

and struck a large river, with many affluents, to which he gave the name of the Darling. This river, flowing from north-east to south-west, drains the marshes in which the Macquarie and other streams from the south appeared to be lost. The course of the Murrumbidgee, a deep and rapid river, was followed by the same eminent explorer in his second expedition in 1831 with a more satisfactory result. He travelled on this occasion nearly 2000 miles, and discovered that both the Murrumbidgee, carrying with it the waters of the Lachlan morass, and likewise the Darling, from a more northerly region, finally joined another and larger river. This stream, the Murray, in the upper part of its course, runs in a north-westerly direction, but afterwards turning southwards, almost at a right angle, expands into Lake Alexandrina on the south coast, about 60 miles S.E. of the town of Adelaide, and finally enters the sea at Encounter Bay in E. long. 139°.

After gaining a practical solution of the problem of the destination of the westward-flowing rivers, Sir Thomas Mitchell, in 1835, led an expedition northward to the upper branches of the Darling; but the party meeting with a sad disaster in the death of Mr Cunningham, the eminent botanist, who was murdered by the natives on the Bogan River, further exploration of that region was left to be undertaken by Dr Leichardt, nine years later, and by the son of Sir Thomas Mitchell. Meantime, from the new colony of Adelaide, South Australia, on the shores of Gulf St Vincent, a series of adventurous journeys to the north and to the west was commenced by Mr Eyre, who explored a country much more difficult of access, and more forbidding in aspect, than the "Riverina" of the eastern provinces. He performed in 1840 a feat of extraordinary personal daring, travelling all the way along the barren sea-coast of the Great Australian Bight, from Spencer Gulf to King George's Sound. Mr Eyre also explored the interior north of the head of Spencer Gulf, where he was misled, however, by appearances to form an erroneous theory about the water-surfaces named Lake Torrens. It was left to the veteran explorer, Sturt, to achieve the arduous enterprise of penetrating from the Darling northward to the very centre of the continent. This was in 1845, the route lying for the most part over a stony desert, where the heat (reaching 131° Fahr.), with scorching winds, caused much suffering to the party. The most northerly point reached by Sturt on this occasion was about S. lat. 24° 25'. His unfortunate successors, Burke and Wills, travelled through the same district sixteen years later; and other expeditions were organised, both from the north and from the south, which aimed at learning the fate of these travellers, as well as that of Dr Leichardt. These efforts completed our knowledge of different routes across the entire breadth of Australia, in the longitude of the Gulf of Carpentaria; while the enterprising journeys of MacDouall Stuart, a companion of Sturt, obtained in 1862 a direct passage from South Australia northward to the shores of the Malayan Sea. This route has been utilised by the construction of an overland telegraph from Adelaide to the northern coast.

A military station having been fixed by the British Government at Port Victoria, on the coast of Arnhem Land, for the protection of shipwrecked mariners on the north coast, it was thought desirable to find an overland route between this settlement and Moreton Bay, in what then was the northern portion of New South Wales, now called Queensland. This was the object of Dr Leichardt's expedition in 1844, which proceeded first along the banks of the Dawson and the Mackenzie, tributaries of the Fitzroy River, in Queensland. It thence passed farther north to the Burdekin, ascending to the source of that river, and turned westward across a table-land, from which there was

an easy descent to the Gulf of Carpentaria. Skirting the low shores of this gulf, all the way round its upper half to the Roper, Leichardt crossed Arnhem Land to the Alligator River, which he descended to the western shore of the peninsula, and arrived at Port Victoria, otherwise Port Essington, after a journey of 3000 miles, performed within a year and three months. In 1847 Leichardt undertook a much more formidable task, that of crossing the entire continent from east to west. His starting point was on the Fitzroy Downs, north of the River Condamine, in Queensland, between the 26th and 27th degrees of S. latitude. But this eminent explorer had not proceeded far into the interior before he met his death, his last despatch dating from the Cogoon, April 3, 1848. In the same region, from 1845 to 1847, Sir Thomas Mitchell and Mr E. B. Kennedy explored the northern tributaries of the Darling, and a river in S. lat. 24°, named the Barcoo or Victoria, which flows to the south-west. This river was more thoroughly examined by Mr A. C. Gregory in 1858. Mr Kennedy lost his life in 1848, being killed by the natives while attempting to explore the peninsula of Cape York, from Rockingham Bay to Weymouth Bay.

Among the performances of less renown, but of much practical utility in surveying and opening new paths through the country, we may mention that of Captain Banister, showing the way across the southern part of West Australia, from Swan River to King George's Sound, and that of Messrs Robinson and G. H. Haydon in 1844, making good the route from Port Phillip to Gipps' Land with loaded drays, through a dense tangled scrub, which had been described by Strzelecki as his worst obstacle. Again, in West Australia there were the explorations of the Arrow-smith, the Murchison, the Gascoyne, and the Ashburton Rivers, by Captain Grey, Mr Roe, Governor Fitzgerald, Mr R. Austin, and the brothers Gregory, whose discoveries have great importance from a geographical point of view.

These local researches, and the more comprehensive attempts of Leichardt and Mitchell to solve the chief problems of Australian geography, must yield in importance to the grand achievement of Mr Stuart in 1862. The first of his tours independently performed, in 1858 and 1859, were around the South Australian lakes, namely, Lake Torrens, Lake Eyre, and Lake Gairdner. These waters had been erroneously taken for parts of one vast horse-shoe or sickle-shaped lake, only some twenty miles broad, believed to encircle a large portion of the inland country, with drainage at one end by a marsh into Spencer Gulf. The mistake, shown in all the old maps of Australia, had originated in a curious optical illusion. When Mr Eyre viewed the country from Mount Deception in 1840, looking between Lake Torrens and the lake which now bears his own name, the refraction of light from the glittering crust of salt that covers a large space of stony or sandy ground produced an appearance of water. The error was discovered, after eighteen years, by the explorations of Mr Babbage and Major Warburton in 1858, while Mr Stuart, about the same time, gained a more complete knowledge of the same district.

A reward of £10,000 having been offered by the Legislature of South Australia to the first man who should traverse the whole continent from south to north, starting from the city of Adelaide, Mr Stuart resolved to make the attempt. He started in March 1860, passing Lake Torrens and Lake Eyre, beyond which he found a pleasant, fertile country till he crossed the M'Donnell range of mountains, just under the line of the tropic of Capricorn. On the 23d of April he reached a mountain in S. lat. nearly 22°, and E. long. nearly 134°, which is the most central marked point of the Australian continent, and has been named Central Mount Stuart. Mr Stuart did not finish his task on

this occasion, on account of indisposition and other causes. But the 18th degree of latitude had been reached, where the watershed divided the rivers of the Gulf of Carpentaria from the Victoria River, flowing towards the north-west coast. He had also proved that the interior of Australia was not a stony desert, like the region visited by Sturt in 1845. On the first day of the next year, 1861, Mr Stuart again started for a second attempt to cross the continent, which occupied him eight months. He failed, however, to advance further than one geographical degree north of the point reached in 1860, his progress being arrested by dense scrubs and the want of water.

Meanwhile, in the province of Victoria, by means of a fund subscribed among the colonists and a grant by the Legislature, the ill-fated expedition of Messrs Burke and Wills was started. It made for the Barcoo, with a view to reach the Gulf of Carpentaria by a northerly course midway between Sturt's track to the west and Leichardt's to the east. The leading men of the party were Mr Robert O'Hara Burke, an officer of police, and Mr William John Wills, of the Melbourne observatory. Messrs Burke and Wills, with two men named Gray and King, left the others behind at the Barcoo on 16th December 1860, and proceeded, with a horse and six camels, over the desert traversed by Sturt fifteen years before. They got on in spite of great difficulties, past the M'Kinlay range of mountains, S. lat. 21° and 22°, and then reached the Flinders River, which flows into the head of the Gulf of Carpentaria. Here, without actually standing on the sea-beach of the northern shore, they met the tidal waters of the sea. On February 23, 1861, they commenced the return journey, having in effect accomplished the feat of crossing the Australian continent. Unhappily, three of the party perished on the road home. Gray, who had fallen ill, died on the 16th of April. Five days later, Burke, Wills, and King had repassed the desert to the place on Cooper Creek (the Barcoo, S. lat. 27° 40', E. long. 140° 30'), where they had left the depôt, with the rest of the expedition. Here they experienced a cruel disappointment. The depôt was abandoned; the men in charge had quitted the place the same day, believing that Burke and those with him were lost. The main body of the expedition, which should have been led up by a Mr Wright, from Menindie, on the Darling, was misconducted and fatally delayed. Burke, Wills, and King, when they found themselves so fearfully left alone and unprovided in the wilderness, wandered about in that district till near the end of June. They subsisted miserably on the bounty of some natives, and partly by feeding on the seeds of a plant called nardoo. At last both Wills and Burke died of starvation. King, the sole survivor, was saved by meeting the friendly blacks, and was found alive in September by Mr A. W. Howitt's party, sent on purpose to find and relieve that of Burke.

Four other parties, besides Howitt's, were sent out that year from different Australian provinces. Three of them, respectively commanded by Mr Walker, Mr Landsborough, and Mr Norman, sailed to the north, where the latter two landed on the shores of the Gulf of Carpentaria, while Mr Walker marched inland from Rockhampton. The fourth party, under Mr J. M'Kinlay, from Adelaide, made for the Barcoo by way of Lake Torrens. By these means, the unknown region of Mid Australia was simultaneously entered from the north, south, east, and west, and important additions were made to geographical knowledge. Landsborough crossed the entire continent from north to south, between February and June 1862; and M'Kinlay, from south to north, before the end of August in that year. The interior of New South Wales and Queensland, all that lies east of the 140th degree of longitude, was ex-

amined. The Barcoo and its tributary streams were traced from the Queensland mountains, holding a south-westerly course to Lake Eyre in South Australia; the Flinders, the Gilbert, the Gregory, and other northern rivers watering the country towards the Gulf of Carpentaria were also explored. These valuable additions to Australian geography were gained through humane efforts to relieve the lost explorers. The bodies of Burke and Wills were recovered and brought to Melbourne for a solemn public funeral, and a noble monument has been erected to their honour.

Mr Stuart, in 1862, made his third and final attempt to traverse the continent from Adelaide along a central line, which, inclining a little westward, reaches the north coast of Arnhem Land, opposite Melville Island. He started in January, and on April 7 reached the farthest northern point, near S. lat. 17°, where he had turned back in May of the preceding year. He then pushed on, through a very thick forest, with scarcely any water, till he came to the streams which supply the Roper, a river flowing into the western part of the Gulf of Carpentaria. Having crossed a table-land of sandstone which divides these streams from those running to the western shores of Arnhem Land, Mr Stuart, in the month of July, passed down what is called the Adelaide River of North Australia. Thus he came at length to stand on the verge of the Indian Ocean; "gazing upon it," a writer has said, "with as much delight as Balboa, when he had crossed the Isthmus of Darien from the Atlantic to the Pacific." The line crossing Australia which was thus explored has since been occupied by the electric telegraph connecting Adelaide, Melbourne, Sydney, and other Australian cities with London.

A third part, at least, of the interior of the whole continent, between the central line of Stuart and the known parts of West Australia, from about 120° to 134° E. long., an extent of half a million square miles, still remained a blank in the map. But the two expeditions of 1873, conducted by Mr Gosse and Colonel Egerton Warburton, have made a beginning in the exploration of this *terra incognita* west of the central telegraph route. That line of more than 1800 miles, having its southern extremity at the head of Spencer Gulf, its northern at Port Darwin, in Arnhem Land, passes Central Mount Stuart, in the middle of the continent, S. lat. 22°, E. long. 134°. Mr Gosse, with men and horses provided by the South Australian Government, started on April 21 from the telegraph station fifty miles south of Central Mount Stuart, to strike into West Australia. He passed the Reynolds range and Lake Amadeus in that direction, but was compelled to turn south, where he found a tract of well-watered grassy land. A singular rock of conglomerate, 2 miles long, 1 mile wide, and 1100 feet high, with a spring of water in its centre, struck his attention. The country was mostly poor and barren, sandy hillocks, with scanty growth of spinifex. Mr Gosse, having travelled above 600 miles, and getting to 26° 32' S. lat. and 127° E. long., two degrees within the West Australian boundary, was forced to return. Meantime a more successful attempt to reach the western coast from the centre of Australia has been made by Colonel Warburton, with thirty camels, provided by Mr T. Elder, M.L.C., of South Australia. Leaving the telegraph line at Alice Springs (23° 40' S. lat., 133° 14' E. long.), 1120 miles north of Adelaide city, Warburton succeeded in making his way to the De Grey River, West Australia. Overland routes have now been found possible, though scarcely convenient for traffic, between all the widely separated Australian provinces. In Northern Queensland, also, there have been several recent explorations, with results of some interest. That performed by Mr W. Hann, with Messrs Warner, Tate, and Taylor, in 1873,

related to the country north of the Kirchner range, watered by the Lynd, the Mitchell, the Walsh, and the Palmer Rivers, on the east side of the Gulf of Carpentaria. The coasting expedition of Mr G. Elphinstone Dalrymple, with Messrs Hill and Johnstone, finishing in December 1873, effected a valuable survey of the inlets and navigable rivers in the Cape York peninsula. The Endeavour River, in S. lat. 16°, which was visited by Captain Cook a hundred years ago, seems capable of being used for communication with the country inland. A newly discovered river, the Johnstone or Gladys, is said to flow through a very rich land, producing the finest cedars, with groves of bananas, nutmeg, ginger, and other tropical plants. The colonial geologists predict that the north-east corner of Australia will be found to possess great mineral treasures. At the opposite extremity of the continent, its south-west corner, a tour lately made by Mr A. Forrest, Government surveyor, from the Swan River eastward, and thence down to the south coast, has shown the poorness of that region. The vast superiority of eastern Australia to all the rest is the most important practical lesson taught by the land-exploring labours of the last half century.

*Physical Description.*—The continent of Australia, with a circumference of nearly 8000 miles, presents a contour wonderfully devoid of inlets from the sea, except upon its northern shores, where the coast line is largely indented. The Gulf of Carpentaria, situated in the north, is enclosed on the east by the projection of Cape York, and on the west by Arnhem Land, and forms the principal bay on the whole coast, measuring about 6° of long. by 6° of lat. Further to the west, Van Diemen's Gulf, though much smaller, forms a better protected bay, having Melville Island between it and the ocean; while beyond this Queen's Channel and Cambridge Gulf form inlets about S. lat. 14° 50'. On the north-west of the continent the coast line is much broken, the chief indentations being Admiralty Gulf, Collier Bay, and King Sound, on the shores of Tasman Land. Western Australia, again, is not favoured with many inlets—Exmouth Gulf and Shark Bay being the only bays of any size. The same remark may be made of the rest of the sea-board; for, with the exception of Spencer Gulf, the Gulf of St Vincent, and Port Phillip, on the south, and Moreton Bay, Hervey Bay, and Broad Sound, in the east, the coast line is singularly uniform.

The conformation of the interior of Australia is very peculiar, and may perhaps be explained by the theory of the land having been, at a comparatively recent period, the bed of an ocean. The mountain ranges parallel to the east and west coasts would then have existed as the cliffs and uplands of many groups of islands, in widely scattered archipelagoes resembling those of the Pacific. The singular positions and courses of some of the rivers lend force to this supposition. The Murray and its tributaries, the Murrumbidgee, the Lachlan, and the Darling, rising from the mountains on the east coast, flow inwards so far that they were at one time supposed to issue in a central sea. They do, in fact, spend their waters in a large shallow lake; but this is not far from the south coast, and is provided with an outlet to the ocean. The Macquarie and the Lachlan merge in extensive swamps, and their beds in the dry season become a mere chain of ponds. This agrees with the idea that the whole country was a sea-bottom, which has scarcely yet assumed the character of permanent dry land, while another proof consists in the thinness and sterility of the soil in the lowlands.

Along the entire line of the east coast there extends a succession of mountain ranges from Portland, in Victoria, to Cape York in the extreme north, called in different parts the Australian Grampians, the Australian Alps, the Blue Mountains, the Liverpool Range, and other names. These

constitute, like the Andes of South America, a regular Cordillera, stretching from north to south 1700 miles in length, with an average height of 1500 feet above the sea. The rivers flowing down the eastern slope, having but short courses before they reach the sea, are of a more determined character than those which take a westerly and inland direction. They cut their way through the sandstone rocks in deep ravines; but from their tortuous and violent course, and from the insufficient volume of water, they are unfit for navigation. Very few of them traverse more than 200 miles, inclusive of windings, or pass through any district extending more than 50 miles inland. It is different with the Murray, flowing westward, which has a course of 1100 miles, traversing a space from east to west measuring 8° of longitude. The Murray is navigable during eight months of the year along a great part of its course. This great river, with its tributaries, drains a basin the area of which is reckoned at half a million of square miles. Yet it has no proper outlet to the sea, debouching into a lagoon called Lake Alexandrina, on the sea-coast of Encounter Bay. On the opposite or north-western part of the continent there are several important water-courses. One river, the Victoria, which rises somewhere about 18° or 19° S. lat. and 131° E. long., flows northward to 15° 30' S. lat., where it turns westward. Its bed forms a deep channel through the sandstone table-land, with cliffs 300 feet high, while in width it sometimes extends to half a mile, its depth varying from 50 feet to as many fathoms. The Victoria debouches into Cambridge Gulf, 14° 14' S. lat. and 129° 30' E. long., an estuary 20 miles broad, with a depth of 8 or 10 fathoms. To the westward of this district run two other large rivers, the Prince Regent and the Glenelg, the latter being navigable, with a fertile country on its banks. The Roper, a navigable stream in Arnhem Land, has a width of 500 to 800 yards 40 or 50 miles from its mouth, which is at the Limmen Bight in the Gulf of Carpentaria. In the more settled and inhabited provinces of Australia there are the Brisbane, the Fitzroy, and the Burdekin, rivers of Queensland; the Glenelg River, of Victoria; and the Swan River, of West Australia. But this continent cannot boast of a Nile, an Indus, or a Mississippi, and the interior suffers from the want of water communication.

*Geology.*—The interior plain of Australia, enclosed by the coast mountain ranges, is a vast concave table of sandstone, with a surface area of 1,500,000 square miles. The sedimentary rock, in some parts, has been washed away or scooped out; but in the opinion of Mr W. H. L. Ranken (*Dominion of Australia*, 1874), the edges of the plateau, where highest and least reduced by denudation, are actually formed of this sediment. While the southern margin of the plain consists of walls of sandstone cliffs, extending along the sea-coast, the plateau on the east, south-east, the west, and partly on the north, is bordered by terraced ramparts of mountains. These elevations consist of granite and syenite on the west side, rising from 1000 to 3000 feet in height. On the east side, in New South Wales and Gipps' Land, they rise to a much greater height, attaining 7000 feet at the south-east corner in the Australian Alps. Here, too, the sandstone masses are often violently rent asunder, and mingled with the overflows of igneous matter, forming basalt and trap. On the north side of the continent, except around the Gulf of Carpentaria, the edge of the sandstone table-land has a great elevation; it is cut by the Alligator River into gorges 3800 feet deep.

In examining more particularly the geological structure of eastern Australia, we must take into account the neighbouring island of Tasmania. The late Count Strzelecki, author of the first scientific essay upon the subject, in 1845, after minutely describing all the mountain ranges of

New South Wales, passes on to Wilson Promontory, the most southerly point of Australia, whence he looks seaward at the islands in Bass's Strait. As he there observes the Tasmanian mountains, with which he is equally familiar, it occurs to him that the whole is the result of identical forces, operating in a direction from north-east to south-west. Such phenomena he ascribes to a series of "volcanoes of elevation," along a vast fissure of the earth, upon the line regarded by him as "the Australian eastern axis of perturbation." These forces he believes to have been exerted, with different degrees of intensity, at four several epochs, which are indicated by the character of the sedimentary rocks, broken through or contorted by the eruptive greenstone and basalt. That eruptive action is seen in the ravines and precipices of the Blue Mountains near Sydney; in the Grose valley, below Mount Hay and its neighbours, Mount King George and Mount Tomah; but still more remarkably in the mountains of Tasmania, viewed from Ben Lomond, within 30 miles of Launceston. The sedimentary deposits of the first epoch are characterised by the presence of mica slate, and of argillaceous and siliceous slate, as well as by the absence of gneiss. Those of the second epoch are found to be arenaceous, calcareous, or argillaceous stratified deposits. The third epoch includes the coal deposits, with their intervening shales and sandstones, including many fossils; while the fourth and last epoch is marked by the occurrence of elevated peaks, and by the remains of land animals found in the limestone caves or in alluvial deposits.

The Rev. W. B. Clarke, of Sydney, again, in a revised treatise published in 1871, expresses a doubt whether the southern range of mountains, extending to Wilson's Promontory, be really a continuation of the main Cordillera of New South Wales. He rather considers this to be prolonged in a westerly direction, taking a bend that way at the Warragong or Snowy Alps, and to be continued within 60 miles of the border of South Australia, which is on the 141st meridian of E. long. The subject is further discussed by Mr R. Brough Smith, of Melbourne, in his essay of 1872 on the mineralogy and rock formations of Victoria. This geologist has also remarked that the Murray, which must have repeatedly shifted its bed and changed its outlet, may have once been a far more powerful stream, flooding a vast tract of the interior, and thus becoming an effective agent in the geological formations of all south-east Australia. It has produced, in Victoria more especially, the Tertiary stratifications which are equivalent to the Pliocene rocks of Europe.

Throughout the whole of eastern Australia, including New South Wales and Queensland, while no tertiary marine deposits have been found, there occur many remarkable beds of siliceous sandstone, bearing impressions of ferns and leaves of trees, which are referred to the Tertiary epoch.

An interesting theory is advanced by Mr Clarke to account for the absence of Tertiary deposits on the eastern coast, when they are found on the western and southern coasts of Australia. In the islands of New Caledonia and other Australasian groups, from the Louisiade, near New Guinea, to New Zealand, there is a repetition of Australian geological formations, and there are abundant Tertiary deposits; and this may confirm the supposition that the Australian continent at some period extended farther to the east, and that a vast portion has disappeared under the ocean. To the same hypothetical cause Mr Darwin ascribes the formation of the Great Barrier Reef, stretching along the east coast from S. lat. 22° 23' to Torres Strait, with an interval between it and the land varying from 12 to 140 miles.

With regard to the more remote geological epochs, Australia presents fewer materials for study than the other

continents of our globe. Mr Clarke doubts the origin of some of the more ancient slates mentioned in the "first epoch" of Count Strzelecki, and does not find, either in eastern or in southern Australia, sufficient proof that these regions contain azoic and metamorphic rocks. Large masses of granite occur along the coast, and more extensively in Western Australia. Of the lower Palæozoic there is a great deal of Upper Silurian rock in New South Wales and Queensland, and some in Tasmania. It is in the Lower Silurian formation, as Sir Roderick Murchison predicted, that gold deposits are chiefly found. Rocks of the Devonian period are not yet proved to exist anywhere in Australia, and it is doubtful if any true Permian or Trias, so common elsewhere, have been met with in this continent. The great Carboniferous series is very prominent in New South Wales and in parts of Queensland; it prevails less in Victoria. Coal-beds, of thickness varying from 3 feet to 30 feet, are found associated, both above and below, with fossils resembling those of the Carboniferous strata in Ireland. Their antiquity is proved beyond question, in some districts, as in the valley of the Hawkesbury, where they are overlaid with beds of sandstone, shale, and conglomerate, 1000 feet thick. It has been shown by Mr Daintree that there is a very extensive distribution of the Secondary or Mesozoic rocks in Queensland—the Cretaceous strata, both there and in Western Australia, covering a large area. The Oolitic are more abundant in Western Australia.

The great plains of the interior, and the slopes of the inner mountain ranges, consist largely of deposits of the Tertiary epoch. They occupy an immense area in Victoria and New South Wales, including the Riverina district, which was probably, as Mr Brough Smith considers, levelled and planed down by the ancient vast expansion of the Murray. "The waves of the sea," he remarks, "and the waters of this river, have eaten away mountains of granite and great hills of schist in past times, and placed instead of them a smooth covering of sands and clays." The great basin east of Port Phillip, connected with another basin about Westernport, is overlaid with Mesozoic carbonaceous rocks, upper Miocene, a nodular basalt, and decomposed amygdaloid of older volcanic origin, the quartzose drift of the first Pliocene formations, and some volcanic products of more recent date. Here the Miocene beds abound with fossil leaves of plants belonging to that age. The sands, clays, and gravels of later periods, in the ancient beds of the streams within the Silurian areas, are more or less auriferous. Some of the deeper "leads" of the gold-miner contain fossil fruits and the trunks and branches of trees, which are described by Baron von Müller in the Melbourne official reports of the mining surveyors. In the Ballarat gold-fields the auriferous quartzose gravels are overlaid by flows of lava and vesicular volcanic rocks, while in a neighbouring district south of Ballarat, pebbles and sand are cemented by ferruginous matter into an extremely hard conglomerate.

In eastern Australia, where no Tertiary marine deposits are met with, there are deep accumulations of drift, such as transuted beds of the Carboniferous formation, porphyry, and basalt, and other igneous rocks, and fragments of the older Palæozoic strata. Many of the drift streams are not only highly auriferous, but contain gems of all kinds. Diamonds, though of small size, have been taken from the Cudjcong River, near Mudgee, in New South Wales, and likewise from the Macquarie River.

In the eastern plains of the interior, embedded in black muddy trappean soil, are found the bones of enormous animals of the marsupial or kangaroo order, as well as birds, fishes, and reptiles. The accumulations of bones in caverns at Wellington, New South Wales, and on the rivers Colo, Macleay, and Coodradigbee, are of great interest

A femur bone of the *dinornis*, the gigantic extinct bird of New Zealand, has been discovered in the drift on Peak Downs in eastern Australia, at the depth of 188 feet; and this would lead to the belief that land once existed where now the Pacific Ocean separates by a thousand miles two countries of Australasia, whose present animal and vegetable races have so little in common.

*Minerals.*—The useful and precious metals exist in considerable quantities in each of the five provinces of Australia. New South Wales has abundance of gold, copper, iron, and coal, as well as silver, lead, and tin. The mineral riches of Victoria, though almost confined to gold, have been the main cause of her rapid progress. South Australia possesses the most valuable copper mines. Queensland ranks next to the last-named province for copper, and excels her neighbours in the production of tin, while gold, iron, and coal are also found in considerable quantities. In Western Australia mines of lead, silver, and copper have been opened; and there is much ironstone.

The discovery of gold in New South Wales and Victoria took place in 1851, and during the next twenty years Victoria exported 40,750,000 oz. of the precious metal, while New South Wales, from 1851 to 1871, exported nearly 10,000,000 ounces. The Queensland gold mines, since 1860, have displayed increasing promise; up to the end of 1872 they had yielded rather less than 1,000,000 ounces; but much was expected, at a more recent date, from the Palmer River and other districts of the north. The yearly value of the aggregate gold exports of Australia, on the average of fifteen years, has been £10,000,000. Victoria alone has produced gold to the value of £170,000,000. The alluvial gold-fields, in which the early diggers, with the simplest tools, obtained for a short time large quantities of the coveted ore, seem now to be mostly exhausted. It is in the quartz formations of the mountain ranges, or in those at a great depth underground, reached by the sinking of shafts and regular mining operations, that Australian gold is henceforth to be chiefly procured. There are mines in Victoria 1000 feet deep, as at Clunes, and many others from 300 to 600 feet.

The copper mines of Burra Burra, in South Australia, proved very profitable some twenty-five years ago, yielding in a twelvemonth ore to the value of £350,000, and the Moonta mines, in 1872, were scarcely less productive. The province of South Australia, in that year, exported copper to the amount of £800,000. Queensland, in 1873, produced one-fourth that quantity. Tin, an article of great mercantile interest, is divided between Queensland and New South Wales in a frontier district, two-thirds of the extent of which belongs to the Darling Downs, within the last-mentioned province. There is a little tin, also, in some parts of Victoria. Lead, silver, and cinnabar have been obtained not only in New South Wales, but likewise in Western Australia.

The abundance of good iron ore, in convenient vicinity to thick beds of excellent coal, ensures a future career of manufacturing prosperity to New South Wales, and not less to Queensland. The country north and south of Sydney, and west of that city 100 miles inland to the dividing range of mountains, is all of Carboniferous formation. At the mouth of the Hunter River, from the port and town of Newcastle, coal was exported in 1873 to the value of £1,000,000 sterling. The collieries there taken up have an extent of 35,000 acres, but the area of the coal-field is officially estimated at 10,000,000 acres, and the seams are 9 feet to 11 feet thick. The quality of this coal is said to be equal to that of Great Britain for most furnace purposes, and it is generally used by steamships in the Pacific and Chinese navigation. Next in importance are the Wollongong collieries, south of Sydney, and those of

Hartley, Maitland, and Berrima, now connected by railway with the capital.

In each of the places above named there is iron of a superior quality, the working of which to advantage cannot be long delayed. On the Illawarra coast it is found close to the finest bituminous coal, and to limestone. The iron of New South Wales is mostly hæmatite, and the ironstone contains from 60 to 70 per cent. of ore.

Among other mineral products of the same region are cannel coal and shale yielding kerosene oil. This is a recognised article of export from New South Wales to the other colonies. It is hardly worth while to speak of diamonds, opals, and precious stones, but they are often picked up, though of small size, along the Mudgee and Abercrombie Rivers, and at Beechworth and Daylesford, in Victoria.

*Climate.*—The Australian continent, extending over 28° of latitude, might be expected to show a considerable diversity of climate. In reality, however, it experiences fewer climatic variations than the other great continents, owing to its distance (28°) from the Antarctic circle and (11°) from the equator. There is, besides, a powerful determining cause in the uniform character and undivided extent of its dry interior plain. On this subject Mr Ranken, in his *Dominion of Australia*, remarks—"A basin having its northern portion in the tropics, it acts like an oven under the daily sun. It becomes daily heated; then its atmosphere expands; but such is its immensity that no sufficient supply of moist sea air from the neighbouring oceans can reach it, to supply the vacancy caused by this expansion. Of an almost perfectly flat surface, there is no play for currents of air upon it; only the heat is daily absorbed and nightly radiated. Such is the heat, that in the summer the soil is more like a fire than an oven; the air, if it moves, is like a furnace-blast; and such its extent and sameness, that as great heat may prevail hundreds of miles south as north of the tropics." This continual radiation of heat is sometimes relieved—though not with the regularity of an annual season, indeed rather at uncertain intervals of several years—by the admission of masses of vapour, drawn in from the Pacific or the Indian Ocean. Great masses of clouds, after labouring many months to reach the interior from the sea, succeed in passing over the sea-bound mountains, and spread themselves in floods of rain upon the inland country. The north-west shore, and that of Carpentaria, are favoured with an annual visitation of the monsoons, from December to March, penetrating as far as 500 miles into the continent, where the sands of the desert are driven in wavy heaps by the force of this wind. But South Australia, though it feels a cool sea breeze from the south-west, gets little rain, for lack of any mountain range parallel with the coast to arrest and condense the passing vapours. The yearly rainfall at Adelaide and Gawler is therefore not more than 15 or 20 inches, while at the head of Spencer Gulf it is but 6 or 8. In Victoria and in New South Wales, on the contrary, where a wall of mountain fronts the ocean, most places on the sea-board enjoy a fair allowance of rain. It is 32 inches at Portland, nearly 26 inches at Melbourne; at Sydney and Newcastle, on the east coast, as much as 48 and 44 inches in the year. But at Brisbane, in Queensland, farther north, it amounts to 50 inches; at Rockingham Bay, in latitude 18° S., where the hills are covered with dense forests, the rainfall in 1871 was no less than 90 inches. In every part, however, of this magnificent highland region, the supply of moisture is rapidly diminished by passing inland; so that very little remains to fall on the interior or western slopes of the coast ranges, and to irrigate the interior plains.

With regard to the temperature, the northern regions of the continent being situated within the tropic of Capricorn,