bicolor*, *T. nigrescens*, and *T. Preissii*; the green tree-snake, *Dendrophis punctulata*; and the carpet snake, *Morelia variegata*; while Krefft also recorded the diamond snake, *M. spilotes*. Of venomous Elapidæ, we have four species of *Diemenia*, two of *Pseudechys*, and four of *Hoplocephalus*; also *Furina bicucullata*, *Vermicella annulata*; and the dread deaf

* Professor M'Coy's nomenclature is retained for convenience, though several of these lizards take other names in Boulenger's "British Museum Catalogue."

adder, *Acanthophis antarctica*. The most abundant of these are the tiger snake, *Hoplocephalus curtus*, the most widespread, active, and dangerous of them all; the brown snake, *Diemenia superciliosa*, pretty generally distributed; the copper-head, *H. superbus*, and whip-snakes, *H. flagellum* and *H. coronoides*, in the southern districts; with the black snake, *Pseudechys porphyriacus*, and the deaf adder, near the Murray.

Amphibia.

Our commonest frog is the golden bull-dog, *Ranoidea aurea*. Two others have also been described and figured in the "Decades," *Limnodynastes tasmaniensis* and *L. dorsalis*. This very meagre list evidently requires to be largely supplemented, especially in the face of Mr. Fletcher's catalogue of species from the neighbourhood of Sydney.

Fish.

There seem to be only about ten kinds of strictly resident sharks as yet known or recorded from Victorian seas. These are the hammer-head, *Zygæna malleus*; the grey nurse, *Odontaspis americanus*; carpet shark, *Crossorhinus barbatus*; angel fish, *Rhina squatina*; spotted dog-fish, *Parascyllium nuchale*; tope, *Galeus australis*; smooth hound, *Mustelus antarcticus*; picked dog-fish, *Acanthias vulgaris*; saw-fish, *Pristiophorus nudipinnis*; and Port Jackson shark, *Heterodontus phillipi*. The seven-gilled shark, the white shark, and the thresher are occasional visitors, and single captures have been made of *Carcharias melanopterus*, and of the spiny and the basking sharks. A specimen of the latter, 36ft. long, was taken at Portland in 1883. Our commoner rays are the sting ray, *Myliobatis nieuhofii*, *Raja lemprieri*, *Urolophus testaceus*, and the fiddler ray, *Trygonorhina fasciata*. The king

of the herrings, *Callorhynchus antarcticus*, is fairly common with us, and is afflicted with the same parasitic genus, *Synaptyches*, as is its northern representative.

The most useful for food of our marine bony fishes are the Gippsland perch, *Lates colonorum*; salmon trout, *Arripis truttaccus;* the ludrick, *Girella simplex;* snapper, *Pagrus unicolor;* bream, *Chrysophrys australis;* butter fish, *Chilodactylus nigricans;* flat-heads, *Platycephalus bassensis* and *P. lævigatus;* whiting, *Sillago punctata;* pyke, *Sphyræna novæhollandiæ;* king fish, *Sciæna antarctica;* barracouta, *Thyrsites atun;* silver trevally, *Caranx georgianus;* skip-jack, *Temnodon saltator;* sand mullet, *Mugil grandis;* mullet, *Agonostoma diemensis;* stranger, *Odax richardsoni*; rock cod, *Pseudophycis barbatus;* sole, *Rhombosolea bassensis;* flounder, *Pleuronectes victoriæ;* gar-fish, *Hemirhamphus intermedius;* and pilchard, *Clupea sagax*.

Species remarkable for their form, colour, or habits are the old-wife, *Enoplosus armatus*, and *Neotephræops zebra*, with their black transverse zebra-like stripes; the flying gurnets, *Trigla polyommata*, *T. kumu*, and *Lepidotrigla vanessa;* the stone-lifter, *Kathetostoma læve;* the gorgeous multi-coloured parrot-fish, *Labrichthys* and *Heteroscarus;* the sea-horses, of which our most common species is *Hippocampus breviceps*, with their ally, the sea-dragon, *Phyllopteryx foliatus;* the leather-jackets, *Monacanthus;* toad-fish, *Tetrodon;* sea hedge-hogs, *Diodon;* and the beautiful trunk-fishes, *Aracana*.

With regard to the river fish, the most interesting point is their local distribution. In the rivers of the Murray system we have the Murray cod, *Oligorus macquariensis*, species of *Ctenolates*, *Therapon*, *Murrayia*, and the Murray cat-fish, *Copidoglanis tandanus*. None of these were found originally in our southern streams. Again, the Yarra herring, *Protoctroctes maræna*, several species of *Galaxias*, and the black-fish, *Gadopsis marmoratus*, are the characteristic original southern forms. The distribution of the species of *Galaxias* needs elucidation, but it is certain that several of the Yarra species do not occur in the north-flowing rivers. Very small black-fish are common in the upper reaches of those streams, but do not attain at all to the size which they reach in the Yarra (of old days) and the Gippsland rivers. Thus the fresh-water fish of the south Victorian water-courses are those of Tasmania, and not, generally speaking, even remotely allied to those found in the rivers of the Murray system.

There are two sorts of Lampreys which live in the tidal waters of the southern streams. The commoner is the Tasmanian Lamprey, *Mordacia mordax*.

The Lancelet has been dredged in large numbers on the sandy bottoms of Western Port and the South Channel of Port Phillip, in the latter locality by Mr. Bracebridge Wilson.

In composing this account of the Victorian Vertebrates, I have made use of all available means of information. I have especially to acknowledge indebtedness to the National Museum, and to Professor M'Coy's valuable "Decades," and to Mr. D. Le Souef, the assistant director of the Zoological Gardens, for his kindness in imparting information concerning the distribution of some of our mammals, which he has long been accumulating.

ZOOLOGY: INVERTEBRATA.

By Arthur Dendy, M.Sc., F.L.S.

In the limited space at my disposal it is quite impossible to attempt more than a very brief and imperfect account of the Invertebrate Fauna of Victoria. Even were the space at my command sufficiently great, yet the very rudimentary condition of our knowledge would preclude anything like completeness. Certain groups, it is true, and especially the *Mollusca*, *Polyzoa* and *Hydroida* amongst marine forms, and the *Lepidoptera* and *Coleoptera* amongst terrestrial forms, have already received a large amount of attention at the hands of systematists, so that we are in a fair way towards a tolerably complete systematic knowledge of these divisions. Other large and important groups, however, such as the terrestrial worms and the less conspicuous insects, and amongst marine forms the Sponges, Tunicates, and Worms are as yet scarcely known to us at all. In the case of the marine groups, however, we have good reasons for hoping that, owing mainly to the exertions of Mr. J. Bracebridge Wilson in collecting, and of the Port Phillip Exploration Committee of the Royal Society of Victoria in distributing the collections, our knowledge will soon make rapid advances. Even then, however, it must be remembered that only a very limited portion of the Victorian seas is being explored, and that a vast field will still remain almost unknown to us.

With regard to the terrestrial invertebrate fauna, we must rely on the exertions of individual explorers, and much may be done in this way. The fresh-water fauna is perhaps less known to us than either the marine or terrestrial, and a thorough examination of our rivers, lakes, and ponds cannot fail to yield most valuable results.

For the purposes of the present chapter it will be convenient to consider the invertebrate fauna of Victoria under three main heads—(1) Marine, (2) Fresh-water, (3) Terrestrial. A complete enumeration of the species, or even genera, as yet known to us in each of these divisions would, of course, be entirely unsuitable—even did space admit of it—for a chapter like the present, which aims at placing before the scientific public only a very general idea of the present state of our knowledge. I propose, however, to treat the matter systematically, taking group by group, and giving some brief account of the most interesting or best known members of each. Many lamentable gaps which I have been unable to fill will at once be apparent to the zoologist. Some of these at least are due to actual gaps in our knowledge, and we can only hope that they will be to a large extent filled up before the Association again meets in Melbourne.

To several local zoologists I am greatly indebted for much valuable assistance in the preparation of this chapter, and most especially to Mr. J. Bracebridge Wilson, M.A., of the Geelong Grammar School.

(1) The Marine Invertebrates.

The following observations naturally apply principally to the fauna of Port Phillip and its immediate neighbourhood outside the Heads, and this for reasons already indicated. Fortunately, however, Port

Phillip is a veritable store-house, teeming with the lower forms of life, which doubtless find in the almost land-encompassed bay a more congenial habitat than along the open coast line, where the waves roll in from the Southern Ocean with disastrous force and sweep everything away before them. The great richness of Port Phillip in invertebrate life is perhaps to be accounted for partly by its geographical peculiarities. Its immense area affords abundant choice of habitat for the different forms, and abundant variety in the nature of the bottom. The comparatively small size of the channel through which it communicates with the open ocean is also, I believe, an important factor. Myriads of free swimming larvæ of animals which are fixed or almost stationary in the adult condition, must be washed in with every tide. They have then the whole area of the Bay to wander about in, and before they can find their way out again through the narrow opening the vast majority of them will have exchanged the free swimming for a sedentary life, and find themselves caught in a trap. Thus many more individuals will be washed in than will ever get out again, and every tide will bring its larval contributions to the invertebrate fauna of the Bay.

Porifera.—The *Porifera* or Sponges form certainly the most conspicuous feature in the marine invertebrate fauna of Victoria. They are met with everywhere along our coasts in great profusion and variety. Their dead skeletons are washed up in hundreds of tons along the beach, and the living sponges crowd the sea-bottom from low-water mark to the greatest depths yet explored, and form thick encrustations all over the piles of the various piers in the Bay. They vary in shape, size and colouration to an almost incredible degree; from the amorphous bath sponge *(Euspongia)* to the exquisitely cup-shaped

Grantia labyrinthica; from the almost microscopical calcareous forms to the huge masses of *Spirastrella* and many other *Silicea*; from the milky white of most of the *Calcarea* to the brilliant purple of *Suberites wilsoni*, the rosy red of *Dendrilla rosea*, and the bright scarlet, orange, and blue of others. The rarest colour is green, but even this is represented in several species, and most notably in a bright metallic green calcareous sponge, recently dredged by Mr. Bracebridge Wilson and not as yet determined.

It is absolutely impossible to give anything like a short and concise account of the group, owing to the great confusion which still exists with regard to the nomenclature and classification. A large number of species have, however, already been described by Mr. Carter in the Annals and Magazine of Natural History, from specimens collected and sent home by Mr. Wilson, and there are something like 2000 specimens collected by the same naturalist at present awaiting investigation.

The calcareous, siliceous and horny groups are all abundantly represented in the Victorian fauna. Amongst the *Silicea*, however, the *Hexactinellida* are as yet wanting, but probably investigations in deeper waters will reveal the presence of these also.

Amongst the calcareous-spiculed sponges, the genus *Clathrina* is perhaps the most conspicuous; there are several species, some attaining almost the size of a child's head. They are mostly massive sponges, made up each of an immense number of very slender, ramifying and anastomosing, hollow threads, interwoven so as to form a dense mass varying in compactness according to the species. The most beautiful of the *Calcarea* is, however, the extraordinary *Grantia labyrinthica*, originally described by Mr. Carter under the generic name *Teichonella*, but very widely removed from that genus in reality.

This sponge consists of a stalked, wide-mouthed cup, measuring some three or four inches across the top. The wall of the cup is very thin and much folded on itself, and pierced at right angles to the two surfaces by the radial canals. The whole cup is, in short, a single *Sycon* individual, with a very widely expanded gastral cavity and an enormous osculum. The type-species of the genus *Teichonella (T. prolifera)* is also found outside the Heads. It is a somewhat encrusting form, rising up into vertical, wall-like ridges or plates, along the margins of which are placed rows of oscula. It is, perhaps, worth while to take the present opportunity of correcting a mistake which has crept into the generally accepted diagnosis of the genus, and upon which, indeed, the family *Teichonidæ* has been chiefly maintained. It is usually stated (*e.g.* by Vosmaer) that the oscula are on one side of the plates and the pores on the other, while, as a matter of fact, in the type species the pores are on both sides and the oscula at the top, along the margin. The sponge is, in short, a typical *Leucon*.

Amongst the *Silicea* the Halichondrine sponges, represented by the genera *Reniera*, *Tedania*, *Myxilla*, *Esperella* and numerous others, predominate, offering the greatest variety in size, shape, and colour. Other groups, however, are by no means wanting. *Tethya ingalli*, a very hard, orange-coloured sponge, about the shape and size of a cricket ball, is exceedingly common in certain parts of the Bay. Outside the Heads we sometimes meet with the beautiful *Suberites wilsoni*, a large, massive sponge, at once recognisable by its peculiar bright purple colour, present not only in the living specimens, but retained permanently both in alcohol and after drying. The colour of this sponge is a very powerful dye, and has been found by Mr. Wilson to make deep and lasting

marks on the dredge-rope where it has come in contact with it. The *Tetractinellida* are only fairly represented, one of the commonest being an exquisite little spherical *Tetilla* (probably *T. æruginosa*), generally of a bright cobalt blue colour, owing to the presence of symbiotic algæ.

Of the horny sponges, the most striking are perhaps the large, cup-shaped forms. *Dendrilla rosea* is also a singularly beautiful sponge, forming finger-like branches covered with large conuli, and of a beautiful rosy red colour. This species is frequently found washed up along the sea-shore after high tides. Some of the horny sponges (*e.g.*, *Stelospongos flabelliformis*) are remarkable for the enormous size of the embryos which they contain. From an economic point of view, however, doubtless the most interesting of all our sponges is a large species of *Euspongia*, well adapted for domestic use, found outside the Heads. To the *Ceratosa* are now also generally referred the arenaceous sponges, such as *Dysidea* and *Holopsamma*, which occur in great quantity in the neighbourhood of the Heads. In these genera the horny fibres of the skeleton are replaced by sand of varying degrees of fineness, so that, when dry, the sponges readily crumble to pieces. When alive they resemble agglomerated masses of sand, invested and permeated throughout by an abominable slime.

Sponges entirely devoid of skeleton are also well represented by the genus *Halisarca*, which forms great, fleshy, encrusting masses of a white or pinkish colour, frequently found enveloping the stem of the [illegible].

Hydrozoa.—A large number of Victorian Hydrozoa have been described by Mr. W. M. Bale in his "Catalogue of the Australian Hydroid Zoophytes," and elsewhere. To this work I would refer the student who desires detailed information on the

group ; for the present chapter it will be sufficient to quote the following notes kindly furnished by Mr. Bracebridge Wilson :—"Among the more interesting forms occurring near the Port Phillip Heads may be noted :—

"*Sertularella longitheca*, not mentioned in Bale's Catalogue.

"*Sertularia tuba*, a variety different in habit to the ordinary *S. tuba*.

"*Eucopella campanularia*, the larval condition of which is peculiar (*vide* Bale's Catalogue, p. 61).

"*Campanularia caliculata* var. *macrogyna*, not given in Bale's Catalogue.

"*Monosclera pusilla*. The genus not in the Catalogue.

"*Plumularia wattsii*, abundant in the deeper channels.

"*Plumularia huskii*, previously recorded in the Catalogue only from Griffith's Point.

"*Plumularia filicaulis*, three different forms only recorded from Portland.

"*Diplochilus mirabilis*. Genus not in Bale's Catalogue.

"*Eudendrium*. Several species not yet determined.

"*Halecium*. Species not determined.

"*Calicella*. Species not determined.

"There is also one form not yet placed even generically."

Of sea-anemones, several beautiful species occur in great abundance on the shores of Port Phillip, and a very large form, covered with wart-like tubercles, has been dredged by Mr. Wilson. None of these forms have yet been determined. I have found also very curious parasitic Actinian larvæ, resembling somewhat those of *Halcampa*, but probably belonging to a distinct genus, attached to a small Medusa of the genus *Desmonema* occurring at Cheltenham.

Alcyonarians are fairly abundant, especially some Pennatulid species, and these have been sent by the Port Phillip Exploration Committee to Dr. Sydney J. Hickson for determination. It is hoped that a report on these forms will soon be published.

Echinodermata.—A number of Crinoids or feather stars, collected by Mr. Bracebridge Wilson, were sent to Dr. P. H. Carpenter, F.R.S., for identification. They are all stalkless forms, and are identified by Dr. Carpenter as belonging to five distinct species, viz., *Antedon pumila*, *Antedon wilsoni*, *Antedon macronema*, *Antedon* (new species), and *Actinometra trichopiera*. Thus the crinoids are certainly well represented in the neighbourhood of Port Phillip Heads. Probably the commonest is the small-sized *Antedon pumila*.

The Echinoids or sea-urchins are also well represented in our marine fauna. The largest and most beautiful are *Goniocidaris tubaria* (figured in the "Prodromus of the Zoology of Victoria") and *G. geranioides*. Professor M'Coy states that the two are easily distinguished, but at the same time suggests that *G. geranioides* may be female, and *G. tubaria* male of the same species. This suggestion is, however, not supported by anatomical examination of the two forms made by Mr. Wilson and myself, which tended to show that sex has nothing to do with the distinction. *Amblipneustes* and *Strongylocentrotus* are also very abundant in the Bay, the latter frequently bearing the parasitic Gastropod *Stilifer*. *Echinocardium australe* is also abundant on muddy bottoms.

A number of Holothurians, not yet determined, have been collected, and some species are by no means uncommon. Star-fishes (Asteroidea) and Brittle Stars (Ophiuroidea) are also abundant. Of the former group one of the commonest is the especially beautiful *Goniaster australis*, frequently

seen shining like a brilliant red star at the bottom of shallow water. Another common form is the dark purple, cushion-shaped *Asterina calcar*, and another, the little *Asterias calamaria* (?), chiefly remarkable for the strange irregularity in the number and size of its rays. I do not know any species of *Ophiuroidea* from our shores which has been specifically determined, although they are common enough. A beautiful *Euryalid*, resembling *Gorgonocephala*, is occasionally dredged by Mr. Wilson.

Mollusca.—We are fortunately in possession of lists of the marine Mollusca of Victoria, published by Mr. Gatliff and Mr. Bracebridge Wilson in the *Victorian Naturalist* (Vols. IV. and V.) Mr. Gatliff's "List of some of the Shells of the Marine Mollusca found upon the Victorian Coast" is by far the most extensive, and comprises 264 species of *Gasteropoda* and 86 of *Lamellibranchiata*. The *Gasteropoda* are distributed amongst 48 families, of which those most numerous in species (*i.e.*, the dominant families) appear to be as follows:—*Turbinidæ*, 29 species; *Muricidæ*, 18 species; *Pleurotomidæ*, 14 species; *Columbellidæ*, 13 species; *Mitridæ*, 12 species; *Cerithidæ*, 11 species; *Palellidæ*, 10 species; all the remaining families contain less than 10 species each. The *Lamellibranchiata* are distributed amongst 26 families, of which only two contain as many as 10 species, viz., the *Veneridæ* with 17 species and the *Tellinidæ* with 10 species.

Mr. Wilson's list is naturally not so long as Mr. Gatliff's, which embraces a much wider area. Mr. Wilson has, however, up to the present date (December, 1889) obtained no less than 168 species of Gasteropodous and Lamellibranchiate Mollusca in the neighbourhood of Port Phillip Heads alone, and as these forms only are known to me I shall confine my more special remarks to them, making use also

principally of the nomenclature employed by Mr. Wilson, with which I am best acquainted.

Amongst the *Gasteropoda*, the following are noteworthy forms:—*Crepidula immersa* and *C. monoxyla*. The latter is found in the Pleistocene beds of Limestone Creek, near the mouth of the Glenelg, and was first found in the recent state in Australia by Mr. Wilson. *Sigapatella calyptræformis*, a very abundant and beautiful species. *Conus anemone*, very common in dredgings, and also abundantly thrown up on the beach. *Cypræa bicolor*, the Australian cowrie, a very beautiful little shell, fairly common in the dredge, closely allied to which is *Trivia australis*. *Columbella parkensis* and *Murex triformis* are also characteristic and fairly common forms met with in the dredge. *Tenebra albida* is a beautiful milky white, steeple-shaped spiral, which may be found on the shore to the west of Sorrento. Perhaps the handsomest of all the Port Phillip Gasteropoda is *Voluta undulata*, which may be obtained in some abundance at the place last mentioned when the tide is exceptionally low. This species is at once recognisable by the conspicuous reddish-brown wavy or zigzag lines which ornament not only the smoothly polished shell, but also the back of the living animal. *Patella tramoserica*, the common Australian limpet, is a much less handsome but a much more abundant shell, found in millions clinging to the rocks between tide-marks, and often attaining a very great size. *Fissurella*, the keyhole limpet, may sometimes be met with between tide-marks, and the allied form, *Scutus* (*Parmophorus*) *anatinus* is common, appearing in the living state as a large, soft, black mass, in which the white, shield-shaped shell is hidden; the smaller *Tugalia parmophoidea* is also frequently met with. Of the Venus'-ear shells or Ormers (the Ormers of the Channel Islands) we have three species, *H. carinata*, *H. glabra* and *H.*

rugoplicata. *Haliotis* is, indeed, one of the commonest of the animals met with at the sea-side at about low-water mark, clinging to the rocks with immense tenacity. The British species of this genus is used as an article of food, after being well pounded between stones, but I am not aware that the experiment has been tried in Australia. The Pheasant shells, *Phasianellidæ*, are highly characteristic of the Molluscan fauna of Port Phillip; *P. bulimoides*, a large and very beautiful species, presenting great variation in colour and markings, is very common. A large species of *Turbo*, *T. undulatus*, is very abundant on the rocks about low-water mark, and is also frequently met with in the fishmongers' shops. Amongst the Tectibranchiata, *Philine angasi* and *Bulla australis* are common. The former is especially abundant in some parts of the bay, and its thin and delicate shell and strong triangular teeth are easily recognisable when once seen. The Chitons, again, are very characteristic of our littoral marine fauna. According to Mr. Gatliff, there are four Victorian species of the family—*Chiton australis*, *C. petholatus*, *C. longicymba* and the curious *Chitonellus spinosus*, with its very small dorsal plates not nearly covering the body.

We come now to the *Lamellibranchiata*. We have at least two species of true cockles, *Cardium cygnorum* and *C. tenuicostatum*, and closely allied to these we have the two very interesting and beautiful forms, *Pectunculus flabellatus* and *P. obliquus*. *Crassatella kingicola* is a large and very massive bivalve, of a chestnut-brown colour, sometimes dredged by Mr. Wilson near the Heads. The Razor shells are represented by *Solen vaginoides*. Amongst the Veneridæ the beautiful Night-cap shell (*Chione lamellata*) and *Tapes fabagella* are very abundant. One of the commonest, if not the commonest, of all

the shells washed up along high-water mark is the wing-shell, *Avicula georgiana* (or *pulchella*), whose delicate transparent valves vary in colour from red to green. Among the *Arcidæ* we may notice *Barbatia radula* and *Arca trapezium*, the latter now much more common in a sub-fossil than in the living state. Mr. Wilson records the occurrence of two distinct species of oyster—*Ostrea angasi* and *O. auriculata*. The largest bivalve which we have is, by a very long way, *Pinna tasmanica*, of which beautiful specimens, about a foot in length, may sometimes be obtained by dredging. The *Pectens* or Scallops, which are occasionally used as articles of food, are represented more especially by *P. asperrimus* and *P. fumatus*, two very common species which I have also dredged in great abundance in the River Derwent at Hobart. Mr. Wilson also records *P. actinos* and *P. undulatus*. Lastly, we have the very beautiful and characteristically Australian shell *Trigonia margaritacea*, which, however, does not appear to be nearly so abundant in the neighbourhood of Port Phillip as it is at Sydney.

So far we have dealt only with the Gasteropodous and Lamellibranchiate Mollusca of Victoria, and we have still to mention the Cephalopoda, or cuttle-fish family, of which some very interesting members exist in our waters. All the following four species will be found described and figured in Professor M'Coy's "Prodromus of the Zoology of Victoria":—*Sepioteuthis australis*, the Australian tooth-cupped cuttle-fish, is one of the rarer cuttle-fishes of the Bay. It attains a very large size, the eye alone being as much as two inches in diameter. *Ommatostrephes gouldi*, Gould's Squid, is a gregarious species inhabiting mid-ocean. *Sepia apama* is the largest and commonest cuttle-fish on our coasts, the internal shell, or cuttle-bone, being abundant on the shore

everywhere in the colony. Shells of the beautiful Paper Nautilus, *Argonauta oryzata*, are sometimes found on all parts of our coasts, stranded on the beach, and the animal has been taken alive near Brighton. Professor M'Coy states that all the shells are female ; the male in this genus being devoid of a shell, and not known at all in the case of *A. oryzata*. In addition to these four species of *Cephaloda*, there is a fairly large *Octopus* met with in the Bay, the specific name of which I do not know ; and Mr. T. S. Hall, M.A., has obtained the delicate, spiral-chambered shells of the extremely interesting *Spirula australis* at Port Campbell, west of Cape Otway.

Brachiopoda.—Mr. A. H. S. Lucas, M.A., has recently contributed a paper on the Victorian Brachiopoda to the Proceedings of the Royal Society. From this it appears that five distinct species have been found in our seas, viz., *Megerlia willemoesii*, a rare and very beautiful little species found by Mr. Bracebridge Wilson outside the Heads ; *Terebratulina cancellata ; Waldheimia flavescens ; Kraussina lamarckiana*, found in some abundance by Mr. Lucas at Williamstown, and *Magasella cuminyi* var. *fibula*.

Polyzoa.—Thanks to the prolonged and minute investigations of Mr. P. H. MacGillivray and Mr. J. Bracebridge Wilson, the marine Polyzoa of Victoria are certainly better known to us than any other group of marine invertebrates, with the exception of the Mollusca. The state of our knowledge of these interesting forms in 1887 is admirably summarised in Mr. MacGillivray's "Catalogue of the Marine Polyzoa of Victoria," published by the Royal Society of Victoria in that year. To this Catalogue, and to the excellent descriptions and figures given by Mr. MacGillivray in the "Prodromus of the Zoology of Victoria," I must refer the reader for detailed information. About 350 species are included in the list,

but, as Mr. MacGillivray observes, the only locality which has been systematically searched is the neighbourhood of Port Phillip Heads, and the list will certainly be very much added to.

The most striking and handsomest of the Victorian Polyzoa are certainly the species of the genus *Adeona*, sometimes known as black corals, of which four occur in our seas. *Adeona albida* is common outside Port Phillip Heads, where it occurs in masses as large as a man's head, each consisting of a number of thin, brittle, fenestrated plates, branching and anastomosing with one another, and the whole mass perched upon a short, twisted stem, attached to the rocks by root-like processes. Several species of Polyzoa have already been added to Mr. MacGillivray's list, and of these the most remarkable are the two species of *Cryptozoon*, *C. wilsoni* and *C. concretum*, which I have described in detail in the "Proceedings of the Royal Society of Victoria" for 1888. The genus differs from all other known Polyzoa in the habit of enveloping the zoœcia in agglomerations of sand-particles, a habit which for long prevented the recognition of the true nature of the organisms, until, in fact, through Mr. Wilson's kindness, I was able to make a microscopical examination of living specimens. Both species are common in Port Phillip, and *C. wilsoni* has since been recorded from Sydney.

Mr. Wilson has kindly furnished me with the following note concerning the Polyzoa found inside the Heads ; the stations referred to (St.) are those adopted by the Port Phillip Exploration Committee of the Royal Society of Victoria :—"The greater part of those in Dr. MacGillivray's Catalogue have been found outside the Heads. Amongst those which are met with inside Port Phillip, chiefly in the dredging stations near the Heads, may be mentioned :—

Rhabdozoum wilsoni. Rare. Sts. 1, 5 and 9.

"*Catenicilla fusca*. St. 1.

"*Scrupocellaria obtecta*. Growing on the surface of sponges. Sts. 5 and 9.

"*Farcimia appendiculata*. St. 9.

"*Tubucellaria cereviides*. St. 9.

"*Stirparia exilis*. On sponge, St. 1.

"*Verrucularia dichotoma*. Very abundant on St. 5.

"*Electra flagellum*. Sts. 5, 8, 9.

"*Diploporella cincta*. Wherever *Cymodocea* occurs.

"*Adeona cellulosa*. Rare inside the Heads. St. 1.

"*Parmularia obliqua*. Rare inside. Sts. 1 and 5.

"*Petralia undata*. Frequent. Sts. 1, 3, 5 and 9.

"*Densipora corrugata*. On stems of *Cymodocea* and hard-stemmed algæ.

"*Flustrella cylindrica*. Not uncommon. Sts. 1, 5, 9.

"*Amathia*. Most of the species, some of which are new, occur at St. 1 and in the South Channel.

"*Pedicellina* is met with on algæ and sponges. Sts. 1, 5, 8 and 9."

Marine Worms.—A large number of very interesting marine worms have been collected by Mr. Wilson, including Turbellarians, Nemertines, Gephyreans, Polychætes and probably other groups, but none of the forms have as yet been specifically determined.

Arthropoda.—Amongst the *Crustacea*, only the larger and more conspicuous forms, and especially such as are good for food, are at all well known to us. Of these the Melbourne Crayfish (*Palinurus lalandi*) is doubtless the best known, being very common in the market. This animal, which is excellent eating, attains a length of 18 inches, exclusive of the antennæ. It abounds in Victoria, Tasmania and New Zealand, and also at the Cape of Good Hope. It is not, however, known as far

north as Sydney, where the Sydney crayfish, belonging to a distinct species (*P. hügeli*), is found. Professor M'Coy, from whose work (Prodromus) the above information is taken, records two specimens of (*P. hügeli*) from Victorian waters, and gives figures of both the species. Amongst the crabs, *Pseudocarcinus gigas*, the great red king crab, is most deserving of mention. The species is not uncommon at the western end of the Victorian coast line. It is of a bright scarlet colour, with black extremities to the great chelæ, and attains a length of 8½ inches by a width of 10½ inches (Prodromus).

A number of very interesting representatives of the *Pycnogonida* have been collected by Mr. Wilson, and Professor W. Hatchett Jackson, of Oxford, is preparing a report upon them.

Tunicata.—This group is extremely well represented in our marine fauna by an immense number of species, both simple and compound. The large collection made by Mr. Wilson has been forwarded to Professor Herdman, of Liverpool, for examination, and pending the arrival of his report it is perhaps best not to attempt any account of the group.

(2). The Fresh-water Invertebrates.

The fresh-water invertebrate fauna of Victoria is, so far as I have been able to ascertain, as yet almost unknown to zoologists, and I can therefore give but very little information concerning it. An interesting paper, entitled "Die Süsswasser-Cœlenteraten Australiens. Eine faunistische Studie" has been published by Dr. R. von Lendenfeld in the "Zoologische Jahrbücher," but even here only two Victorian forms are recorded, viz., *Meyenia capewelli*, a fresh-water sponge from Lake Hindmarsh, and *Hydra* [illegible] from the neighbourhood of Melbourne. It will be best, however, to follow the plan already

adopted, and give what little information I can in a systematic manner.

Protozoa.—The *Infusoria*, so far as my very limited observations extend, appear to closely resemble the European forms. A very fine species of *Acineta* occurs infesting a *Vorticella*-like form parasitic on *Astacopsis bicarinatus* in the University lake. I have also seen exquisite specimens of the remarkable *Anthophysa vegetans*, exactly corresponding with those figured by Saville Kent in his manual of the Infusoria, and obtained by the Rev. Mr. Fielder in the neighbourhood of Melbourne. Probably our fresh-water Infusorian fauna will be found, as might indeed be expected from what is known of the geographical distribution of the group, to present no marked peculiarities.

Porifera.—Of freshwater sponges I have already mentioned *Meyenia capewelli*, recorded by Lendenfeld from Lake Hindmarsh. Two or three species occur in the Barwon River, near Geelong, where they have been obtained by Mr. Bracebridge Wilson, but these I have not yet had time to determine.

Coelenterata.—*Hydra oligactis*, apparently identical with the British form (frequently known under the name *H. fusca*), occurs in the neighbourhood of Melbourne, and Mr. Bracebridge Wilson informs me that a Hydrozoon, somewhat resembling *Coryne*, occurs near the junction of the Moorabool and Barwon Rivers.

Polyzoa.—A species of *Plumatella*, probably *P. repens*, is abundant in the Barwon, and in waterholes far from the river, growing on weed (Wilson).

Mollusca.—The genus *Lymnæa* amongst the Gasteropoda, and *Unio* amongst the Lamellibranchiata, are very common, and beyond this I can say nothing of the fresh-water Mollusca. The group appears to have been entirely neglected in Victoria.

Arthropoda.—The *Crustacea* are well represented in our rivers, lakes, and ponds. Beginning with the lower forms, we have a species of the curious genus *Apus* occurring in several localities. *Branchipus* has been found in abundance by Mr. Wilson amongst the salt scrub between the Geelong Botanical Gardens and Point Henry. Two distinct species of crayfishes are known to us, *Astacopsis serratus*, the Murray lobster, and *A. bicarinatus*, the Yabber crayfish. Both are figured and described in the "Prodromus." Concerning the first-mentioned, Professor M'Coy writes:—"This gigantic species is now sent to the Melbourne market in considerable quantity from the Murray by railway for the table instead of lobsters, and is by far the most delicious of the few Victorian Crustacea good for food." A variety of the species, *A. serratus* var. *yarraensis*, is common in the River Yarra. The Yabber crayfish, *Astacopsis bicarinatus*, attains a length of about six inches, exclusive of the antennæ. It apparently does not inhabit running water, and it does great damage to dams and reservoirs by burrowing through the banks. It can live a long time in its underground burrows after the water above has dried up. The species is extremely abundant in many places, as for example in the University lake, in which locality it is found swarming with the parasitic Trematode *Temnocephala*, a curious worm described in detail by Professor Haswell in the "Quarterly Journal of Microscopical Science" for November, 1887.

(3.) The Terrestrial Invertebrates.

Worms.—Victoria is very rich in interesting terrestrial worms of various kinds. Commencing with the lowest forms, we find the land Planarians very

numerous, individually and specifically. In Messrs. Fletcher and Hamilton's valuable "Notes on Australian Land Planarians," 18 Australasian species are described, but of these one only, *Geoplana quinquelineata*, is recorded from Victoria. I have, however, with the assistance of several friends, collected a number of Victorian species, of which the most remarkable is *Geoplana spenceri*. This worm was first discovered by Professor W. Baldwin Spencer at M'Mahon's Creek on the Upper Yarra, and I have myself obtained it abundantly since, not only at the same locality, but also at Warburton and Walhalla. I have given a full anatomical account of the species in the "Transactions of the Royal Society of Victoria" for 1889, and I hope shortly to be able to describe a number of other Victorian forms. The land Planarians are much elongated, usually flattened worms, very soft and slimy, and found under stones and decaying logs. They are admirable examples of *cryptozoic** animals, usually issuing from their hiding places only at night, in order to search for food. They are provided with a large, protrusible, mouth-bearing sucker (pharynx), placed in the centre of the under surface of the body, by means of which they suck the juices out of worms and insects. When not actually in use, the sucker is completely withdrawn into the body of the animal. The Victorian species, so far as has yet been ascertained, all belong to the genus *Geoplana*, characterised by the possession of innumerable minute eye-spots scattered irregularly over the sides of the body, chiefly at the anterior end. The worms are usually not more than three or four inches in length when crawling, though *Geoplana spenceri* may attain a length of six inches. They are usually very conspicuously coloured; thus *G. spenceri* is bright blue

* *Vide* "Victorian Naturalist," December, 1889, for explanation of this term.

on the lower surface and very dark olive-green on the upper. Another common species is bright sulphur-yellow all over, and others are ornamented with variously-coloured longitudinal stripes running down the back.

Closely related to the land Planarians is a very extraordinary little worm which I had the good fortune to discover quite recently under stones and dead wood at Walhalla, Gippsland. This is one of the extremely rare and interesting terrestrial Nemertines—a group which is almost exclusively marine. According to Jackson ("Forms of Animal Life") only four terrestrial Nemertines are as yet known, one of which, *Geonemertes chalicophora*, is given as doubtfully coming from Australia. The Walhalla Nemertine is, when lying still, a small slug-like creature, very slimy and somewhat translucent, and of a brownish-orange colour. When crawling it elongates itself, and the anterior part of the body is seen to terminate in a small head. The most remarkable feature about the animal is the presence of a very long, cylindrical, white proboscis, which, when not in use, is packed away in a special sheath lying along the dorsal surface, but which can be shot out from an aperture at the anterior end of the animal with lightning-like rapidity, and then withdrawn into the body again. The Nemertines are at once distinguished from the Planarians by the presence of the proboscis, by the position of the mouth at the extreme anterior end of the body, by the absence of a sucker, and by the presence of a definite vent or anus at the posterior end of the body. (Since this was written I have found another specimen of a terrestrial Nemertine, probably specifically identical with the Walhalla specimens, in a collection of Planarians kindly obtained for me by Mr. Bracebridge Wilson from the Otway Forest.)

Other somewhat near relations of the Planarians are the only too well-known land-leeches, which abound in our gullies. They may be at once recognised by their peculiar looping mode of progression and by the presence of two powerful suckers, one at the anterior end containing the mouth, and one at the posterior end.

The most striking of our terrestrial worms still remains to be noticed—the Giant Earthworm of Gippsland. This remarkable Oligochæte has recently been very fully described and illustrated by Professor W. Baldwin Spencer in the "Transactions of the Royal Society of Victoria." The worm (*Megascolides australis*) appears to be abundant in the neighbourhood of Warragul and Brandy Creek, and another species of the genus is also found in Gippsland. It is probably the largest earthworm in the world, and attains the extraordinary length of six feet, with a corresponding thickness. The animal is, however, capable of great elongation, and under ordinary circumstances the length is probably seldom, if ever, so great. Professor Spencer gives the average length as from 44 to 48 inches, with a breadth of three-quarters of an inch. The worm lives principally on the sloping sides of creeks, being sometimes found beneath fallen logs and sometimes turned out of the ground by the plough. The presence of the animal underground may be recognised by a very distinct gurgling sound made as it retreats in its burrow when the ground above is stamped upon. It has a peculiar smell when living, somewhat resembling that of creasote, and when held in the hand it throws out jets of a milky fluid from its dorsal pores to a height of several inches. For the anatomical details of the structure of this remarkable worm I must refer to Professor Spencer's beautiful monograph, from which the information above given is extracted.

Arthropoda.—This group, which derives its name from the jointed limbs which characterise all its numerous members, comprises, amongst the terrestrial fauna, the Insects, Centipedes, Spiders, Scorpions, Land Crabs, and last, and most interesting, the remarkable genus *Peripatus*. As *Peripatus* is the most primitive, as well as the most important, member of the group, it may appropriately take the foremost place in our account.

The only species of the genus met with in Victoria, or indeed, in any part of Australia, is *Peripatus leuckartii*. This remarkable little animal is found hiding away under logs and stones, whence it issues only at night time in search of food. It appears to be nowhere by any means common, and in Victoria it has been found as yet only in small numbers and in three localities, as follows:—A single specimen from Warragul, Gippsland; two specimens from Warburton, on the Upper Yarra, and 11 specimens from Brown Hill, near Ballarat. (Since this was written Mr. Lucas informs me that he has found two specimens at Christmas Hills.) *Peripatus* owes its special scientific interest to the fact that it is evidently the sole surviving representative of a very ancient group, and forms a connecting link between the worms on the one hand and the insects on the other, having, in particular, the excretory organs of the former and the respiratory organs of the latter group. *Peripatus leuckartii* in general appearance resembles a small caterpillar, having a worm-like body about an inch in length and provided with 15 pairs of short, claw-bearing legs. In addition to these appendages there are also a pair of long feelers or antennæ on the head, and a pair of "oral papillæ," one on each side of the mouth. When the animal is irritated an intensely sticky, viscid secretion is emitted with considerable force from an aperture

at the extremity of each oral papilla. This secretion, on coming in contact with the air, very soon hardens, and it is supposed to be used by the animal for the purpose of capturing the insects upon which it feeds, so that it has been not inaptly compared, as regards function, with the web of a spider. It is not, however, used as a set trap for catching the insects, but is shot out at them from some little distance.

Peripatus leuckartii is remarkable for its great range in colour variation, being dark indigo-blue, or almost black, in some cases, and chestnut-red in others. The predominant marking consists of a series of diamond-shaped patches of dusky red along the back, and I have endeavoured to show elsewhere* that the markings of all the specimens may be deduced from one and the same fundamental pattern. The Australian species is very closely related to one found in New Zealand (*P. novæ-zealandiæ*), the two being distinguished only by certain very small structural differences, and by the markings on the back. The other species of the genus are found in very different parts of the globe, viz., South America, the West Indies, and the Cape of Good Hope.

With regard to the remaining terrestrial Arthropods—the Spiders, Scorpions, Land Crabs, Centipedes and Insects, I do not propose to go into any detail. The spiders and insects of Victoria are enormously numerous, and a great deal is already known about them. The Australian spiders have been very fully treated of by von Koch, and of the insects a few of the more remarkable Lepidoptera and Orthoptera will be found beautifully illustrated in Professor M'Coy's "Prodromus of the Zoology of Victoria." The subject of entomology is moreover dealt with in a special article.

* Proceedings of the Royal Society of Victoria, 1889.

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 rich 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 injurious 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 subject has obtained the consideration which it deserves. We hope, however, with the co-operation of all entomological workers, 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 is 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.

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, &c., and the perfect insect stripping the *Eucalypti* 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, 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. The smallest is perhaps a species of *Scopodes*, although there are several that are almost microscopic in their 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 many more; 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 cuminghami*, 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, 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, &c.; the larger kinds, as *Cresphilus*, 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, &c., 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*, *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 a few 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-bird.

In the order *Lepidoptera*, we are comparatively poor in the *Rhopalocera*, or butterflies, the principal groups being the *Papilionidæ*, *Pieridæ*, *Nymphalidæ*, *Danaidæ*, &c.; 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*, &c. 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*, &c., 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 *Zelotypia 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.

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 *Cœquosa triangularis*, a splendid insect, measuring about six or seven inches across the wings, but comparatively rare in Victoria. In Queensland and in 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 titan*, *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 this order 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 cockroaches, 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.

Amongst the *Orthoptera* 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 this large group, as do also the much-dreaded Termites, or white ants.

Amongst *Neuroptera* may be mentioned the Ant-lion *Myrmeleon*.

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, most 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 (Hompotera), 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, *Cicada 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, &c., 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*.

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*, *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.

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

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 the nearly level tops of the

tea-tree may be seen, sometimes isolated, sometimes several together, the drooping, feather-like foliage of the sheoaks (*Casuarina quadrivalvis*), or the stiff, erect branchlets 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 the 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 fragant *Melaleuca ericifolia*, and *squarrosa*. The following Papilionaceous bushes are common:—*Daviesia ulicina*, *Aotus villosa*, *Pultenaea 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*, *menziesii*, 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 *pugioniformis*) 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 *Eriostemons*, 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 coespitosa*, *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*, *Pomoderris 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*, *A. 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 fern trees 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 water-courses, however, the gigantic fronds and massive trunks of the *Osmunda babara* (*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 cartilaginium*, 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 vestitute 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 lofty forest 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 lowlands, 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*, &c.

Of plants belonging to genera not met with on the lowlands may be mentioned *Caltha introloba*, *Scleranthus uniaroides*, *Aciphylla glacialis*, *Orites lancifolia*, *Abrotanella nivigera*, *Gaultiera hispida* (with *Willsteinia vaccinacea*, 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 (*Borbarœa 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 durinscula*), and a few others.

COMMERCE & MANUFACTURES.

By Wm. H. Thodey.

I. Commerce.

The admirable review of the commerce of Victoria, annually presented to the public of Victoria by the Government Statist in the "Victorian Year Book," practically leaves nothing to be desired, so far as the external features of the subject are concerned, and it is unnecessary merely to epitomise that review. The writer, therefore, does not propose to do more than to supplement the Government Statist's work by a few general considerations, and, by an analytic statement, showing the directions in which the commerce of Victoria is undergoing development or otherwise, guiding himself throughout by the consideration that a body like the Australasian Association for the Advancement of Science desires some kind of scientific method to be followed in treating upon so complex a subject as commerce.

It is difficult to assign to commerce its position in the economy of a state without ascertaining its relations—(1) from an industrial point of view, to the manufacturing status of that state; (2) from a comparative point of view, to the whole volume of trade, including both internal and external operations; and (3) from a financial point of view, to public and

other borrowings from other countries. If a state has not entered into the first stage of manufacturing development at all, but is simply exchanging with other states its productions of raw materials for the ordinary requirements of life, its commerce forms the greater part of its trading, the other portion consisting in the collection of the raw products for exportation, and in the distribution of the importations. If large and numerous manufacturing interests have sprung into existence (whether in the natural course of events or under the artificial fostering of a certain fiscal system is not a question which concerns a statement of fact), there is an active interchange within the borders of the state itself of raw materials for local manufactures, and this form of internal trade tends to reduce the volume, both of exportation and importation. But, in the third place, the competition of local manufacturing interests with the external trade of the state may be reduced to a relatively low degree of importance by heavy public borrowings from abroad—borrowings undertaken, not for the purpose of obtaining a supply of coin, but directly or indirectly for carrying out works which require material, and which foster consumption by increasing the amount of labour and its rewards. The three phases of commerce thus indicated have been presented by Victoria. Two periods of Victorian commerce have elapsed, viz., I. The primitive, or commerce undisturbed by local manufacturing of any kind; and II. Commerce growingly affected by local manufacturing. A third period is in progress, viz., III. Commerce largely affected by local manufacturing, but, at the same time, receiving a great impetus from borrowings on a comparatively gigantic scale. The first period may be roughly dated from the first record of imports and exports for 1837 (imports, £115,379; exports, £12,178) to, say 1860

(imports, £15,093,730; exports, £12,962,704), and these 24 years may be again divided into a term of 14 years before the discovery of gold, and one of 10 years after that event. The second period may be as roughly taken as extending from 1861 (imports, £13,532,452; exports, £13,828,606) to, say 1883 (imports, £17,743,846; exports, £16,398,863). This period commenced under a free-trade regime, while at its close a distinctively protective policy reigned. Although the colony has always borrowed capital from Britain, either by its Government or through banking, squatting, and other institutions, the third period dates approximately from 1884 (imports, £19,201,633; exports, £16,050,465), and is still in progress, the last completed year (1888) showing: imports, £23,972,134; exports, £13,853,763. The following is a summary of the imports, exports, and excess of the former over the latter:—

	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, not completed, 1884 to 1888 (5 years) . .	98,771,097	68,602,452	30,168,645	43·97

It thus appears that for the last five years alone the excess of imports over exports has absolutely been

larger than that for the previous 47 years. But for about seven or eight years of the second period no record was kept of the wool received from Riverina, and the figures stated are modifiable to that extent.

If the attention be confined to the figures for the last year (1888), viz.:—Imports, £23,972,134; exports, £13,853,763; excess of imports, £10,118,371; the difficult problem to account for the enormous excess of the last five years will be brought into a narrower compass. In addition to the excess shown, the colony had to provide for interest and other returns on capital borrowed from Britain, such borrowings having been made (1) by the Government; (2) by corporate bodies, such as the Harbour Trust, the Tramways Trust, the Metropolitan Gas Co., municipalities, &c.; (3) by the squatting companies (in the form of debentures issued); (4) by the banks on fixed deposit, and by other institutions on either fixed deposit or debenture; (5) by mortgages from life assurance companies and private individuals. There was also a considerable sum in the aggregate to be transmitted to absentees. If, for 1888, the total under these heads is placed at £2,500,000, there was an apparent balance against the colony of over 12½ millions sterling. This sum is accounted for principally in three ways—(1) public and corporation borrowings during the year; (2) the revenue derived by Victorians from their investments in mining and squatting in other colonies; and (3) the borrowings of the banks and other financial institutions outside the colony. These items, there is reason to believe, hardly supplied the required difference, the banks furnishing the balance by putting some strain on their resources.

A statement of the imports and exports of the colony for 1888, taken from the official returns

(which, however, will be shown further on to be rather misleading), is as follows :—

Gross Imports	£23,972,134
Less Re-exports	3,497.130
Net Imports	£20,475,004
Exports of Produce and Manufacture of the Colony (including all articles partly or wholly made up of imported materials)	10,356,633
Excess of Imports	£10,118.371

But a recital of the statistics of Victorian commerce, culled from the annual returns of the colony, gives only a superficial view of the subject matter. The intrinsic value of the statistics may easily be overrated, especially as values are often carelessly assigned to imports and exports, while countries of origin are frequently undescribed. There are two articles of the first importance, viz., gold and wool, in which negligence assumes proportions fatal, unless detected, to a right understanding of the real export trade, as distinguished from the re-export trade, of the colony. In the case of gold and gold specie the imports in 1888 amounted to £959,045, but the whole of the exports, amounting to £3,690,519, were entered as Victorian produce. Properly speaking, the difference between the two amounts, £2,731,474, represents Victorian produce, and this sum will be taken into account later on. Again, in 1888 the quantity of greasy wool imported in Victoria is stated in the Customs returns at 58,378,279lbs., of the value of £2,215,855, but the exports of greasy wool, described as other than Victorian, amounted to 26,583,343lbs., valued at £1,243,332. Two large errors are at once apparent :—1st. A quantity exceeding 58,000,000lbs. shrinks into a quantity exceeding 26,000,000lbs., the balance going to the credit of Victoria. 2nd. The average price of the wool brought into the colony, according to the declared value, was 9·11d. per lb., and the average price of the same wool, when shipped from the colony, was declared at 11·22d. per lb. The obvious deduction is that the particulars published by the Customs Department are so imperfect that room is left for wide, albeit uncertain, allowances. Subject to allowances for the tendency to error thus disclosed, the task remains to investigate the movements in the commerce of Victoria. Such an investigation may be profitably made by adopting the method of comparing two annual returns ten years apart, say the returns for 1878 and 1888. As mere totals, or even a display of the movements which have occurred in the principal articles, are of far less scientific and economic value than a systematic analysis of the whole, the writer has preferred to make an attempt at exhaustiveness, adopting, so far as local circumstances will permit, the system of classification employed by the Board of Trade. The figures which follow will present—I. Net imports (*i.e.*, imports less re-exports), or, as expressed in the Customs returns, "Exports of British, foreign, and other colonial produce and manufacture;" II. Exports of Victorian produce and manufactures only ; and III. The relation of net imports and exports of Victorian produce and manufactures to population :—

I. NET IMPORTS (*i.e.*, IMPORTS LESS "RE-EXPORTS").

	1878.	1888.
I. ANIMALS (living)	£590,564	£1,904,807
II. ARTICLES OF CONSUMPTION—		
A. Food—		
1 Cereals and Breadstuffs	422,573	265,319
2 Sugar	966,700	853,854
3 Other Vegetable Productions for Food, including Preparations	165,063	391,901
4 Dairy Products ..	5,075	42,500
5 Animal Food Products and Fish	124,192	241,690

B. Drink—		
6 Tea, Coffee, Cocoa, &c.	£346,348	£511,237
7 Intoxicants, &c. ..	466,753	845,867
C. Sundries—		
8 Tobacco and Cigars ..	45,407	233,221
9 Sundry Articles for Household Consumption	79,710	126,620
Total.. ..	£2,621,821	3,512,209
III. Minerals, &c.—		
1 Coal and Coke ..	£358,998	£625,149
2 Sundry Crude Metals and Minerals ..	42,702	37,168
Total.. ..	£401,700	£662,317
IV. Chemicals, Drugs, &c. ..	£188,386	£295,777
V. Oils, Paints, &c.	264,374	373,209
VI. Crude Vegetable Products	160,656	169,246
VII. Crude Animal Products ..	126,542	217,693
VIII. Building Materials—		
1 Cement, Marble, Stone, &c.	76,666	189,226
2 Timber..	509,912	1,388,931
Total.. ..	£586,578	£1,578,157
IX. Manufactured Articles—		
1 Textile and other Manufactures (including Materials) for Personal Wear	£2,639,623	£3,768,478
2 Finished Metals, Machinery, Manufactures of Metals, &c.	1,087,930	2,442,631
3 All other manufactured Articles	1,242,943	2,866,293
Total.. ..	£4,970,496	£9,077,402
X. Government Stores, Personal Effects, Travellers' Samples, and Sundries not enumerated above ..	£226,493	£380,121
Grand Total of Net Imports (Gold and Wool not included)	£10,137,610	£18,170,938

The foregoing table shows, amongst other increases, the following, viz.:—Living animals, £1,314,243 (222 per cent.); drink of all kinds, £544,003 (67 per cent.); coal, £266,151 (74 per cent.); timber, £991,579 (169 per cent.); textile and other manufactures for personal wear, £1,128,855 (42 per cent.); finished metals, machinery, manufactures of metal, &c., £1,354,701 (125 per cent.).

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.
I.—Animals (living)	£432,246	£269,004
II.—Articles of Consumption—		
A. Food—		
1 Cereals and Breadstuffs	341,167	950,659
2 Sugar	139,688	50,617
3 Other vegetable Productions for Food, including Preparations ..	124,163	171,978
4 Dairy Products ..	67,350	69,843
5 Animal Food, Products, and Fish	90,810	36,192
B. Drink—		
6 Coffee, Cocoa, &c. ..	7,852	5,624
7 Intoxicants, &c. ..	13,074	61,244
C. Sundries—		
8 Tobacco and Cigars ..	35	—
9 Sundry Articles for Household Consumption ..	26,961	23,279
Total	£811,100	£1,369,436
III.—Minerals, &c.—		
1 Coal and Coke	£486	£496
2 Sundry Crude Metals and Minerals ..	67,598	3,354
Total	£68,084	£3,850

IV.—Chemicals, Drugs, &c. ..	£12,602	£13,837
V.—Oils, Paints, &c.	21,717	3,083
VI.—Crude Vegetable Products..	117,808	188,811
VII.—Crude Animal Products ..	157,443	401,412
VIII.—Building Materials—		
1 Cement, Marble, Stone, &c.	9,037	12,767
2 Timber	28,768	10,059
Total	£37,805	£22,826
IX.—Manufactured Articles—		
1 Textile and other Manufactures (including Materials) for Personal Wear	£275,029	£163,330
2 Finished Metals, Machinery, Manufactures of Metals, &c.	131,942	113,830
3 All other manufactured Articles (including Leather)	410,161	293,589
Total	£817,132	£570,749
X.—Government Stores, Personal Effects, Travellers' Samples, and Sundries not enumerated above	£84,424	£67,426
Grand total of Exports of Victorian Produce and Manufactures (exclusive of Gold and Wool)	£2,560,361	£2,910,434

The principal movements for the ten years are:—*Increase:* Breadstuffs and cereals, £609,492; other vegetable food (unprepared), £53,754; wines, £28,009; crude vegetable products, £71,003; and crude animal products, £243,969. *Decrease:* Live animals, £163,242; sugar refined in Victoria, £89,071; minerals, £64,244; manufactures, £246,383.

The third portion of this investigation has to do with the relations of—(1) Nett imports, and (2) Exports of Victorian produce and manufactures to (3) Population. The mean population of the year was about 821,000 in 1878, and about 1,062,000 in 1888.

III.—Nett Imports and Exports of Victorian Produce and Manufactures per Head of Mean Population:—

	Nett imports.		Exports of Victorian produce and manufactures.	
	1878.	1888.	1878.	1888.
	£	£	£	£
Living animals	0·719	1·793	0·526	0·253
Vegetable productions for food	1·892	1·422	0·737	1·105
Animal productions for food (exclusive of living animals)	0·157	0·267	0·192	0·099
Drink of all kinds	0·990	1·277	0·025	0·063
All articles of consumption (exclusive of living animals)	3·193	3·307	0·988	1·289
Coal, coke, minerals, and crude metals	0·489	0·623	0·083	0·004
Chemicals, drugs, &c. ..	0·229	0·278	0·015	0·013
Oils, paints, &c.	0·322	0·351	0·026	0·003
Crude vegetable products ..	0·195	0·159	0·143	0·177
Crude animal products ..	0·154	0·205	0·191	0·378
Building materials (principally timber)	0·714	1·486	0·046	0·021
Textile and other manufactures for personal wear ..	3·215	3·548	0·335	0·153
Finished metals, machinery, manufactures of metals, &c.	1·325	2·300	0·160	0·107
Other manufactured articles	1·514	2·697	0·269	0·177
Total manufactured articles	6·054	8·545	0·764	0·437
Total of nett imports per head of mean population ..	12·348	17·110	—	—
Add to Exports—				
1. Excess of wool exported over wool imported—(£3,447,451 in 1878, £2,456,870 in 1888) ..	—	—	4·199	2·322
2. Excess of gold and specie exported over gold and specie imported—(£2,893,625 in 1878, £2,473,263 in 1888) ..	—	—	3·524	2·519
Total export of Victorian produce and manufactures per head of mean population	—	—	10·841	7·581

The broad result is that while in 1878 the exports of Victorian produce and manufactures per head of population bore the proportion to nett imports of 878 to 1000 (17s. 7d. in the pound), in 1888 the corresponding proportion was 443 to 1000 (8s. 10½d. in the pound), or about one-half of that of 1878. Or, putting the case in another form, while net imports per head of population in 1888 showed an increase of 38½ per cent. as compared with 1878, exports of Victorian produce and manufactures showed a decrease of 30 per cent.

The movement in the distribution of Victorian commerce during the last 10 years is shown briefly by the following figures :—

Imports from	1878.	1888.
United Kingdom	£7,389,239	£10,851,667
Other Australasian Colonies and Fiji	5,625,589	8,561,938
Other British Possessions ..	1,453,772	1,356,801
United States	595,713	1,112,520
Other Foreign States	1,096,767	2,089,208
Total..	£16,161,880	£23,972,134

It is necessary to exercise caution in accepting the foregoing figures without qualification. For example, the imports from New South Wales (the increase of which almost entirely accounts for the increase shown under the head "Other Australasian Colonies and Fiji") include a considerable amount of American, British, and Chinese merchandise, which is forwarded on from Sydney. The imports from the United Kingdom should for this reason receive a slight addition, the imports from America a large addition, while those from other foreign states should be enlarged to a moderate extent. The growth of the volume of imports from the United Kingdom is made up of manufactures ; the United States supply more timber, kerosene, and fish, Norway and Sweden more timber, and China more tea. The settlement for the imports from all places, excepting other Australasian colonies, is effected in London, the amount being approximately 10½ millions sterling in 1878, and 15½ millions sterling in 1888.

The distribution of exports affords the following comparison :—

Exports to	1878.	1888.
United Kingdom..	£6,458,484	£8,050,056
Other Australasian Colonies and Fiji	4,854,129	4,318,631
Other British Possessions ..	3,536,642	422,058
United States	23,941	361,434
Other Foreign States	52,511	701,584
Total..	£14,925,707	£13,853,763

In the foregoing figures there is again much to mislead. The enormous exports to "other British possessions" in 1878 consisted to a large extent of gold entered for Ceylon, simply because the mail steamers touched there first. The necessary correction would yield the net result that the total exports to the United Kingdom were about 1½ millions sterling less in 1888 than in 1878.

It is hardly desirable in this place to comment upon the causes which have induced so enormous an increase of importation into Victoria and a partial decay of the export trade in both its branches, viz., re-exports and exports of the produce and manufactures of the colony. But the vast preponderance of imports over exports has led to freight difficulties, for while it is easy in the United Kingdom, America, and elsewhere to fill a ship for Melbourne, it is often difficult to send a return cargo, and many vessels have to go elsewhere in ballast. Naturally all this means that the freight charge against Melbourne is more onerous than would otherwise be the case. The phenomenal increase of imports has also strained

the harbour accommodation and its administration to almost the breaking-down point.

The commerce of Victoria is in its aggregate very large in proportion to population. A mean population of about 1,062,000 carried on in 1888 a trade with other colonies of the Australasian group amounting to £12,880,569, and with the rest of the world to £24,945,328, the total of the external trade of Victoria being £37,825,897.

II. Manufactures.

With a population largely drawn from the urban centres of the United Kingdom, and therefore accustomed to town occupations, Victoria has for a long time had strong proclivities towards manufacturing industries. These proclivities have received encouragement from the close centralisation of the interests of the colony at large in its metropolis, while the climate is fortunately of a description which is highly promotive of that condition of health which is capable of sustaining energetic application. There are, however, two serious drawbacks to a great development of manufactures for the present, viz.:—(1st) The limited field for the disposal of the productions of the numerous competing factories; and (2nd) 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. The field for Victorian manufactures is, as has been shown in the comparative statement of exports given above, slowly contracting outside the limits of the colony itself. The necessity for training a factory hand in all the branches of his trade is, under modern exigencies, an economic waste. Victorian manufacturing possesses the great advantage of being conducted by highly intelligent, capable, and energetic men, and the dubious advantage of a protective tariff—dubious, because competition receives artificial stimulus, and because a concession won for one industry is often largely neutralised by a concession granted to another. But, setting the drawbacks against the advantages, the manufacturing life of the metropolis of Victoria is a very active one.

A correct statistical view of Victorian manufactures, upon the accuracy of which everybody will agree, is next to impossible, simply because, in Victoria at least, the question of what is a manufacture is an open one. A steam-engine is certainly a manufacture, and that of the highest type, but it has also been claimed that bone-dust is a manufacture. The Government Statist very properly heads his annual compilation of town occupations, "Manufactories, Works," &c., and the latest return of this kind was published in the *Government Gazette* of 6th September last. This return gives particulars under the following heads, viz.:—1. Number of establishments; 2. Hands employed; 3. Horse-power employed; 4. Value of machinery and plant. Although the total number of hands stated as employed, 56,271, appears to be exaggerated, its proportion to the total working population being too large (a point upon which the next census may be useful), yet it is strikingly small as compared with the total number of establishments, 3154, the average per establishment being only about 18. This feature is suggestive of a waste of manufacturing power in a multiplicity of very small factories. Following the Government Statist's classification, two arrangements will be interesting—1. A statement of the various classes, according to the number of hands employed; and 2. According to the value of machinery and plant engaged. First—Description of manufactory, work, &c., according to number of hands employed:—

1. Machines, tools, and implements, 9151 ; 2. Dress, 8783 ; 3. Vegetable matters (including saw-mills), 6558 ; 4. Stone, clay, and glass, 6040 ; 5. Books and stationery (including printing establishments), 5188 ; 6. Carriages and harness, 3614 ; 7. Drinks and stimulants, 3506 ; 8. Animal matters, 2467 ; 9. Vegetable food, 2431 ; 10. Furniture, 2030 ; 11. Textile fabrics (woollen mills), 841 ; 12. Coal and lighting, 773 ; 13. Houses and buildings, 693 ; 14. Chemicals, 691 ; 15. Fibrous materials, 455 ; 16. Animal food, 443 ; 17. Gold, silver, and precious stones, 385 ; 18. Ships and boats, 213 ; 19. Metals, other than gold and silver, 182 ; 20. Carving, engraving, &c., 141 ; 21. Arms, ammunition, &c., 104 ; 22. Musical instruments, &c., 50 ; 23. Water (in manufactures), 50 ; 24. Philosophical instruments, &c., 33. Second—Description of manufactory, work, &c., according to value of machinery and plant engaged :—1. Coal and lighting (gas and electric works), £1,525,812 ; 2. Machines, tools, and implements, £749,782 ; 3. Drinks and stimulants, £544,657 ; 4. Vegetable matters, £527,894 ; 5. Vegetable food, £414,717 ; 6. Books and stationery, £407,529 ; 7. Stone, clay, and glass, £363,512 ; 8. Animal matters, £207,224 ; 9. Textile fabrics (woollen mills), £156,136 ; 10. Dress, £104,603 ; 11. Carriages and harness, £94,791 ; 12. Ships and boats, £66,425 ; 13. Fibrous materials, £62,715 ; 14. Furniture, £55,668 ; 15. Chemicals, £50,820 ; 16. Gold, silver, and precious stones, £45,160 ; 17. Arms, ammunition, &c., £29,560 ; 18. Water (in manufactories), £29,550 ; 19. Metals, other than gold and silver, £28,690 ; 20. Animal food, £25,984 ; 21. Houses and buildings, £14,226 ; 22. Carving, engraving, &c., £13,670 ; 23. Musical instruments, &c., £4550 ; 24. Philosophical instruments, &c., £1650. The total value of machinery and plant

employed is £5,565,325, of which only a small proportion is engaged in industries other than those naturally arising (whatever may be the fiscal system) from the circumstances of the colony itself. But the fact remains that Melbourne is a busy hive of industry, and is, on the whole, unrivalled by any other colonial city in the variety of its manufactures. For machinery, specially adapted to colonial requirements, it has become celebrated, and its engineering works and foundries are well worth visiting. Whatever difficulties may oppose themselves, it may be regarded as certain that the manufacturing interests of Victoria will steadily grow. The two requisites for their development, on a grand scale, are a larger population and perfect freedom of intercourse with the other members of the Australasian group of colonies.

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 years' 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, 1862, and the latter on July 21st, 1869. The mean monthly temperatures are as follows:—

Jan.	Feb.	March.	April.	May.	June.
66·3	65·3	63·6	58·7	53·2	49·5
July.	**Aug.**	**Sept.**	**Oct.**	**Nov.**	**Dec.**
47·6	50·3	53·3	56·7	60·3	63·6

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 barometric 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 occasions 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:—

PERCENTAGE OF HOURS DURING WHICH THE WIND BLOWS FROM DIFFERENT POINTS OF THE COMPASS.

	N.	N.W.	W.	S.W.	S.	S.E.	E.	N.E.	Calm.
Spring	25·0	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	20·1	7·6	12·2	12·6	14·9	14·1	5·6	15·2	1·7
Winter	29·5	23·9	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.