are an indefinite number of positions these marked molecules (representing the portion of introduced gas) could take up in the vessel, consistent with equilibrium, and there would be (practically) an infinite number of chances against the portion of introduced gas arranging itself as in a vacuum: for to do this, the marked molecules (composing the portion of gas) would require to arrange themselves in such a way that their mean distance is everywhere the same throughout the vessel, a contingency almost infinitely unlikely. What applies to marked molecules applies to chemically different molecules of *equal* mass, or which are *dynamically* similar. Hence it would follow that portions of gas of the same kind, or portions of chemically different gases of equal molecular mass could not be said "to behave to each other as vacua," in regard to *arrangement*. On the other hand, where the gases have unequal molecular masses there is (as we have seen) a forcible dynamical tendency for the gases to diffuse themselves symmetrically through each other, so that each gas behaves to the other as a vacuum, each gas becoming uniformly diffused through the vessel, as if it existed alone in a vacuum. The successive introduction into a vessel of portions of gas of the same kind (or of portions of chemically different gases of equal molecular mass) may be compared to the introduction into any closed space of successive sets of equal differently coloured perfectly elastic balls (the balls being supposed left in free motion among each other in analogy with the molecules of a gas), when evidently no one arrangement of the different coloured balls in the closed space (at any given instant) could be said to be more probable than another, and it would be extremely unlikely that the sets of coloured balls should "behave to each other as vacua," in the sense of each set diffusing itself symmetrically through the closed space, as it would do in a vacuum. But if the sets of balls were of *unequal* masses [in analogy to gases of unequal molecular masses], then no doubt the different sets would behave to each other as vacua, or each set would forcibly tend to arrange itself according to strict dynamical principles, so as to pervade uniformly the entire closed space, precisely as it would do a vacuum.

S. TOLVER PRESTON

OBSERVATIONS ON THE PHYSICAL GEOGRAPHY AND GEOLOGY OF MADAGASCAR

ALTHOUGH Madagascar is known to be the third largest island in the world, its actual size and extent is not very generally understood. It is easy to see how misconception on this point arises, for in maps the island is usually seen only in connection with Africa, and that great continent is so large that it dwarfs by comparison with itself everything in its near neighbourhood, so that the really large island sheltering under its south-eastern side appears but an inconsiderable appendage to its vast neighbour. If, however, we take a good-sized map of Madagascar, and put by its side the outline, to the same scale, of another country with whose dimensions we are familiar, such, for instance, as England, we begin to realise how important an island it is as regards size, being nearly 1,000 miles long[1] by about 250 in average breadth, so that it is nearly four times as large as England and Wales.

During the last ten years much light has been thrown upon the physical geography of Madagascar, principally through the researches of M. Alfred Grandidier, and the numerous exploratory journeys made in various parts of the country by missionaries and others. Until a very recent period there was no reliable map of the island; a number of mountain ranges were shown in positions where no such geographical features are to be found, and the physical geography was completely misunderstood. But it is now quite clear that instead of a "central mountain chain," as described in most histories and gazetteers, there is *an elevated mountainous region*, which, however, does not occupy the centre of the island, but is more to the east and north, leaving a considerable extent of country to the west, and all beyond the 23rd parallel of south latitude, at a much lower level above the sea. Broadly speaking, therefore, Madagascar consists of two great divisions, viz., (1) an elevated interior region raised from 3,000 to 5,000 feet above the sea-level; and (2) a comparatively level country surrounding it, not much exceeding 400 or 500 feet in elevation, and most extensive in the west and south.

The elevated region is largely composed of primary and crystalline rocks. Lines of hills traverse it in all directions, but they do not rise to a very great height, the highest points in the country, the peaks of the Ankàratra group of mountains, being a little under 9,000 feet above the sea-level. A very large extent of this portion of Madagascar is covered with bright red clay, through which the granite and basaltic rocks protrude. But there are also extensive rice-plains, especially near the capital cities of the two chief provinces, where there is a rich black alluvial soil; and it can hardly be doubted that some at least of these plains, from their perfect level, out of which the red clay hills rise like islands, have formerly been the beds of extensive lakes, subsequently drained, possibly by slight changes in the level through subterranean action.

A good deal of this portion of Madagascar is bare and somewhat dreary-looking country. The long rolling moor-like hills are only covered with a coarse grass, which becomes very brown and dry towards the close of the seven months' rainless season; but the hollows and river-valleys are often filled with a luxuriant tropical vegetation, and, wherever there is population, with the bright green of the rice-fields. There is, nevertheless, an element of grandeur in the landscape, from the great extent of country visible from many points in the clear, pure atmosphere, which renders very distant objects wonderfully sharp and distinct. And many portions of the central region possess still greater claims to admiration from its picturesque mountain scenery.

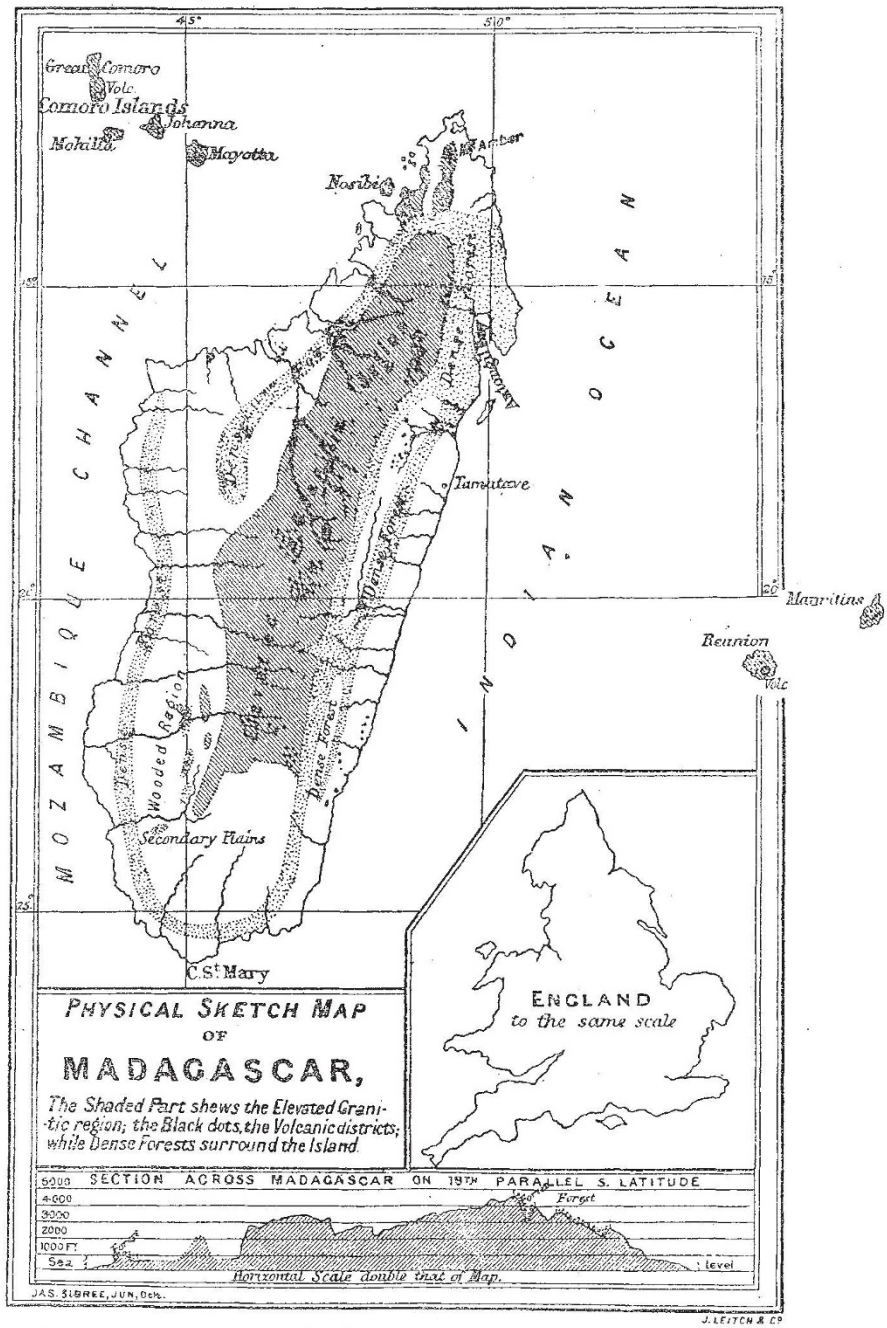
In the southern Bétsiléo country, the grand and varied forms of the mountains filled me with an exultant kind of delight. To the south was a crowd of mountain-tops, peak beyond peak, with the greatest variety of outline: one had the appearance of a colossal truncated spire, another had a jagged saw-like ridge, another was like a pyramid with successive steps, and another an enormous dome. Their summits were never long free from clouds, and many of the peaks must be at least 3,000 feet above the plain.

Sections taken by the aneroid across this elevated region from east to west at the latitude of the capital show that it has a depression in the centre, the edges on either side being considerably higher than the country between them. At some points this height of 4,000 to 5,000 feet is gained by a series of steps from the maritime plains, each range of hills rising higher and higher, while at other points it descends almost at one steep slope for nearly 3,000 feet. The water-shed is not in the centre of the island, but is much nearer the eastern side. Through the eastern wall many of the rivers cut their way by magnificent gorges, amidst dense forest, finding their way to the sea by a succession of rapids and cataracts, and occasionally by stupendous falls, as in the case of the Màtitànana river, which descends at one plunge 500 or 600 feet. Some of the western rivers, also, are said to form grand waterfalls, particularly that of the Mania, whose sound is reported to be heard at a distance of two days' journey, *i.e.*, about forty to fifty miles.

The lower region of Madagascar consists of extensive plains only a few hundred feet above the sea-level, but there are at least three prominent chains of hills traversing it from north to south, one of which appears nearly

[1] More exactly, 975 miles.

continuous in a very straight line for above 600 miles. The eastern side of the island is for the greater part of its extent without any bay or inlet, but the north-western side is deeply indented with large bays, into which the chief rivers fall. This part of the coast is bold and mountainous, and some of the finest scenery in Madagascar is to be found here, as the northern extremity of the volcanic region forms several very grand mountains, particularly the one called Amber or Ambòhitra. This is said to be about 6,000 feet high, and from its isolated position in the low country surrounding it, is a remarkably majestic hill as seen from every direction, as well as from far out to sea.[1] It has three summits, and its sides are clothed with impenetrable woods.



South-west of this mountain is a remarkable rock-fortress of the tribe inhabiting this portion of the country, who are called Antankàrana, that is, "the people of the rocks." It is an enormous, lofty, and precipitous rock, having an elevation of nearly 1,000 feet, and covering an area of about eight square miles. Its sides are so steep that they cannot be climbed unless artificial means are used, and it is thickly wooded wherever trees can possibly grow. The only entrance into the interior of the rock, which is full of caves, is by means of a subterranean passage, a portion of which is extremely narrow, allowing only a single person to pass along it at a time, and has on each side of it deep water.

The other principal group of mountains in Madagascar

[1] According to a French engineer's estimate, it considerably exceeds the above given altitude, being, so he says, 2,700 metres high.

is the great mass of elevated peaks called Ankàratra, in the central province. This has hardly the grand appearance of Mount Amber (although it considerably exceeds the latter in absolute height), since it rises from the elevated region of Imérina, which is at the capital about 4,000 feet above the sea-level. Ankàratra is nevertheless a noble group of hills, and is the most conspicuous feature of the landscape over a considerable portion of the central regions of the island. There are five or six principal summits, which vary from 8,000 to 9,000 feet in height, the most lofty one, a peak called Tsiàfajàvona ("that which the mists cannot climb"), being 8,950 feet above the sea-level, and is the highest point in the island.

Another interesting physical feature of Madagascar, which has only been made clear very recently, is the existence of an almost continuous belt of virgin forest all round the island, and generally following the coast-line. This forest-belt divides into two on the eastern side of the country, leaving a long narrow valley about 250 miles long between the two lines. The uppermost of these clothes the slopes which form the edge of the upper plateau of the island. North of this valley the two lines unite, and here is the widest portion of the forest, it being about forty miles across. The average breadth is from fifteen to twenty miles. On the north-west side the forest is not continuous, but the extremities overlap about 100 miles, leaving an opening seventy miles wide. The total length of this forest must be about 2,300 miles, and much of this is yet unexplored, so that there is doubtless still much of interest in botanical science awaiting research. Besides the forest-belt a good deal of the plain country to the west is well wooded.

A third fact of interest in the physical geography of Madagascar is the evidence of recent volcanic action throughout a great part of the country. It has been known for several years that there were signs of this on the north-west coast, and that in the island of Nòsibé and the adjacent mainland there are numerous extinct craters and much igneous rock. A few years ago the Rev. T. Campbell pointed out evident traces of volcanic agency in the district near the Ankàratra hills. He says: "It seemed as if the whole place were once a great smeltery, from the enormous number of clinkers lying about. There are altogether five mountains all near to each other, which have been active volcanoes at some remote period; each has one of its sides melted down and the inside hollowed out. The flow of lava looks as if it had been some immense reservoir bursting its banks, and the water dashing and foaming through, bearing everything away with it, or covering the plain beneath."

In a journey I took to the Lake Itàsy in 1866, I was struck with the number of truncated cones in the hills surrounding the lake. But extensive journeys made more recently in various directions have revealed the existence of a very widespread and powerful subterraneous action, probably extending almost unbroken from the south-east to the north-west and extreme north of Madagascar. There seems reason to suspect that this volcanic belt is part of a line which has its eastern extremity in the island of Réunion, where there is a volcano still showing occasional signs of activity; while the other (north-western) extremity passes through the Comoro Group (the islands of which consist of grand masses of lofty volcanic mountains), and terminates in the island of Great Comoro, where also, as in Réunion, is a still active volcano. It would seem as if the subterranean forces had expended their energy in the intermediate space, for there is no active volcano in Madagascar, while at each end of the line their presence is still occasionally felt. There are, however, signs of not altogether extinct forces in Madagascar in the slight earthquake-shocks which are felt almost every year, and in the hot springs of various kinds which occur in many parts of the country.

A large number of extinct volcanoes are found west of Lake Itàsy. These are thus described by Dr. Mullens:—"When we ascended the lofty hill overhanging the western end of the lake, crater after crater met our astonished gaze. There were forty in all, of which we were sure; we think there were others beyond to the north." "Fifty miles further south we came on the volcanoes again. We climbed a lofty rounded hill called Ivòko, and then found that we were on the crater wall. The inner hollow was a quarter of a mile wide, the height of the wall above the level country outside being 1,100 feet. Two lava streams went out towards the south and west; three small craters were at the foot, and others, large and conspicuous, were around us on every side. Close by, another huge crater, Iatsìfitra, had its opening towards the north, and the lava that had issued from it was fresh, black, and sharp, as if broken yesterday. But stranger still, at its eastern side was a plain, a mile square, covered with heaps of lava, like stone cottages, fortresses, and ruined palaces. I counted thirty greater piles, and noted numberless smaller ones; it was clear that at one time the entire plain had been on fire, that a hundred jets of fire and flame and molten lava had spurted from its surface. The heaps were now old and moss-grown, but we were informed of a vague tradition among the people that their ancestors had seen these flames bursting forth. Altogether, in that important journey, we saw and counted a hundred extinct craters, extending over an arc of ninety miles, not reckoning the central mass of Ankàratra, round one side of which that arc bends."[1]

In a journey to the south-east of Madagascar I discovered traces of volcanic action in many places; in some parts shown by the deposits of rolled pebbles of lava, and in others by the streams of lava rock running into the sea and forming reefs which were gradually being broken up by the surf. And in the very opposite part of the island, on the extreme north-west coast opposite the Minnow group of islets, Bishop Kestell-Cornish observes:—"This coast is the most distinctly volcanic that I have seen in Madagascar; at one point the lava must have run down to be quenched in the sea, and it looked as if this had taken place only last year."

In the Antsihànaka province also the same plutonic agency is distinctly visible. A great part of this region consists of an immense marshy plain, about forty miles long by twenty wide, with the lake Alaotra at its north-east corner, and surrounded by hills; and it has evidently been the seat of some powerful subterranean force by which this depression was caused. This is clear from the fact that the lines of hills which are seen on both sides the Antsihànaka plain do not run in the same direction as the main valley or depression of the country, but cut it at an angle of about 45°. Many of the ridges seem to be broken off more or less abruptly by the level ground for several miles, and then are continued on the other side of the plain. It seemed impossible to avoid the conclusion that by some great convulsion a vast rent and depression had been made across the lines of hills in a diagonal direction; while the water-worn remains of some of these toward the south, forming a line of low detached hills, suggested that the action of water, either as an arm of the sea or a great river, had completed what was commenced by more violent agencies. The evidence of former volcanic action in the presence of extinct craters and lava streams to the west, north, and north-east of the plain, gives considerable support to this supposition.

About a hundred miles north of the Antsihànaka province there seem to be further traces of the same agency. The Rev. J. A. Houlder thus describes a remarkable valley called Màndritsàra, which, until he saw it in 1876, was unknown to Europeans even by name, and not marked upon any map:—"It is a great basin, or rather a mighty elongated pit, sunk deep down among the surrounding heights. It is about thirty miles long and

[1] *Proc.* Roy. Geogr. Soc., January 25, 1875, pp. 187, 188.

nearly 2,000 feet below the level of the country east and west of it. Dante would have imagined it, not a 'circle' certainly, but a remnant of some region of the horrible pit itself, which for a wise and gracious purpose had been gently touched by the cooling breath of heaven. There had evidently been a great commotion going on there in the ages gone by; for all the long valley was dotted with rounded hills, giving it the look of boiling water or bubbling pitch, which by some strange process had suddenly become congealed."

It will therefore be seen that igneous agency has been a powerful factor in shaping the physical geography of many portions of Madagascar; in few places could that agency have been present in a grander scale than in the volcanic region of which Madagascar is the centre, and the Comoro and Mascarene groups the extreme points in either direction. An attempt has been made in the accompanying sketch-map to show the prominent features of the physical geography of the island already noted. Probably closer examination would show that the detached groups of extinct craters are all connected by intermediate links, so as to form a continuous line of igneous disturbance from the extreme northern point of Madagascar to at least as far south as the 23rd parallel; and from the appearance of a line of hills seen at a distance south of this latitude, I am strongly inclined to believe that there has been subterranean agency at work even beyond the upper granitic plateaux, but no examination has yet been made of this southernmost region.

With regard to the geology of Madagascar, but little is at present known with any exactness, for no competent geologist has yet made a systematic exploration of the country. There are, however, a few facts of a general character which have been noted by various observers, and these may be here collected together as a slight contribution to a knowledge of this subject pending a more complete and scientific treatment of it.

As already mentioned, the elevated region which forms so large a part of the central, northern, and eastern portions of the island is largely composed of primary and igneous rocks. Granite, gneiss, mica schist, and basalt are present almost all through this high region, and generally form the loftiest points in the country. In a single hill there is often a considerable variety of rock both in colour and texture: granite of various shades of grey, red, and rose-colour, with the constituent parts both fine and coarse. Veins of quartz, running both through these and the clays by which they are overlaid, are often met with, and very fine specimens of rock crystal are frequently found. A hard whitish stone, which has some resemblance to the Yorkshire stone called Bramley Fall, is used in Antanànarìvo for public buildings, as well as for the native tombs.

The lower hills, as well as the high moors, are usually composed of a bright red clay, but below the surface this often seems to pass into a light pink or white earth resembling kaolin or china clay. This frequent change of colour would lead one to infer that atmospheric influences have something to do with the difference between the surface clay and that exposed in the numerous precipitous clefts which the rains excavate on the hill-sides. In many places the material found amongst the rock seems exactly like granite in its constituent parts, but without the cementing elements, so that it can be cut quite easily by a spade. The red clay is sometimes varied by a light brown clay on the hills, while the plains and valleys are filled with rich alluvial clays, blue and black in colour. In all these clays there is an apparently total absence of all organic remains, either animal or vegetable, so that it is not an easy task to determine their geological age, and there is little sign of stratification, although I have detected some appearance of this in the rocks, with tilting of the strata.

In this elevated region there seem to be few, if any, sedimentary rocks of a more recent age than the primary ones which are so prominent a feature of it. A soft dark red stone is found in some places, but this appears to be only a hardened clay. Columnar basalt has been noticed in two or three places, as well as extensive beds of volcanic ash, decomposed lava, scoria, and lava rock of all varieties of hardness, in some of which crystals of olivine are found in abundance.

At one point, however, in the upper region of the island a limestone deposit occurs. This is at Sìrabé, to the south-west of the Ankàratra mountains, and from the pits dug here most of the lime used for building in the central province is procured. It has not yet been examined by any one with competent scientific knowledge, but it appears to be a sulphate of lime, and is probably only a local deposit and not a stratified rock, and most likely is connected with the subterranean action so visible all around the district.

Clay slate is met with in the southern part of this elevated region; and in the Bétsiléo country a valuable slate, suitable both for building and for writing upon, is found, although it has not yet been worked to any extent. According to some accounts, greywacke or whinstone, silex, and chert with chalcedony, are also met with in the southern highlands.

From certain of the facts above given, as well as from other considerations, it appears highly probable that the extensive elevated region of Madagascar is very ancient land, and has most likely remained for many ages above the waters of the Indian Ocean; otherwise, some trace of marine deposits would surely be found in some portion of this great extent of country. I may, however, here note the fact that there are in some places such rounded boulder-like masses of blue basalt rock, sometimes on the surface and sometimes partially embedded in the soil, that did these occur in the temperate zone, one would certainly ascribe them to glacial action; but the point requires fuller investigation, and possibly some other solution may be given to the rather puzzling inquiry suggested. But in travelling to the north-west coast, as we got near the sea-level, we met with boulders composed of rock which certainly is not found *in situ* anywhere near the spot where these boulders occur, but has come from far away in the interior.

With regard to the lower region of Madagascar—the extensive plains to the west and south of the island, as well as the narrower extent of country on the east coast—we have a little more definite information as to the geology of some portions of it. This division of the country is only as many *hundreds* of feet above the sea as the granitic region is *thousands* of feet; and there we find not only deposits of the later Tertiary epochs, containing fossils of animals but recently extinct, but also fossils of the Secondary age. This fact was first pointed out by M. Grandidier, who, in speaking of the south and west portions of the country, says: "*Nerinea* and other characteristic fossils of the Jurassic formation which I have there collected prove the existence of Secondary strata, which cover a vast extent of this island" (*Bull. de la Soc. de Géog.*, août, 1871, p. 88). In a later number of the same publication (avril, 1872) he also speaks of an extensive "terrain nummulitique parfaitement charactérisé par des *Neritina schmideliana*, et pétri de foraminifères appartenant aux genres *Alveolina*, *Orbitoïdes*, *Triloculina*, &c." This is confirmed by the fossils discovered in the south-west of Madagascar, in the upper part of the valley of the St. Augustine river, by the Rev. J. Richardson in 1877. These occur in vast numbers, and from a drawing he gives appear to belong to the Neocomian formation, and are species of the genera *Ammonites*, *Terebratula*, *Nerinea* or *Turritella*, *Einoceramus*, and *Rhynconella*, together with an *Echinoderm*.

It is evident also that there are deposits of a much later date than the above, for in the south-west of Mada-

gascar M. Grandidier discovered the fossil remains of a hippopotamus (a pachyderm not now living in the island), of gigantic tortoises (which are now only found in the little island of Aldebra to the north of Madagascar), and of the probably very recently extinct struthious bird, the *Æpyornis maximus*, whose egg ($12\frac{1}{4}$in. $\times 9\frac{1}{4}$in.) so far exceeds that of any other known bird. It seems highly probable, therefore, that a systematic examination of these less elevated portions of Madagascar would reveal the existence of much that is interesting both in palæontology and geology, and so light would be thrown upon many problems connected with the anomalous animal life of the country and of the neighbouring islands in the Indian Ocean. It is evident that these maritime plains were under water during portions at least of the Secondary period, at which epoch the high granitic region alone formed the Island of Madagascar, then a country probably only a third of its present extent.

Dr. Auguste Vinson speaks of seeing yellow sandstone on the eastern coast, and he also describes the plain between the two eastern lines of forest as being composed of beds of sedimentary formations, "rich in fossil remains." Unfortunately he gives no particulars as to these alleged extinct organisms, so we are still in the dark as to the geological age of these formations. In sailing down the river Bétsibòka to the north-west coast, I noticed at one point that for a considerable distance the river bank was formed by layers of yellowish sandstone closely resembling a low wall of masonry. Some of the courses appeared much weathered, while others had a smooth face as if of much harder materials.

From the account given by an intelligent native of some rocks in the western part of Madagascar, and a little to the south of the centre, a conglomerate seems to be found there, for he describes hard rocks of great size as being filled as thickly as possible with rolled pebbles of all dimensions and shapes. He also mentions that near the sea he found a hard black stone which rang like iron, and was full of shells in good preservation and appearance. Unfortunately he too brought no specimens for examination.

A little more information as to the geology of Madagascar is found in papers contributed to scientific periodicals in England and France several years ago. The earliest of these is by the late Dr. Buckland, who, in a "Notice on the Geological Structure of a Part of the Island of Madagascar"[1] (Port Louquez, near the northern extremity), describes a sandstone without fossils, which he compares to the New Red Sandstone, and in which are intercalated trap-rocks similar to those of Antrim in Ireland.

As to the north-west side of Madagascar, in the *Annales des Mines* (1854, 5me série, t. vi. pp. 570-576) there is a paper on the discovery of beds of lignite both in the island of Nòsibé and at two points on the north-west coast. In the opinion of the officers who made the exploration the beds of this combustible are more ancient than the Tertiary formation. It is contained in layers of sandstone and clay schists, is fibrous, and shining, and burns readily with a long and white flame, leaving little ash. If beds of this lignite should be discovered in greater thickness it will therefore be valuable both as steam coal and for use in the industrial arts.

In the same French publication of a little later date (5me série, t. viii., 1856) there is an "Essai sur la Géologie de Nòsibé," in which the soil of that island is described as consisting of three different groups of strata:—(1) granitic rock, gneiss, mica-schist, slaty-schist, and plastic clay; (2) red and yellow sandstones, traversed by veins of gneiss and quartz; while (3) is essentially volcanic, consisting of basaltic and trap lavas, overlaid in some places by beds of sandy material, tuffs, and volcanic *rappilis*. The essay is accompanied by a complete geological map.

[1] *Trans.* Geol. Soc. London, vol. v. p. 478.

Since the date of this last paper some further attention has been paid to this part of the country in connection with the French Company proposed by M. Lambert,[1] but hardly anything more has been done towards a scientific examination of other portions of Madagascar except a slight notice of the peninsula inclosing Antongil Bay,[2] although probably M. Grandidier will have some fresh information in his great work now in progress.

It may be here observed that a reef barrier of coral extends for at least 350 miles along the east coast, varying in its distance from the land from a quarter of a mile to three or four miles; while fringing reefs surround the northern end of the island, extending for 400 miles down its eastern side, and are also found on the south-west coast.

With regard to minerals, Madagascar is tolerably rich in some of the most useful metals. Iron is found in great abundance in Imérina, sometimes almost in a pure state. In some of the hills it is so plentiful that it is difficult to get a bearing with the compass, from the deflection caused by the iron in the ground. Copper, lead, and silver have also been discovered, and from the geological structure of the country it is highly probable that gold would be found in some of the ravines of the granitic highlands; but as it is at present a serious offence against the native laws to search for the precious metals, hardly anything has been done in this direction. Rock-salt is found near the coast, and nitre is also met with. Iron pyrites, from which sulphur is extracted, is also found in abundance; in the northern part of the island antimony seems to be plentiful, and oxide of manganese has been found about fifty miles south of the capital. A substance resembling plumbago exists in great abundance, and is used by the Malagasy to colour and glaze some of their articles of pottery. A considerable variety of ochres and coloured earths are met with, and are used not only for colouring the native houses, but also in dyeing some of the woven cloths made by the people.

In conclusion, it may be remarked that there is a vast extent of country on the coast-plains where the soil is most fertile, but which is only thinly peopled, or has no population at all. Many parts of the island which separate the territory of one tribe from another are well watered and wooded, and seem to invite occupation. Madagascar could well sustain a population from ten to twenty times its present amount, for hardly any portion of it is rainless or desert, except a small section of the extreme south-western coast. Surrounded by the ocean it enjoys an abundant rainfall, so that the droughts which constantly afflict large portions of Southern Africa never occur in Madagascar, while its insular position gives it a more equable climate, freer from extremes of temperature, than is enjoyed in most tropical countries.

JAMES SIBREE, Jun.

NOTES

THE first zoological station established in Scotland was opened the other day at Cowie, near Stonehaven. The work, which is more directly in connection with the natural history class of the Aberdeen University, will be carried on in a small wooden house which was erected in the beginning of last week on flat ground, a few yards to the north of Cowie, and close to the sea-shore. The building was constructed in sections, special provision being made for ventilation. It consists of two apartments, the lesser of which is to be fitted up as a library and office, while the main room will be devoted to reception of the proceeds of the dredging, trawling, and other expeditions. The latter department contains the dredging and trawling apparatus, a number of microscopes, with chemical and other appliances

[1] See *Annales des Mines*, 6me série, t. x. pp. 277-319.
[2] *Bull. de la Soc. de Géog.*, Sept. et Oct., 1867.