The Tasmanian Naturalist

THE JOURNAL OF THE

Tasmanian Field Naturalists' Club

New Series—Vol. I. DECEMBER, 1925. No. IV.

Nomadic Migration of Birds

Just as the nomad savage wanders to and fro about his wilderness, pitching his tent here one day, miles away the next, according to his ever-fluctuating supply of the bare necessaries of life, so do certain birds pass the greater part of their existence moving round. Few birds are really stationary throughout the year; in fact, it is rather the exception for a species to be absolutely sedentary. Many, if not all, young birds are great wanderers, being driven from their birthplace by their parents, or deserting it voluntarily as soon as parental care becomes unnecessary, while several nectar-feeding species are constantly on the move. At one time we may notice a flock of a certain variety in a particular district, and at another time not a bird is there, the food supply of the area perhaps having failed, as it often does, or the existing climatic conditions being found unsuitable. The birds, therefore, have found it necessary to move to other districts where the things they require are obtainable; but, so soon as these fail, or change, they are on the move again, appearing here one week and somewhere else the next, and so on. This local movement of birds is known as nomadic migration. It differs from the ordinary seasonal migration in that the birds affected by it do not usually return with any degree of regularity to the districts from which they departed. It has been pointed out by writers on migration that the greatest amount of nomadic migration prevails among birds peculiar to the coldest regions of the earth, either on mountains or in high northern or southern latitudes—species whose food supply is not greatly curtailed by any decrease in temperature. Tasmania, therefore, offers several good examples.

Case of the Quail.

The brown quail, for instance, are constantly on the move, although a bevy may remain in a neighborhood offering a plentiful supply of food and suitable cover for several months; but eventually they move somewhere else. I know of the location of a fairly large number at present. The place is well grassed and full of seeds upon which the birds live, and until this supply is exhausted the quail will stay there; provided, of course, they are not unduly disturbed. When quail move it is at night, and although appearing to be such weak flyers, it is surprising how far they will go in a few hours. In other parts of the world, especially in the northern hemisphere, some quail are subject to extensive seasonal migration, and are even known to cross the Mediterranean Sea in their flight. One year a certain district may hold a large number of quail, and good shooting may be had, but the following year none may there be seen, a change in weather, or a fire, which is always disastrous to these birds, perhaps having wiped out their supply of food, and districts that have not previously held them will be crowded. Some quail live in swamps and marshes, and might remain there for years provided the place is not affected by dry spells, and if such does occur there is a considerable migration of not only quail, but of water birds, such as crakes, herons, coot and others, to districts offering better conditions for existence. Frequently, the baldcoots pocket their natural shyness and enter farmyards feeding quite contentedly with the domestic fowls till conditions in their proper quarters improve. More frequently, however, they raid neighboring crops and wheat fields and play havoc with the grain, trampling it down by their numbers in the way that cattle do.

Parrots and Lorikeets.

Probably the best examples of nomadic migration are afforded by the parrots and lorikeets. Their movements, like those of other birds, are purely in search of food, and as this in the case of lorikeets, is found in the flowers of the eucalypts, we find the birds following up the irregular flowering periods of the trees. They periodically sweep over Hobart with noisy crys hunting out every garden, park and reserve where the flowering trees are to be found, and after exhausting the supply of nectar for the time are off to the country to seek for more. They may be described as birds at the mercy of circumstance—here one day, gone the next, as it were. During the course of the year they move round the country very extensively, each district being visited in turn, and they seem to breed in any suitable place when spring comes upon them. The rosella and other kinds of parrots are birds that also roam, though not to the same extent as those species, which are almost entirely dependent upon a supply of nectar for their food. When the natural food supply of the parrots becomes scarce a diet of fruit is often resorted to, the birds making raids on orchards or gardens for the purpose, and it is because of this that they are looked upon with much disfavor by some fruitgrowers.

Other Nomads.

Birds of the pigeon tribe are notorious wanderers as is instanced by the case of two or three mainland varieties occurring in Tasmania from time to time. So are martins, and to some extent, swallows, though these species are subject to seasonal migration as well, and cannot, correctly speaking, be classed as nomadic migrants. But, strangely enough the swift, which visits us from Japan, combines in a very marked manner examples of both regular and nomadic forms of migration. Its lengthy journeys from lands well above the equator to the extreme south of Tasmania and back again the following season, which compel us to admire this wonderful flyer, is one of the best and most advanced examples of regular migration; its constant wanderings on the wing in search of food during the time it is with us in the summer also render it an outstanding species of the nomadic class of feathered migrants.

Other nomads of the avian world are the little white-eyes, ground lark, chats, native hens and some varieties of the honeyeaters. Swans and ducks are very irregular in their habits, for they will be found in thousands on a swamp one year, and then for no apparent reason they will desert it. During the period of a drought in one part of the country there is an extensive movement in progress to others, and at such times we see birds in our districts that perhaps have never come before. When there is a dry spell in Victoria or New South Wales, for example, as there is from time to time, many kinds of water birds, ducks especially, migrate southward to Tasmania and flock to the marshes and lagoons there where they feed. At that time nomadic migration is at its height, and many interesting things can be observed by the outdoor ornithologist.

Such birds as the black magpie, eagle and jay, seem to be fairly stationary in the hills, however cold it is, for their food supply is not affected by the winter to the same extent as that of insectivorous or granivorous birds; but at times, even these are compelled to move as the food may fluctuate, and come down to the lowlands close to human habitation during spells of unusually inclement weather, hastening back again, however, as soon as easier climatic conditions recur. This also applies to white and black cockatoos ,which are usually only to be seen away from their wildnesses when severe weather drives them to the open country.

Movements of Robins.

Were it not for the fact that we are in possession of a certain amount of evidence of their regular movements, I might refer to the robins as other birds with nomadic tendencies. But, as a general rule, the robins move from the highlands to the lowlands, and vice versa, at regular periods of the year. It has been observed that at the approach of winter the birds leave their haunts in the mountains, which they have inhabited all the summer, and make down the gullies to the warmer regions on the eastern coast, where they stay for two or three months of the year. Then, when spring comes round and the snow is disappearing from the mountain tops, they obey an impulse to return to the uplands, and we see them making back to these places to nest and escape the hot weather on the lower country. It is admitted, of course, that all robins (the red-breasted variety) do not breed in the highlands, since individual pairs may be seen about the plains at almost any time of the year; but it is safe to assert that the bulk of them prefer the uplands in spring and summer, and regularly migrate there with the arrival of those seasons. When winter comes we have evidence of a distinct influx of the birds in eastern coastal districts.

What we Learn.

The study of the nomadic movements of birds is to the naturalist highly attractive, as it is from such migration that the wonderful flights of the swift, the curlew, the turnstone, and golden plover, which literally travel from pole to pole have originated. Ordinary seasonal migration has sprung from it as well. Furthermore, it goes to prove that the great initiating cause of all migration was food. That, of course, is still the underlying motive of today, for birds, in order to secure a proper diet, not merely for themselves, but for their young, travel the wide world to find it. That is why so many millions flock to the tundras of Siberia and North America every year to nest. They find there absolutely countless hordes of mosquitoes and insects on the edge of the snow, as well as berries and other fruits, and have only to open their beaks to get a meal. These nomadic migrations represent incipient migration in the past which never developed in these species or their ancestors to any greater extent than what we now witness. But, in the great majority of birds throughout the world, the practice of migration gradually became a function fraught with great importance to avian life, and necessary even for the preservation of the races. For its origin we must look back to a very remote past, when the globe was subject to mighty climatic changes and physical disturbances, with vast alterations in the relative level of land and sea, and remarkable volcanic activity; and such glimpses into the ages are dear to the heart of every scientist. At whatever period of the world's history the migration of birds commenced there cannot, however, be any other conclusion but that the underlying cause of the movement was the failure of food supply.

M. S. R. Sharland.

Outlines of Tasmanian Geology

SECTION 17
EXTRAORDINARY LANDSCAPES

There are three types of landscapes, common in certain localities, but by no means usual when the whole surface of the globe is considered, and which do not fit in with any of our previously discussed classifications. They do not occur as part of the normal development of a landscape, but are produced by outside causes which may operate during any stage of development and on any landscape, but which, after all, operate only occasionally and over limited areas. These types of landscapes are (1) Ice Caps: (2) Deserts: and (3) Lakes and Marshes.

Ice Caps.

Little need be said of these landscapes. For practical purposes they are blanks on the map of the world. The great example is the whole great continent of Antarctica, Greenland, Northern Canada, Iceland, Scandinavia, and Northern Siberia give us further examples. The economic effect of an ice cap is to give a perfect blank, far more so than a desert. The physiographic effect can only be observed when the ice disappears. These effects are a general levelling of the country. All irregularities are smoothed out and planed to an extent that water cannot accomplish

Deserts.

Deserts are regions of the earth's surface with an average annual rainfall of under three inches. The cause of the existence of these dry areas is mainly geographical. There are four great dry belts circling the globe, and in these belts, unless geographical conditions supply a greater amount of rainfall or water supply from outside the area, a desert is the result. These belts are, along the Antarctic and the Arctic circles and along the tropics of Capricorn and Cancer. The higher latitude dry belts occur just beyond the ice sheets. Here the intense cold freezes the moisture in the air and rain never falls, hence the unexposed land surface is always exceedingly dry. It may be of passing interest to some readers to note that the yellow mud of northern France, of peculiar and well remembered attributes, was formed from banks of wind driven dust of such a desert occurring in this region when the northern ice cap reached half way down England The reached desert belts are due to the absence of downward moisture bearing wind currents this absence being due to asmospheric conditions imparted by the rotation of the earth. Mountain ranges as deflections of rain bringing winds have little effect.

However they are caused deserts all present a peculair type of erosion. The effects of water are reduced to a minimum and the effects of wind are increased and allowed full play. The active agents in wind erosion are the particles of sand blown against the rocks. In dry regions the rocks are worn away by this rubbing. In time the softer portions stand out. Much of the north of South Australia consists of strata of quartzite with some layers much harder than the rest. These beds are tilted at an angle of about 45 degrees, and the hard layers recur every five miles or so; also they run parallel to the line of the prevailing wind. The soft portions have been worn out by the wind carried sand and these hard layers now stand out as walls 20 to 100 feet high, and running for miles across country. This is quite a common feature of desert topography.

As the wind has more cutting power just above the ground level, where its sand content is highest, isolated hills tend to become cut away at the base, and this very sharp featured, or even somewhat mushroom shaped. Forms are given which water could never give. These precipitous sides and shape faces are always on the side facing the prevailing wind, the leeward being uneroded and gently sloping. A landscape dotted with hills all shaped in this way, and with the gently sloping sides all pointing in the same direction, is a certain indication of past desert erosion. Not only do the solid rocks become worn by the sand, but also loose boulders and pebbles are affected. They become faceted into irregular faces and polished, more so on one side than another. These peculiar features of the desert are termed "Gibbers" in Australia from the native name for a stone, and are very typical. Great accumulations of wind blown rock fragments, termed "loess," are another indication of dry localities.

Lakes and Marshes.

A lake indicates an "accident" in the development of the landscape. A moment's reflection will satisfy anyone that water erosion, working as it does gradually back from the river's mouth could never hollow out a lake basin. To do so would require the river at some stage to run uphill. Further, lakes indicate that the accident to the orderly course of erosion has occurred in the not far distant past. The existence of lakes is ephemeral. Rivers may soon either cut away the dam empounding the lake or fill it with silt.

The commonest cause of the formation of lake basins is ice action. A glacier scoops hollows in the rocks over which it passes in a way impossible for water. Also a glacier drops all its moranial load, where it melts. This very often forms a dam of rocks and clay right across its valley. When the ice melts water accumulates in the hollows, thus formed as lakes. Most of the important lakes in the world were formed in this way. All in Tasmania, with the exception of Lake Tiberias, Lake Dulverton, Grimes's Lagoon, and perhaps Lake Crescent and Lake Sorell are due to ice action, so are the great lakes of Northern America, Russia and Siberia. The next important method of lake formation is by a relatively rapid alteration of level due to earth movements. Either a block of land sinks into what is called a rift valley, and as a result portion is left as a basin with no outlet. The salt and mud plains marked on the maps of Australia is Lake Torrens, Eyre, Gardiner, and others in South Australia; also the great lakes of Central Africa, and the Black and Caspian Seas, are so formed. Or portion of the landscape may be uplifted, and at the same time slightly tilted, this again interfering with drainage. Lake Tiberias and Lake Dulverton, and the swamps at Mona Vale and Cressy are due to this cause.

Lakes may also be formed by other accidents such as the blocking of a valley by lava flow, and small ones even by a landslip. Again, a river may build its bed up so high that tributaries cannot reach it as is done in N.W. Victoria and along the Darling, or the sea winds may block a river's mouth with sand dumes, as at the mouth of the Murray, and many river mouths in Tasmania, although strictly speaking there are more arms of the sea than lakes.

Marshes are merely regions formed in a similar way to lakes, but either not so perfectly formed or nearly obliterated by river erosion or deposition of sediments. One common illusion must be dispelled here. It is often said that vegetation may fill in lakes, and Lake Tiberias, with its weed-covered surface is instanced as an example. This is a fallacy. Vegetation cannot grow in water over about 6 feet deep, with the exception of small aquatic plants which would not help materially to fill a lake basin. Plants do not cover a lake's surface until the water level has been reduced by other circumstances almost to vanishing point. Lake Tiberias is a reed-covered marsh and not a lake. Marshes, butter-grass plains, peat bogs, etc., are typical of glaciated country, and owe their origin to similar causes in glacial lakes.

This brings to a close our all ready over-long chapter III. The main agencies at work developing our landscape have been pointed out. All possible examples cannot be given, but every form except perhaps the desert, can be observed in Tasmania. It is only necessary to look about you during any bush walk to see numbers of the phenomena described above. The student should, after mastering the principles of landscape development, pause during his walk and say to himself, to what agencies were these features I see before me due? This study of physiography is the basis of practical geology, and the most important part of our subject. The student should master it before proceeding further.

The writer would have preferred to place examples of the above described features in the text and in a hoped-for re-issue of these articles this will be done, but at the present time has not allowed the collection of all the available examples and a reasonable choice cannot be made. Also these examples are so numerous that without a judicious selection they would overload and confuse the text. There is the additional reason that at present there is a controversy as to whether our landscape is due to differential diabase intrusion followed by erosion of the softer rocks, or whether, as the writer thinks, it is due to subsequent block faulting. Until this point is definitely agreed upon many examples will be controversial. All that can be done here is to give a few examples of the features described above in illustration. No attempt is made to give a full list.

The effect of rise and fall of the land or the level of the sea may be observed along all the lower levels of our rivers. Our harbors are mostly drowned valleys worn out by water and then flooded by the sea. The flooding has caused the deposition of sediments high up in the estuaries where the current is now checked. The Derwent, Huon, Tamar, and Mersey are fine examples of drowned valleys. When the sea was much lower during the recent ice age the rivers cut these valleys. Now they cannot carry their sediments beyond Bridgewater, Franklin, Launceston, and Latrobe, where extensive mud flats and flood plains are now being superimpoesd on the old valley floor.

In many places a subsequent partial rejuvenation may be seen to be commencing and these and most other rivers can be seen cutting through their flood plains of river gravels. This is especially noticeable on the Derwent between Macquarie Plains and New Norfolk, where old flood plains consisting of the typical river conglomerates are standing many feet above the highest present flood level. In many places this is caused by the river cutting through hard bars of basalt, which have dammed the valley between these points. The hard rock has held up the course of erosion above it, and given portions of the valley appearances of maturity. When the river has cut through them it has cut through the flood plains deposited higher up. When the South Esk cuts through the hard diabase bar at the Cataract Gorge it will deepen its upper reaches very quickly in the softer rock further south.

The bulk of Tasmania's drainage is in the youthful stage. In fact, Tasmania possesses an area of juvenile drainage in excess of that found in most parts of the world. With the exception of the largest rivers, the drainage is in the earliest stages. This points to the conclusion that water has not long been at work eroding our present landscape. Most of our creeks are mere mountain torrents, and largely depend on actual rainfall for their continuance. Waterfalls and lakes are very common, and the existence of many inland cliffs, apart from watercourses and glaciated country supports this conclusion. A soft rock-like sandstone would not stand as a cliff during many geological ages, and these cliffs are common all over the country. Good examples exist behind Lindisfarne and Risdon, on Mt. Faulkener, and south of New Norfolk.

The rivers such as the Derwent, Huon, Gordon, King, Pieman, Arthur, Duck, Inglis, Blyth, Forth, Mersey, South Esk, and Ringarooma have reached a somewhat more mature stage. But even these are merely a series of deep reaches separated by rapids. None are strictly navigable. Rivers with as much water as these in England, France or Germany would be great internal trade routes. But still these rivers are in a more advanced stage than mere youth. The writer suspects that river erosion has not been entirely responsible for the development of the topography of these valleys. They are probably due to large block faults, and the rivers have found courses in them somewhat ready made at a fairly mature stage. The streams have been at work for a considerable time, and have further moulded the contours. Thus these wide valleys have the characteristics of landscapes approaching maturity, but as soon as you move out of them the drainage is in the first stages of youth. This gives us a double set of landscape topography, and the stage of erosion development in Tasmania can only be described as extremely juvenile, with some of the largest rivers in certain areas approaching maturity.

The South Esk has proceeded farthest in this stage. It "winds in a remarkably sinuous course" over the Tunbridge-Fingal-Deloraine plain, better known perhaps as the Launceston Tertiary Basin. The main course of the river and its tributaries, also the North Esk, as soon as the streams descend from the surrounding mountains, is typical of a mature river. Bends, billabongs, and flood plains are the rule. All the rapids have not yet been cut away, but the gentle slope of about 200 feet from Conara to Launceston gives very little power to the river, which appears to be only able to cut in flood time. Then right at its mouth we find the Cataract Gorge, where the river is in the stage of early youth. Obviously this is due to recent earth movements and when it is cut through, the upper reaches will be gradually rejuvenated.

The Huon, Gordon, King and Pieman commence for many miles in their upper reaches to flow through mature valleys. These in turn give place to juvenile ones for over half their courses. Obviously these features cannot be due to a continued process of river erosion, as in that case the mature stage would have been developed from the mouth backwards. The Derwent flows in a very narrow valley, and presents fewer characteristics of maturity.

There are numerous instances of river piracy, and many more suspected ones not yet fully worked out. The best group is that presented by the Henty, Queen, King and Gordon rivers on the West Coast. The Henty and Queen once ran from the Eldon range across the Sedgwick-Geikie and Owen-Lyell gaps respectively. In their course they had to cut through the hard conglomerate of the West Coast range. The more favored King River, cutting through the Huxley-Owen gap, sent a tributary north on the east side of the West Coast range, and beheaded the Queen and the Henty, and diverted their waters east of the range, leaving the Lake Margaret and Lyell wind gaps showing the former course of these rivers through the range. The same is about to happen further south. The King is also impeded by the hard West Coast Range, but the Gordon flows round the south of Mt. Darwin. The Gordon has sent its largest tributary (the Franklin) up the east of the range, and it has very nearly captured the head-waters of the King at Crotty. So far has this advanced that when the proposed King River dam is erected the overflow from the lake thus made will flow, not down the King River, but through a short channel into the Franklin.

Lakes, of course, are frequent, and most if not all are due to the agency of ice. In the recent past ice invaded most of the centre and western districts and caused the "accident" to the orderly development of water erosion indicated by the innumerable lakes and swamps of the centre and west.

These glaciated landscapes show the earliest stage, the channelled upland, developed to perfection, and in many places, especially at Mt. Anne and La Perouse, the glaciation had entered on the adolescent stage, and comb ridges are met with. Even incipient glacial horns appear at Mt. Anne, Cradle Mountain, Barn Bluff, and other localities.

CHAPTER IV.

SECTION 18

THE MATERIALS OF THE EARTH (PETROLOGY)

ROCK TYPES

We have considered at length the various forces which may have influenced the moulding of our landscape, and have seen that a given type of topography indicates to us the past work of certain earth movements and certain modifying influences. The subject of all these studies are ultimately beds of rocks. Although, as we have seen, the fact that some rocks may be soft and others hard has some bearing on the development of the features of our countryside, in general the influences we studied in the last chapter, operate impartially over a given area, and on their still more general aspect over the surface of the whole world. But this does not cover by any means the whole of our study. In a mile walk anywhere in Tasmania we can notice frequent changes in the nature of the rocks making up this landscape. We must now consider how these changes in rock types occur, and what the differences in rocks tell us of the past history of the landscape. To do this we must find out what kinds of rocks occur, and how they differ from each other. We must then discover why they occur and account for these differences. This is the intensive part of our subject. We turn from the broad form of the landscape to the minute structure of each portion of it, from, as it were, the telescope to the microscope, but always remembering that as geologists we are not interested in structure of rocks for itself, but as an assistance to, as a proof of our theories of the origin of our landscape.

Differences in Rocks.

In examining two pieces of rock they will very often be found to be different. Usually this will be sufficiently marked to be discernible by the eye at once. These differences are differences of general appearance—structure, hardness, color, feel to the touch or lustre. The cause of differences may be due to differences in composition or in mode of formation. Having determined the cause, we get an indication as to the origin of these rocks, which is the object of our present study. The origin of all the rocks in an area, and their relations to each other, tell us of the influences at work to form the ground-work of our present landscape—the terrain upon which the dynamic agencies have worked to produce our present topography.

We learn that some types owe their appearance to the fact that they were deposited in the sea, and further differences show us that some were deposited in river estuaries, others on open beaches, other again in deep water. Another set of characteristics shows us that the rock was laid down where shell-fish and corals abounded, others where trees and ferns lived and died. Some rocks show us by the unmistakable evidence of their own structure that they were poured over the landscape as lavas, others that they were forced under great pressure into older rocks. Again, two adjacent lavas may show us that they flowed from different vents and perhaps were of different ages, because they have an entirely different chemical composition. A further set of rocks show that although once laid down in the sea they have since felt the influence of great heat or great pressure. The structure may show grades of pressure and stages in altering conditions. By knowing the conditions of origin and subsequent history that are indicated by a given type we can thus get at a glance a great deal of information concerning the previous history of our landscape.

Classification of Rocks.

It is, therefore, necessary to know the type of rock we are handling. More than this, it is necessary to know what the fact of finding this rock type where we do teaches us. Each different type has its name, and this name should give us this information. There are many classifications and some go down to the most minute details. For our purposes, it is sufficient to adopt the simplest. Rocks may be classed under three main heads, according to their mode of origin. These are: (a) Original rocks, (b) fragmental rocks; (c) altered rocks; and this classification gives us at once the key to their formation. Terminology varies, and these three groups have for the last century been called respectively: (a) Igneous rocks; (b) sedimentary rocks; (c) metamorphic rocks; names which we now know, not in all cases to express accurately the mode of origin, but by this time so ingrained into our geological terminology as to be endowed with a meaning far broader than the strict derivation of the words would indicate. We will therefore use these latter terms.

A: Igneous or original rocks (sometimes termed massive or unstratified rocks). These include all rocks formed by the crystallisation or solidification of masses of mineral matter which has been forced from deep down in the earth into overlying rocks or out on to the surface. It is the general rule that these rocks have been formed from minerals fused by heat and forced by pressure into overlying rocks in a more or less plastic state. The term "igneous" gives us the idea of their fiery origin, "massive" and "unstratified" their characteristic of absence of definite form. "Original" indicates that they were not formed from particles of older rocks.

B.: Sedimentary or fragmental rocks (sometimes termed clastic or stratified rocks). This includes all rocks formed from rearrangement of particles of older rocks, or of plant or animal remains, or from chemical or mechanical deposits. They are ordinarily those deposited in the sea or on land from sediments or accumulations of particles. The term "sedimentary" indicates the general mode of deposition, but by no means all are deposited as sediments. "Clastic" gives the idea of formation by the aggregation of particles, and "stratified" indicates the general characteristics of beds formed by a succession of layers.

C.: Metamorphic or altered rocks (sometimes termed schistose rocks). These are rocks, some or all the characters of which have been altered from those they once possessed. The original rock may have been igneous or sedimentary, and the change may vary from a slight hardening to a complete change of chemical composition, and structure to an extent which obliterates all idea of the original type. "Metamorphic" indicates heat as the chief agent of this change. The term "schistose" is unsuitable as many metamorphic rocks do not possess this characteristic.

But as has been said, rocks are termed either igneous, sedimentary, or metamorphic, according to certain defined rules and quite independently from the meaning of the words which are now technical terms.

Mineralogy.

Before we can proceed to classify rock types we must study their characteristics minutely. The portion of our science which does this is called mineralogy. It classifies the minerals which together make up the rock. Mineralogy has developed into a science of its own, and requires much equipment, such as microscopes, and ordinary laboratory services. It is quite beyond the scope of these articles to delve into this wide and fascinating study. All that can be attempted here is to give a classification of the more important rock-forming minerals. This must be done as much of our later classification of rock types depends on the presence or absence of certain common minerals. We must call on the specialised knowledge of the mineralogist to give us what assistance he can to determine the origin of our rocks, information gained by the intensive study of the characteristics of the various component parts of our rock.

SECTION 19

MINERALOGY

Rocks are made up of collections of mineral particles in an indefinite mixture of crystals or grains varying greatly in size, shape, and chemical composition. Some few rocks are made up of grains all of the same mineral, a greater number consist of grains of two distinct mineral species, but the majority of rocks are a mixture of three or more minerals. The rock-type depends on the type of these constituting minerals, and the mineral type gives an indication as to the conditions under which the rock was formed.

"A mineral is a body produced by the processes of inorganic nature, having a definite chemical composition, and if formed under favorable conditions, a certain characteristic crystal form and other physical properties." (Dana). It has a single structural form, and a definite chemical composition which can be expressed in a single chemical formula. If it is divided into more than one body physically, or if it contains parts with varying composition, it is a rock. The rocks of the earth's surface consist of interlocking grains of minerals or crystals, or of mineral grains cemented together. All rocks consist of mineral particles. The number of mineral species, although large, is not infinite like synthetic chemical compositions, and the discovery of a new mineral is a rare occurrence.

Minerals have certain definite characteristics by which they may be distinguished. These varieties are differences in—(a) Crystal form (b) physical characters, such as cohesion, hardness, feel, weight or color, etc.; and (c), chemical composition. Mineralogy is the science which deals with the determination of these constituents of the rocks. For the reasons given before only the barest outline of its scope can be indicated here.

Crystals.

Physics tells us that matter consists of aggregates of minute bodies termed atoms, which in their turn consist of electrons, varying in numbers, and revolving within the atom at differing rates and directions. The different forms physical matter assumes is governed by the number, size, and rate of revolution of the electrons in the atom. Groups of atoms from molecules, in which the constituting atoms are, do not touch, but are held together by certain physical forces. Even the molecule is too minute to be seen by the most powerful micriscope. When a portion of matters passes from a gas or liquid to a solid—termed freezing or crystalising—under conditions allowing free action to the forces governing arrangements of the atoms on the molecules, the result is a crystal; a body with a definite form, governed by its chemical composition, or in other words, by the position the atoms group themselves in mutual equilibriums, this in its turn being largely determined by the behavior of the electrons. It is also a characteristic of matter under these circumstances that like atoms attract like as long as the mass is sufficiently liquid for them to move through it, thus, if time is allowed giving considerable accumulations of the one mineral species, or, in other words, large crystals.

Therefore a crystal is not something rare and striking, but the normal condition of inorganic matter which has solidified from a gas or liquid, and all rocks so formed are an interlocking network of crystals, and each crystal is a definite mineral. Other rocks consist of minerals broken from their parent formation, and re-cemented together later. Again, other crystals of the same or different mineral may be insinuated amongst the original crystals subsequent to their formation.

Formation of Crystals.

All liquids in nature consist of a mixture of more than one element (mercury, a very rare element in nature, being an exception). Certain elements have affinities for others with which they combine in accordance with definite chemical laws and form chemical compounds, which on crystallisation give us mineral species. Different minerals melt at different temperatures (c.f., ice, lead, iron, and asbestos), and it follows that on cooling minerals will solidify at different temperatures. Again, certain liquids can dissolve certain solids, but only in definite quantities. If more than this quantity is added, if the liquid is saturated, as it is called, the amount of that solid will be deposited. An alteration in the composition of the liquid, or its temperature, will alter the saturation point (some things can be dissolved by hot water that cold water will not affect).

Now imagine a liquid made up of melted rock in which are certain elements which commonly compound into the minerals, A, B, and C, and which mixture is gradually cooling. As the temperature drops a point will be reached at which either one of the minerals freezes or the liquid becomes saturated with one of them and deposits particles of it. Probably both processes will be proceeding as to different minerals at the same time. In both cases small solid particles of this mineral will be formed in the mixture. If it remains liquid long enough these particles will grow as more of the mineral substance is added by the effect of the cooling, and will form crystals. The withdrawal of these substances will alter the composition of the liquid. This may cause the precipitation or crystallation of another mineral whose crystals will grow alongside the first. If the mass remains liquid long enough every particle will crystallise out into its proper mineral, and the whole will be an interlocked mass of crystals of different minerals. It follows that the compounds predominating in the liquid and those which solidify at the highest temperatures will crystallise out first and the other minerals will grow round the first formed crystals and in the interstices between them, also the lower levels will be richest in the mineral that first crystallises owing to the sinking of the crystals and to precipitation of the mineral. If the mixture is so compounded that in spite of different times of commencement each mineral finishes crystallising at the same time, which must be at the same instant as the disappearance of the last drop of liquid, the minerals are said to be in entectic proportions.

Crystal Forms.

As each of these crystals is growing it develops definite characteristics of structure determined by its atomic structure. The ascertainment of these characteristics gives us the indication of its mineral species. Its species depends ultimately on chemical composition, but chemical composition and atomic structure are so closely connected that it is often possible to determine composition from structure. The only cases in which structure cannot be observed is when the liquid cools so quickly that there is no time for the crystals to grow. A rock so formed is termed amorphous (without shape), and is a glass.

Given room, each mineral assumes a distinctive external form, in the shape of a definite geometrical figure bounded by planes meeting at definite angles according to the laws of solid geometry. But to grow into these distinctive shapes the crystal must have room. In the crystalline rock we pictured above the external shape would be regulated and limited by the adjoining crystals. It is only in a crack, or vein, or cavity that the minerals can develop freely. They are thus found to their best in an ore mine which is often centred round a crack in the rocks. It follows that the perfect external forms are rare, but when met with they are very distinctive and usually distinguishable by eye. Often the mineral type can be traced from its crystal form grown in a cavity back to the crystal without definite form in the surrounding solid rock.

External Shape.

Of all the forms known to solid geometry minerals in nature only adopt 32, which are classed in six systems, the isometric, tetragonal, hexagonal, orthorhombic, monoclinic, and triclinic. These six are subdivided into a total of 32 classes, many of which may combine and give a great variety of figures. For the shapes of these figures the reader must consult a text book of mineralogy, as a discussion of them is impossible except at great length and with the aid of a multitude of figures and diagrams. The determination of a mineral by its crystallographic form is often difficult and very rarely used in practice, the form having been worked out for all known minerals, and is more easily ascertained by reference to a text book than by actually working it out from the principles of crystallography.

Besides these possible forms, others are introduced by the habit possessed by crystals of certain minerals of twinning, that is, of growing together in pairs or more numerous aggregates. Many minerals adopt very characteristic twin forms by which they can be distinguished.

A. N. Lewis

Life of the Swallow

Of all the summer migrants who regularly visit our shores, perhaps none afford the lover of bird life so much pleasure as the swallow.

The arrival of the first swallow stirs the pulse of every lover of Nature, recalling as it does, perhaps, certain pleasant memories, and impresses upon us the fact that summer—or at any rate the months termed by courtesy summer—is almost upon us, while the departure of the beautiful bird warns us of the depressing fact that another winter is drawing on. It is, of course, generally known that some individuals allow their migratory impulses to lapse and remain with us right through the year, as do some of the cuckoos and other birds affected by migration; but the great bulk of the swallows go away, usually to New South Wales and Queensland, at the approach of winter.

It is not the beauty of the swallow alone that attracts our attention, but the useful and innocent life he leads. His semi-domestic habits endear him to us, for he often shares with us the house we live in, and claims the privileges of a welcome guest during his too short stay; and he is well entitled to our love and protection, for, being a purely insect feeder, the amount of good he does is incalculable.

Designed for Flight.

None of our bird visitors are more admirably and beautifully designed for long and continuous flight than the members of the swallow tribe; the expense of wing goes to show what an important part this member plays in the life of the bird. On the other hand, their comparatively small legs go to prove what a small proportion of work they are called upon to perform. For practical purposes the family may be said to consist of the swift, the swallow, the tree and fairy martins, and the wonderfully pretty black-and-white swallow of the interior of Australia. The swift, however, though very much like the swallow in appearance, is classed by naturalists as belonging to a different race.

In grace of form and beauty of plumage the common, welcome swallow excels the other members of the group, with its widely forked tail of brilliant black, with a single white spot on each feather, the lower part of the body pure white, the feathers on the forehead and under the chin rich chestnut-brown, and the upper part of the body a most beautiful black covered with a rich glossy sheen. The swallow can be distinguished from the tree martin, which is with us in great numbers during the summer, by the presence of the forked tail and the chestnut color. The tree martin, instead, possesses a square tail and a conspicuous patch of white on the rump, which is in its turn a reliable identification mark.

Curious Nesting Places.

Occasionally the swallow selects very strange nesting places, its boldness even exceeding that of the robin. A few years ago a pair of swallows took advantage of the open window of an unoccupied bedroom in a house in Launceston to begin building their nest on the curtain rod of a bed. The return of the owner of the house and his occupation of the bed did not in the least disturb or alarm the birds, which completed the nest and brought off three nestlings within seven weeks of the house-owner's return. They took no notice of the occupant of the bed when flying in and out of the window feeding their young; but the hen bird would fly off the nest if anyone entered the room in the daytime. Another very curious instance of the boldness of swallows has been recorded from Ceylon. In this case the birds built over a lamp in the dining-room. What made their choice of site more remarkable was the fact that the lamp could be raised or lowered by counter weights and the connecting chains actually passed through the mud walls of the nest.

The determination with which the swallow returns to its old nesting place is astonishing. An instance came under the writer's notice in which a pair of these birds hatched out a brood of young ones three years in succession; each year the nestlings were killed by a cat, yet the forth year the old ones returned to nest in the same place. Similarly, if a householder should destroy the nest of a pair that may have selected an inconvenient place to build, the birds, with astonishing tenacity, will try over and over again to rebuild it.

Migration of Swallows.

The swallow is for most people a proverbial migrant, and scientifically it serves as a useful type. Its almost complete absence in winter makes the fact of its migration obvious to all, and although much is known of the bird's movements, it remains true that the ordinary observer can seldom note more than its annual appearance and disappearance. One day in early spring one or two are noticed flying about, then no more will be seen for some days. Again a few appear, and the numbers gradually increase till the locality has its full complement for the summer. In the busy months that follow, two or occasionally even three broods are reared, and then the time of departure is at hand. This is heralded by much activity and excitement, and the birds congregate sometimes in immense flocks, and, together with their young, leave for the warmer northern lands. At other times they travel northwards in small bands, and as they move during the daytime as well as at night, migration may often be seen in progress. In the midlands the writer has occasionally observed large numbers passing in a northerly direction, in most cases all being bunched, and in others, strung out in a long line perhaps several miles in length. The swallow usually arrives in Southern Tasmania about July to September, and departs again somewhere about April. On the East Coast, as well as round Hobart, odd pairs may be seen all the year round.

According to Scandinavian tradition, the swallow hovered over the Cross, crying "Svala! Svala!" (Console! Console!) whence it derives its name "swallow" (the bird of consolation). Our own name for the bird is derived from the Anglo-Saxon word swalewe. Tradition still clings to the swallow, happily. It is considered lucky to have a swallow build about the house and unlucky to kill the bird—the personification of avian beauty.

M. S. R. Sharland.

A Cave of the Aborigines

Part way down the steeply sloping sides of Sisters Hills is situated a fairly large cave which is of great interest for its plain, yet unwritten history tells the observer that it was once the stronghold of some tribe of our aborigines. It must have made a splendid winter refuge for them, where, warm and dry, they could defy the fiercest of the winter's easterlies which swept along the North-West Coast. The cave is situated roughly aobut 200 feet above the sea, to which a precipitous path leads, ending in a narrow fringe of rock and pebble-strewn beach. The word beach is almost a misnomer to the tiny strip of level shore. Here the rocks run out under the sea, and between many of these dangerous reefs the sea floor is sandy. From a study of the coastline and an inspection of the innumerable small midden heaps on the flat to the rear of Sisters Beach, one concludes that the summer days were spent in the open and that when the cold weather prevailed a resort was made to the cave.

The position of this cave is so secluded that it is almost unnoticeable except for its small opening showing as a dark line breaking the face of the cleft between the two spurs of the hill. Facing the east it received the early sun, whilst the twin peaks of Sisters Hills, 900 feet high, formed a protecting wall from the cold south and also westerly winds. It almost seemed as if Nature with protective care had formed this natural retreat for her untutored children.

The opening of the cave resembles a mouth with the lips pursed to one side.

Some of the edges of the rocks are worn into the profile of a blackfellow's face—the symbol of the cave's utilitarian history.

Above its brows, the wind-beaten Giant Banksia clings—storm-twisted into grotesque shapes—appearing in age the equal of the hills. Under the banksias is now growing a tangle of heath, creek wattle, swordgrasses, hakea, with an occasional plant of the graceful-leafed wild parsley. November is the month to see the cave in a beautiful setting, when the scarlet bells of the Blandfordia add a brilliant touch of color to the many grey rocks of the hillside.

The entrance is under the shelving brows, barely three feet high, and continues downwards in a slanting direction for a few feet when it opens into a large vault-like room. As soon as the eyes become focussed to the faint daylight the arched roof, running up to 20 ft. in height can be made out. This is of earth, and in many places clumps of green moss add a tone of the outside world to the smoke-darkened walls. A shallow, perennial stream of clear, icy water issues from a hole in the far end, and running over a pebbly bed for about 14 feet, disappears flowing underground until far below, almost at beach level, it emerges into daylight.

Inside the cave a large mound of soft earth slopes upwards from the creek's edge, making a fitting resting place for weary limbs of hunters or shell-fish collectors. So sheltered from the weather is this cave that possibly it is in almost the same condition as when the last aborigine trod its floor.

At the far ends of the cave a scramble of 6 feet or so leads to a ledge of rocks, revealing a passage. With the aid of a bicycle lamp it is possible to creep along this until the floor descends, but at the same time the roof rises higher, enlarging into a second cave of smaller dimensions. This again narrows into a blind tunnel whose walls are blackened by smoke. Even to this far limit the remains of shell-fish lie in the crevices; most likely thrown there by their eater smore than ninety years ago.

This corner has an eerie feeling with an unmistakeable odor of blackfellow pervading the heavy air. Imagination can still people it with its old in habitants and fancy picture them watching with distrust or perplexity these intruders into their refuge, whilst to the ear the low ripples of the creek alomst seem to be their guttural tones as one enquires from the other the reason of this invasion by the white men.

No drawing of any kind is visible on the walls of either cavern, though several dark, reddish patches might suggest bloodstains or ochre marks.

A study of the midden heap outside though revealing nothing of the history of this vanished race, tells of the tale of their daily life, which must have been one of ceaseless toil to procure food. The heap is fifteen feet deep and in the main is composed of mutton-fish shells (Hallotus) with patella and sea snails shells intermingled with the ashes and soil blown down from the slope above.

When digging through this heap one is struck by the absence of bones, either fish, birds or animals. Then, glancing from the midden to the configuration of the surrounding country one's wonder ceases for it is certainly not a hunter's ideal.

A weary work it must have been to the lubras, the dragging up the steep ascent their burden of the heavy Haliotus shell-fish. One corner of the mound is composed entirely of periwinkle and the slightly larger sea-snail. Evidently in this spot sat the hungry-eyed piccaninny, patiently picking out the tiny fish, while at the other end, so runs this story of the midden shells, the men feasted upon solid mutton fish.

The marvel is that such an exclusively fish diet did not cause some loathsome skin disease amongst the eaters. Against this, however, must be set the incessant toil consequent on the procuring of even a limited daily supply. Thus, in her own way, does Nature balance her accounts.

Stones, hammers and chisels lie amongst the shells which once they had knocked from the rocks. Round stones, used both for crushing, and as balls by the children remain where tossed down, until disturbed by the specimen hunter.

It is truly a sad sight—this home of our departed fore-runners.

One's mind slips back to the past and there arises in it the query—who was the last inhabitant of this hill-side fortreess man, woman, or child and what became of the wanderer?

(Miss) J. A. Fletcher.

A Bush Ramble

I went a very interesting walk on a recent Saturday up Lenah Valley, and turned up a new road that has been made towards Glenorchy. I went for about a mile and a half, and found on the way the following plants of interest. Firstly there was the beautiful silver wattle (Acacia dealbater) in great profusion; the blooms were at their best. It is the bestknown of all the wattles. The prickly wattle (Acacia verticillata) is just coming out, and will soon be flowering well. The black wattle I only saw one tree of, and, of course, it is not flowering, but it will be a picture, all being well, in December. The myrtle-leaved wattle was also flowering well, also the plough-shaped leaved wattle (Acacia vomeriformis) was growing well and flowering nicely. It only grows about one foot high, and it is very pretty with the balls of flowers here and there along the stem. Acacia diffusa was also making a very fine show of flowers, all of these having been written about in a previous issue.

The wild cherry, or native cherry (Exocarpus cupressiformis) is very plentiful in that part. It has a very small flower of a cream color, which later on develops into the well-known fruit of a longish shape, with the seed at the far end, and on the outside of the fruit. This is good to eat, and when I was much younger I was able to pick enough of this fruit to make into jam. The jam thus made was very nice, though it would have been better if as much water as fruit had been used, as it was very stiff and candy-like. This kind of tree does not grow easily in the open or if transplanted, though one will often be seen in the open, through being left when clearing the land. The foliage is something like a cypress, and in color it is of a golden olive green. Another interesting plant is the Pultenaea daphnoides, with its leaves something like a shield, with the big end furthest away from the stalk, and in the centre of the large end is a sharp point. It will be flowering with a bright yellow pea-shaped flower about the end of October. It grows up to 10 feet or more under good conditions. The flowers are mostly in a dense terminal head. This plant is to be found in very many places in Tasmania. The fruit is a pod, and therefore it belongs to the family Leguminosae, as do all the Acasias. Another of the same family is the Hovea heterophylla. It has a very pretty blue pea-shaped flower, and only grows a few inches high, the leaves being up to nearly an inch long. It is flowering now, and will be found in dry, poor land. Another of the same family in flower at the present time is the Daviesia alicina, or, as it is sometimes called, native gorse, which is rather a good name, as it is covered with very sharp prickles of various lengths, and would be even harder to get through than the imported variety of gorse. The flowers are very many, small, pea-shaped, and a bright yellow. This plant grows up to three or four feet in height.

There was also the black cutting grass (Gahnia radula) in small lots. This cutting grass is only a small variety. The leaves are long and the edges are like a saw. The teeth along the edges of the leaves are very sharp, and would cut deeply into the hand if drawn carelessly along them. Another plant, or tree, is the banksia. It grows into a fair-sized tree, and has pretty sweet-scented yellow flowers, shaped like a bottle brush. It belongs to the family Proteaceae, when large enough in the tree the timber from it is very finely figured, although pieces of timber from it are never very large.

The bracken fern is also growing well, though the land is poor. Bracken fern (Pteris aquilina) grows from a root stock, which has a trailing habit under the ground, and sends up fronds every here and there. In good, rich ground this fern grows up to nine and ten feet high. In poor ground it is stunted, its wings are spread like an eagle, whence it gets its descriptive name.

Of the eucalyptus family, the Eucalyptus obliqua, or "stringy bark," known when cut into timber and seasoned as Tasmanian oak, was only growing in small trees in this district. There were also small glue gums (Eucalyptus globulas), which is so well-known everywhere; also Eucalyptus viminoliis, the white gum. This particular variety's infant, or junior leaves, especially after a tree has been cut, are of a wedge shape, and set exactly opposite on the stems; their color is a green tinged with red. These trees when grown show very pretty markings and colorings in the bark; also the Eucalyptus Amydalina, or peppermint, is growing well. Among the orchids we found Diuris sulphurea, or dragon's head. This is a very fine and beautiful orchid of a bright yellow color and brown spots. It has several flowers on a stem, and is something like a monkey-face or something like a skull. Another was a Pterostylis, one of the green helmet orchids without horns. Both of these were fairly plentiful. Goodenia ovata, sometimes called parrots' food, is to be found there also, but it is not yet in flower. It has a flower something like a pansy, and bright yellow in color, and this variety will grow up to about fifteen feet high. Dogwoods were also growing at the beginning of the walk; Pomaderris elliptica, also Pomaderris apetalo. These dogwoods will grow (when in good soil and dense forest, such as at National Park) very tall and straight, and sometimes called in various places native pear.

This walk will be found very interesting to anyone who is at all a lover of Nature, and as the spring advances towards summer, the Eucalyptus trees, with the young leaves on them, which are of a red and yellow color, are a magnificent sight. One can imagine all the colors of the rainbow when looking up at the side of one of the hills which are covered with them. The whole distance was not more than two miles from the end of the Lenah Valley tram line.

J. C. Breaden.

Milligania Lindoniana.

Long years ago in the history of this State, when the outskirts of civilisation were mainly populated by men who had left their country for their country's good, the authorities of the day thought it would be an excellent measure to form a natural detention area for really bad characters by locating them in apparently inaccessible centres in the wild West Coast. Macquarie Harbor was chosen for reasons which do not concern us at present. There were many good and able men associated with this undertaking; perhaps none more so than Dr. Milligan. This worthy doctor did much to store up knowledge of many sorts in the interest of those who should come after him. One of the excellent things which he did was to make a collection of the strange plants he came across in his rambles. He submitted his collection to experts, among whom was Sir J. Hooker. The collection contained, besides many others, some very interesting lilies, which differed from any other members of this family. Hooker, in recognition of the work done for science by Milligan, did him the posthumous honor of naming the group Milligania.

The Milliganias have a wide distribution from Cradle Mountain, Lake St. Clair, and Hartz Mountains on the east right to the coast on the west. A few years ago Mrs. Lindon, whom it would be difficult to surpass as a chrewd collector, gathered on the high slopes of Cradle and Barn Bluff ranges a Milligania Lindoniana new to botanists and which should receive the specific name accordingly. The distinction of this from the commoner form is slight, but fairly consistent; it is smaller, the indumentum on the under surface of the leaf is more closely oppressed, the perianth lobes are narrower and more acute, and the pistil is triquetrous instead of being almost spherical. It is always a matter of opinion what should be the amount of distinction to warrant a form being considered a species. As this is largely arbitrary and more a matter of convenience than a scientific fact, botanists often disagree on this point. The plant we are considering is very little removed from Milligania densiflora. but in the field its appearance is distinct, so it is convenient that it should have a name.

L. Rodway.

Robert Brown

There is no greater name associated with early scientific investigations in Australia than Robert Brown. The results of his labors were so important that since his day few have equalled, and none surpassed them. During the few years he was in Australia and Tasmania he laid the foundations for the study of botany in these counries. The rest of his long life was spent in England, and during that period he made those discoveries through which he became to be recognised as one of the first men of science this day.

Robert Brown was born at Montrose, Scotland, in December, 1773. At a very early age he demonstrated an aptitude for the observation of natural phenomena. Before he was twenty years of age he made an original contribution to the proceedings of the Natural History Society of Edinburgh. After two years at Marshischal College, Aberdeen, he went to Edinburgh to study medicine. Whilst pursuing his medical studies, Brown managed to find time to make extensive botaincal excursions into the Highlands. It was at this period of his life that he trained himself in making these extremely accurate observations, so distinctive of his researches in later life. After leaving Edinburgh in 1795, he joined a regiment in the capacity of assistant surgeon, and saw service in North Ireland. A little later Brown's researches became known to that great patron of botany, Sir Joseph Banks.

In 1801 Mathew Flinders was fitting out the Investigator for a prolonged voyage of discovery and marine survey in the little-known Australian waters. Banks had by this time found that his young protege was a botanist of outstanding ability. He therefore secured Brown the position of naturalist. His duties were not confined to an investigation of the flora, but "for the purpose of exploring the natural history (amongst other things)." Ferdinand Bauer, an Austrian, was appointed botanical draughtsman, and Peter Good, a gardener, was attached to the expedition as the keeper of plants and seeds which Brown collected. Bauer was a man possessing eminent talents and great industry. His drawings are marked for their grace and accuracy, and he did invaluable service to Brown.

The expedition sailed from England in June, 1801, and reached Australian waters early in December of the same year, arriving at Sydney on May 9, 1802, At various places along the southern coast of Australia Brown had the opportunity of landing and making collections and observations. After a voyage up the Queensland coast, Brown left the company of Flinders, who proceeded on the disastrous voyage in the Porpoise. Brown then took the opportunity of visiting Tasmania. Through a curious train of circumstances Brown witnessed the foundation of Hobart, as he accompanied Collins on the Lady Nelson, when the Port Phillip settlement was abandoned. It was also his privilege to see Bowen's settlement at Risdon and Paterson's at Port Dalrymple.

In Tasmania Brown fully displayed his characteristic energy. We can gain a very good idea of his travels and work in Tasmania from one of the few published letters he wrote to Banks about this time. It was written from Sydney, and dated December 12, 1804. After speaking of more personal matters, and the safe shipment of specimen boxes, he describes his Tasmanian visit.

"About the end of November, 1803, I left Port Jackson in the colonial tender Lady Nelson, hoping to be able to add largely to my collection in Van Diemen's Land, but not expecting to be absent more than eight or ten weeks. From various unavoidable circumstances, however, my stay was protracted to nine months, of which time a very great part was entirely lost. In this unfortunate expedition I had the opportunity of examining Kent's Islands in Bass Strait, of revisiting Port Phillip, and of examining both extremities of Van Diemen's Land, viz., Port Dalrymple and the neighborhood of the River Derwent. At this last place, to which I went on the removal of Colonel Collins's establishment from Port Phillip, I was detained nearly six months, there occurring in that time no opportunity of getting back to Por Jackson. This detention was the more unfortunate, as without such assistance as I could hardly expect in an infant colony, but little was to be done, for without having a boat at my disposal I found it impossible to get any great distance from the settlement, and its neighborhood was soon exhausted. My researches were consequently confined in great measure to the nearest chain of mountains and the rivers which descended from them. Table Mountain (x) (the plateau of the French charts) which in appearance and height greatly resembles the tableland of the Cape of Good Hope, I ascended ten times, and found it uncommonly productive, most of the new species of plants acquired in Van Diemen's Land belonging to it.

(x) Mount Wellington.

Van Diemen's Land is by no means so rich in plants, and I expected to have found it, Mt. Wellington, my florala, exclusive of cryptogramic plants, not containing more than 540 species, of which little more than 100 are nondescript, and of these I can hardly suppose that a great proportion have escaped the French in their repeated visits to this quarter."

It is apparent that Brown was far from satisfied with the results of his sojourn in Tasmania. This is not difficult to understand in view of limitations which were imposed upon him. Nevertheless we cannot but admire a man who made ten trips on to the Mount Wellington plateau in the days when the slopes were covered with dense scrub, and no track eased the climb over the ploughed fields." It is probable that he first observed the red waratah (Telopea truncata) on one of these expeditions. The list of plant forms which he was the first to describe is very lengthy, but among the well-known ones are blackwood (Acacia melanoxylon), mountain grass tree (Richea dracophylla), waxberry (Gaulthera hispida), turquoise berry (Rrymophile cyanocarha), native gorse (Daviesia ulicina), native potato (Castrodia sasamoides), duck orchid (cryptostylis longiplia) and cranbury (Astoloma humifnoa). In his position as naturalist. Brown had to extend his activities to embrace geology and zoology. the writer has so far been unable to find any record of his observations on, or collections of, rocks and minerals of this island. However, he tells Colonel Paterson (Lieut.-Governor of the settlement at Port Dalrymple) in a letter that, "Of the supposed beasts of prey of the French I have neither seen or heard anything." It is unfortunate that Bauer, the artist, did not visit Tasmania.

Brown returned to England in 1805 and at once set himself to compile his memorable work on the results of his investigations. His book, as was often the custom, was written in Latin, and bears the imposing title, Prodomous Florae Novae Hollandiae et Insulae Van Diemen. This work laid a foundation for all future investigations into Australian and Tasmanian plant life. The writer also generally made a valuable contribution to botanical science by adopting a system of classification advanced by A. L. de Jussieu.

The rest of Brown's life was spent in active research in the various departments of botany. From 1810 till 1820 he was librarian to Sir Joseph Banks. On the death of Banks he became keeper of the Banksian collection. These were removed to the British Museum some years later.

In 1827 Brown made a very important contribution to physical and chemical science. He found that by suspending the spores of a club moss in water, and then making a microscopic examination, the small particles appear to be incessantly vibrating with a slow trembling motion. This phenomena, which is known as the Brownian movement has since been observed in inorganic world. Brown received recognition worthy of his services. President of the Linnean Society, 1849-53, D.C.L., Oxon., 1832, Knight of the Prussian order. "Pour la merite," were among the orders bestowed upon him. No sketch of his life or work would be complete without some description of his inspiring personality. A person who was intimately acquainted with him says:—

"Those who knew him as a man will bear unanimous testimony to the unvarying simplicity, truthfulness, and benevolence of his character. With an appearance of shyness and reserve in the presence of strangers, he combined an open-heartedness in relation to his familiar friends, and a fund of agreeable humor, never bitter or caustic, but always appropriate to the occasion, the outpourings of which it was delightful to witness.

"But what distinguished above all other traits was the singular uprightness of his judgment, which rendered him on all difficult occasions an invaluable counsellor to those who had the privilege of seeking his advice."

In an exalted position amongst the scientists of his country, and with an international reputation, Robert Brown died in June, 1858.