DIAMOND DIGGING IN SOUTH AFRICA.

By James Andrew.

Mr. President, — I feel that some apology is necessary for introducing a subject quite foreign to Tasmania, and which I am unable to treat scientifically, but, as few people, except those who have visited the diamond fields of South Africa, can accurately appreciate the most important part the digging industry has played in promoting the welfare of the country, a brief but very imperfect sketch of the mines, and of the method of working them, may prove of interest. Diamonds may yet attract much attention in Australasia as they have been found in four of the five continental colonies and also in New Zealand, and they are now being systematically sought for with profit to the diggers in the northern part of New South Wales. I may add that my paper has been prepared, not from notes as a casual visitor to the fields, but from the experiences of more than two years as a digger and prospector, and as an official intimately connected with diamond mining as there carried out.

That portion of the British possessions in South Africa, generally known as the "Diamond Fields," or Griqualand West, was, at the time of the first discovery there of precious stones, under the rival jurisdiction of two native chiefs, Adam Kok and Nicholas Waterboer, the latter of whom received recognition of his claims to the sovereignty of the territory in the shape of a pension from the Imperial Government, awarded as compensation for the annexation of his country. An additional claim was, however, made by the adjoining republic of the Orange Free State to the area enclosed between their existing western boundary and the Orange and Vaal rivers, on the latter of which, and in its immediate neighbourhood, the first diamond diggings were established. During the stirring times following the discoveries of 1870, the Free State Government exercised such authority as they were able over the various mining camps on the Vaal ; attempts which were treated with derision by the hardy and independent diggers. Soon the impossibility of the territory being properly governed by such means, and the absurdity of the Chief Watertoer's efforts in a similar direction over the area claimed by him, led to the hoisting of the British flag in the year 1871, and the proclamation of the Imperial Province of Griqualand West.

For some years the Government of the Free State ventilated their grievances in being thus deprived of a valuable piece of country, and the justice of the claim was admitted, as the sum of £90,000 was awarded by Her Majesty's Government as indemnity, and concessions were arranged as to the direction of certain railways then proposed for construction in the Cape Colony, and since

completed, with which it was desired to ultimately connect projected Free State lines.

From 1871 to 1880 Griqualand West remained under Imperial control, and in October of the last-named year the Province was annexed to the Cape colony, a measure which met with much opposition from most of the influential residents on the Fields. The area of the Province is 17,800 square miles, and the population is estimated at about 50,000.

The first diamonds found in South Africa were in alluvial ground on the banks of the Vaal River, and the principal rush of the early days was at Pneil, a mission station of the Berlin Missionary Society. A large population rapidly accumulated at this point, and at various diggings or "rushes" along the course of the river, both above and below the station, for a distance of 70 or 80 miles. Good Hope, Bad Hope, Gong Gong, Waldek's Plant, Cawood's Hope, Niekerk's Rush, and Blue Jacket, Esterhiuzen, Longlands, Delport's Hope, Hebron, etc., all supported a considerable number of diggers, 4,000 claims, each 30ft. square, being at one time worked at Cawood's. As the necessary appliances were comparatively inexpensive, the right and means to search for diamonds were within the reach of almost everyone. At the present time a river digger's outfit usually consists of a few very simple appliances. A "baby," an oblong sieve about 6ft. by 3ft., of very fine mesh, so arranged in a stout frame as to oscillate freely, and inclined to allow the gravel to roll down it, is a necessity. At the upper end of this "baby" is fixed a small sieve coarse enough to pass pebbles of ½in., into which the ground is fed by hand, whilst the worker swings the apparatus backward and forward, and thus removes all sand and separates the larger stones, which are glanced over before being thrown on the *debris* heap in the hope of making a big find. "Babying" is a most noisy and very dusty process.

Many diggers still use the cradle, almost identical with that used in primitive gold mining districts, but after the introduction of the gravitating process, it was generally dispensed with. Some large tubs are required, and, of course, picks, shovels, crowbars, etc., and a mule or bullock cart for the conveyance of water to the claims or of diamondiferous ground to the river, as might be more desirable. Steam machinery has for some years been used for treating alluvial ground in the search for diamonds, but the principle of sieving, sizing, and washing is practically the same as in the process by hand. It was by means of steam power that I carried on the digging operations in which I was interested during my residence on the Vaal River. The gravitating process is of comparatively recent introduction, old style digging providing for no treatment between the "baby" or the "cradle" and the sorting table, much to the advantage of the more experienced men of the present time who work over the *debris* with advantage.

Gravitation consists of the manipulation of the gravel in hand sieves. About two shovelfuls are treated at once, the sieve being worked with a circular and vertical motion in a tub of very dirty water, clean water for some unexplained reason not being suitable. The gravel is kept "alive" during the process, and this has the effect of depositing all the heaviest particles at the bottom, and

in the centre of the sieve, which is of very fine mesh. It is usual for the operator to place one or two small diamonds in each sieveful of gravel as test stones. An iron table is used for sorting purposes, and on to this the contents of the sieve are capsized with a practised swing, which does not disturb the relative position of the pebbles. All diamonds, including, of course, the test stones, should now be exposed on the surface, and in the centre of the mould of gravel, any failure in this respect requiring the operation to be repeated. The whole of the contents of the sieve are, however, sorted over, a scraper of hoop or sheet iron being used for the purpose, but it is seldom that all the diamonds are found in this first sorting. The process is almost invariably repeated, often twice. The man gravitating, after being at work for some time, may lose the peculiar knack requisite for the success of the operation; the test stones are missed, and a rest is necessary, or a fresh hand is obtained before the work can be continued.

In the year 1871 diamonds were found some 25 miles distant from the river, near a shallow pool of water or "vley," known as Dutoit's Pan, and from the early method of dry sorting the ground at this, and the other mines subsequently discovered these, the largest diamond mines in the world, received the name of the "Dry Diggings." Dry in those early days of their history they must assuredly have been. Clouds of dust from innumerable "babies" rose in the air to a great height, and involved everything in dim obscurity. Dust and heat, plagues of flies, and the much dreaded camp fever, scarce and bad water, short supplies of provisions were discomforts and drawbacks the early diggers in this new field had to endure in their search for wealth, but the evidences of reward for the energetic soon brought a large population together, and with population, more substantial dwellings, better supplies of food, etc., soon improved the condition of affairs. The largest and most productive of the four Griqualand mines, Kimberley, or Colesberg Kopje, sometimes even at the present day known as the New Rush, was accidentally discovered when negotiations for the purchase of a farm called "Voornitzigt," upon which diamonds had been found on the site of the present De Beer's mine were in progress. The owner of this property, a Dutchman named De Beer, received £6,000 for his land, some 6,000 acres, but the purchasers, Messrs. Dunnell, Ebden and Co., a Port Elizabeth firm of merchants, a few years later came into collision with the diggers over the collection of claim licenses, and found it prudent to dispose of their property to the Government for £100,000. As, up to the end of 1885, the yield of diamonds from this mine alone had exceeded 17,500,000 carats, equal to three and a half tons weight of these precious stones, in value about £20,000,000, the State cannot be considered to have made an unsatisfactory purchase. The other large Griqualand dry mines are De Beer's, situated about a mile from Kimberley, and Dutoitspan and Bultfontein, about two miles beyond, thus a circle of three and a half miles in diameter would enclose the group. The two last-named mines are of great extent, but the average value of claims is very much below that of Kimberley. Calculations show that, from the known average yield of the ground in each mine, it may fairly be estimated that 10 tons of diamonds have been raised since they were discovered, of value certainly not less than £45,000,000 to £50,000,000. There

is also a dry mine in the Orange Free State at Jagersfontein, which has maintained a small yield for many years, and many other localities have attracted some attention for a time, but without much profit to those working at them.

Diamonds in the early days of the dry diggings were found in what was known as "yellow ground," all of which was removed years ago, and with the characteristics of which I had no opportunity of becoming personally acquainted. Claims of 31ft. square (30ft. Dutch measure), were sub-divided into sections of even so small an area as an eighth, and were worked under this multiplied ownership, much to the advantage of the mining community. At this time the Diamond Fields probably supported a larger population than at any other period, the number of natives employed in the Kimberly mine alone being over 12,000.

The system of working was almost similar to that in vogue on the river, but necessarily performed without water. The ground was sorted on the very brink of the mines, and the *debris* accumulated there in great mounds; afterwards worked again under more careful management to considerable profit. At a depth of some 80ft. to 100ft. a change in the character of the ground led to the belief that the mines would soon be exhausted, some of the claimholders who had sunk deeper than their neighbours having "bottomed" on hard rock. It was ascertained, however, that this rock, or "blue ground" (the name by which it is locally known is "blue") when exposed to the air and moistened at intervals by rain or artificially, decomposed in a similar manner to the more friable yellow ground, and the *debris*, when sorted, was found to contain diamonds. This was the commencement of the most prosperous mining days of the province. Improved appliances were invented for treating the ground after disintegration, powerful steam engines were erected to pump the water out of the mine, and haul the rock as blasted and picked out to the surface, and the industry, owing to the excessive cost of machinery and the high price of skilled labour, soon became too extensive for any but the wealthiest private claimholders to cope with, and amalgamation of many proprietary rights led to the formation of companies, and a systematic method of working and management by which the resources of Griqualand, in this direction, were fully developed. The surface of the country in the neighbourhood of Kimberley is covered with a red sandy soil seldom more than a few inches in depth. Beneath this there is a thin layer of superficial limestone, and then occurs what is known as the upper reef—a yellow shale extending to a depth of 35ft. to 40ft. This is succeeded by a black carbonaceous shale of from 250ft. to 280ft., under which is found unstratified basaltic rock which encircles the whole mine. At De Beers the basalt appears in a layer of about 75ft. in thickness on top of the black shale, and as the latter, where exposed to the action of the weather, decomposes very rapidly the overhanging hard rock, until cut back from the margin, is a continual source of danger to those working in the mine.

Dr. Shaw, of Colesberg, an eminent geologist, has stated that Syenite may be considered the basis of the rocks in the diamond fields district, granite only occurring in isolated boulders, and minus the micaceous portion of the compound. He also states that there is no evidence to show what may be looked upon as the true matrix

of the diamond, but considers the production of these precious stones is not due to any rock more recent than greenstone. Elaborate analyses have been made of the "blue" ground which has proved of such wonderful value, but its precise nature still seems doubtful. It is described as a hydrous magnesian conglomerate with silica as a base. Thin veins of calc spar are of frequent occurrence, and vaalite, mica, iron pyrites, and hornblende are found disseminated through the diamond bearing rock, besides fragments and masses of shale, sandstone, and boulders of dolerite. The generally accepted theory is that the "blue" has filled the crater or funnel of an extinct volcano, which now forms the mine, and that it has been upheaved from a vast depth, the diamonds themselves being of earlier date than the upheaval. Coal has been found in the immediate neighbourhood of the Kimberley mine, and remains of plants and of extinct reptiles are frequently to be met with in the deposits of shale.

The area of the mine originally enclosed within the surrounding rock was about 11 acres, but as this reef has been removed, a course necessitated by the increased depth of the workings, the surface area has been extended to about 30 acres. The greatest depth to which the surface working of the mine has extended is 450ft., but underground excavation has had to be resorted to, owing to the continual slipping of the loose slate or reef. In the year 1883, the whole of the diamondiferous ground was covered in this manner to a depth, in parts, of over 100ft., and it was estimated that the cost of clearing the mine would be, at least, £2,000,000. Up to this time, over £1,500,000 had been spent in connection with this difficulty, and several successive contractors had failed in their efforts to cope with it, and as now the Banks refused further assistance to the Mining Board, it was predicted that the mine was ruined. The result was a crisis on the fields, which coupled with a great fall in the price of diamonds, was most disastrous for speculators.

Two methods of underground mining have been adopted, in one case shafts are sunk from the surface, at some distance from the margin of the mine, and tunnels driven through the hard basaltic rock, which is found at a depth of 250ft. to 300ft., into the "blue ground." The "Jones' system" as the alternative method is called, after its inventor, is to sink shafts on the coffer dam principle through the loose reef to the "blue," after which they could easily be extended and the ground excavated. This system, however, seems to have had but a brief period of success, as continual reef movements wreck the shafts, and destroy all means of access to the valuable solid rock. It may be surmised then that the prestige of Kimberley as the most wealthy diamond mine in the world is, for a time at least, eclipsed, as the yield from De Beers has exceeded the amount there raised for the last three or four years. In the days of its greatest prosperity the Kimberley mine contained 420 claims, each of 31ft. square, and 600,000 loads of blue ground were annually raised to the surface and put through the washing machinery; a load being equal to 16 cubic feet. The value of the mine was estimated at £5,000,000. It is difficult for anyone who has not had an opportunity of seeing this wonderful excavation to form an idea of the immense amount of work which has been done in a few years' time. As its name of Colesberg

Kopje implies the locality was originally a hill, and from its site 20,000,000 of tons of diamondiferous ground and the surrounding rock have been removed. Work of almost similar magnitude has been simultaneously carried on at the three other mines, each but little inferior in depth to Kimberley, and two of considerably greater area.

The "blue ground," composed of pebbles and stones of various kinds cemented together by a silicate of alumina or lime, is of varying degrees of hardness in the several mines, and frequently varies very much in quality in different sections of the same mine. It has first to be loosened by blasting, and then, after being broken with large hammers and heavy picks into pieces which can be handled, it is hauled to the surface for future treatment.

The hauling gear is of most ingenious construction. A complete plant, consisting of a double ærial tramway, each division or line being constructed of two stout wire cables on which travels a frame or four-wheeled carriage, bearing a large iron tub, slung on trunnions, of a capacity of about 30 cubic feet. As the sides of the mine are inclined at varying angles, and the tramway may for some distance be either nearly perpendicular or nearly horizontal, the slinging system is a necessity.

From the large hopper receptacles, into which the "blue" is received on the surface, trucks are filled and run on lines of railway or trams to the outskirts of the camp. There being spread over the surface of the ground, exposed to the disintegrating action of light and weather, the "blue" remains until fit for treatment in the washing machinery, the time varying from some two or three weeks, under favourable circumstances, to so long as three months.

The depositing floors are of great extent, a single company often having 5,000 or 6,000 loads under treatment, and land for this purpose was difficult to obtain within a reasonable distance of the mine.

Large lumps of "blue" are frequently broken up with hammers. I believe steam stone crushers have even been used for the purpose, and rollers, clod crushers, and harrows, etc., intended for agricultural pursuits, have been brought into requisition for pulverising the ground. The boundaries of the floors are marked by beacons and by walls built up with refractory lumps of "blue" used with the dual object of vacating valuable floor room and facilitating the desired result by increased exposure. Careful watch has to be kept over the natives employed in spreading and loading the ground on these floors, as many of the finest diamonds are frequently found there, as well as in the primary operations of blasting and picking in the mines. Lumps always separate more readily at the spot where a large stone is embedded than elsewhere. One white man is usually placed in charge of from every five to ten natives, with the sole duty of keeping watch against theft. The fine gravel which results from this disintegration of the "blue" is next treated in circular rotary washing machines, to which it is fed through revolving cylindrical screens of graduated mesh, so as to remove any remaining lumps. Several arms fitted with knives or scrapers rotate in the washing machine, and stir up the diamondiferous ground mixed with water, which enters through an opening in the outer edge of the machine. The lighter stuff comes to the surface, and floats away through an aperture in the inner rim, and the heavier gravel falls to the bottom of the pan. The inner cir-

cumference of the pan is usually about 12ft., and the outer about 45ft. The mud, or "tailings," escaping through the centre is raised by elevators, the water coming into use over and over again, and the more solid portion going to waste. When the machine is stopped the residuum is either washed in a "cradle," or treated in a pulsator, a machine constructed to perform the process of gravitation previously described. The final sorting is identical with the method followed on the river diggings, but the stones remaining in the larger meshed sieves of the cradle or pulsator are merely glanced over, as a sorter, however inexperienced, would hardly fail to notice a diamond of such size as they would retain. The resulting *debris* is generally sold by the proprietors to private individuals, and is again carefully gone through by women and children, who are often amply rewarded for their trouble by the small stones which have been missed on the sorting table. After rain diamonds are occasionally found in the streets or in paths which have been repaired with material of this nature. A complete plant for raising and washing diamondiferous ground cannot be put up for less than £25,000.

Diamonds in the rough as found in the Griqualand mines are generally perfectly bright and clear, free from any coating of silica, such as I believe sometimes encrusts stones found in other countries. They are more varied in quality, colour, and form than is generally supposed. A white stone of 10 carats weight (151½ carats=1oz), or upwards, of perfect purity, free from speck or flaw of any description is by no means common; such stones have, or had, up to the time my acquaintance with the diamond market ceased, suffered no depreciation in value, whilst those of an inferior quality, had within some twelve months, fallen 50 per cent., and as inferior and small stones are what a digger used to depend upon to pay his working expenses, the great and universal depression on the fields in the year 1883 was chiefly due to this quite unexpected fall. Spots in diamonds are of very frequent occurrence, and it is by no means an easy matter to decide as to the amount of depreciation in value they occasion. The stone may be split or the spot cut out, so as to leave the diamond as perfect and of the same size it would have been when cut had no such blemish existed; under other circumstances it may be comparatively valueless. Buyers are naturally averse to admit that a spot may be anything but a serious defect in a stone. At the river diggings water-worn diamonds resembling ground glass in appearance are common, and are frequently difficult to distinguish from other pebbles. For many months I carried about a stone of this description of the size and shape of a small marble, and saved only on acount of its peculiar form, which ultimately proved to be a diamond although of inferior quality. The majority of stones found are in the form of an octahedron, and of modifications of that shape. Many have all the angles almost as sharp and well defined as in cut stones. Some bear peculiar triangular marks on their facets as if they had been built up in layers. Macles or flat triangular stones are also common, but are of little commercial value, and curious combinations of maces are occasionally met with, but they are only interesting as specimens. I have heard of the discovery of one hollow diamond, but do not recollect its size, and Mr. Streeter, in his work on precious stones, mentions a white diamond in which is enclosed a small yellow stone.

Colour, or rather absence of colour, is almost of more importance in determining the value of these precious stones than freedom from specs or flaws. Yellow is the commonest tint, and it is a general, but very mistaken belief, that all Cape diamonds are more or less tinged with this colour. Yellow stones are frequently of great brilliancy and fire, and by some are admired more than the purer gems. They are found of all shades from a pale straw colour to deep orange. The Dutoitspan mine is remarkable for its yield of large yellow stones. Brown and grey diamonds are often of great beauty, and in purer coloured stones the various tints are known as "Cape white," "bye water," "off colour," etc. Blue, green and pink tinted diamonds are not uncommon, but are seldom looked upon with any great amount of favour unless of exceptional quality and brilliancy, and depth of tint, when their rarity and beauty warrant a specially enhanced price being asked. Such a stone was in the possession of a Dutch canteen keeper on the Vaal River, and it was one I had many opportunities of examining. The colour was a tawny orange red or flame colour, quite distinct from the ruby tint of ordinary red diamonds. When cut it weighed about two carats, and the fortunate owner stated he had refused £600 for it, an instance of an exceptional estimated value, as a pure white diamond of equal size would not be worth more than a twentieth of that sum. Some of the diamonds found in the Dry Diggings develop strange and very disappointing peculiarities. A stone when first found may be remarkable for its fire and great brilliancy. After a few hours' exposure to air and light a faint flaw appears, this gradually spreads and radiates, until, perhaps by the following morning, the diamond may be found burst into a hundred fragments. A suspected stone is often parted with at a very low rate, resold almost immediately, if an unsuspicious buyer can be found, who may shortly find himself the possessor of unsaleable chips. Various expedients have been recommended as precautions against this unprofitable dissolution, and it seems generally accepted that protection for some time from air and brilliant light is necessary. Immersion in honey, treacle, or grease is supposed to have a beneficial effect. Fortunately these stones are not common.

Boart is a term locally descriptive of comparatively valueless stones or fragments of black, brown, or grey diamondiferous substance irregularly massed in one specimen ; 2s. 6d. per carat was the ruling rate for "stuff" of this nature on the fields, and it is principally used, ground into powder, for polishing valuable stones.

Many diamonds of note have been raised from the Griqualand mines. The largest of which there is any authentic record is one of 457 carats ; rumours of the discovery of this gem were current in the fields more than four years ago, but accurate accounts were not to be then obtained, as the stone was an "illicit" or stolen one and the receiver was serving a sentence for other irregularities in connection with the contraband purchase of diamonds. It was afterwards bought by a syndicate of diamond merchants, and they estimated it would cut, as a brilliant, to about 220 carats, or in another form to about 300 carats. In size, colour, and purity it was expected to prove the most marvellous stone ever known, and I believe this was the diamond it was proposed to present to Her Majesty in commemoration of her jubilee. Three celebrated stones,

the Koh-i-nur, Regent of France, and Orloff diamonds, weigh respectively 106, 136, and 195 carats. There are many of much greater weight, but they are badly cut, blemished, or off colour stones of relatively small value.

Another South African gem of some notoriety is the "Porter Rhodes" diamond. This is a stone of 150 carats weight, of great purity. It was found in the Kimberley mine in 1880, and even in that land of diamonds, over £500 was paid by spectators admitted to see it before it left the fields. Mr. Rhodes refused an offer of £60,000 for his find, but subsequently discovered the difficulty of disposing of so large a stone. He had been a digger for only a very limited time, and his fortune was made in a claim which had been long unremunerative.

The first really valuable diamond from the Cape was the Star of South Africa, which, when found, was 83½ carats, and now weighs 46½ carats, and is valued at £25,000. It is in the possession of the Countess of Dudley. The "Stewart" is another large stone of great beauty. It is of a faint yellow tint, and weighed uncut 288½ carats, or nearly 2oz. The "Schreiner," 308 carats, still remains uncut, and its value unascertained.

It is almost impossible for anyone who has been absent for a length of time from the fields to attempt to give an accurate idea of the price of diamonds of any particular size, except in the case of such small "stuff" as is quoted in the market reports. Averages alone can give an impression of the rates ruling the diamond market. The yield of the Kimberley mine for three years, amounting to 2,500,000 carats, brought 19s. 3d. per carat, whilst during the same period the average price of De Beer's stones was 20s. 6d., and those from Dutoitspan brought 27s. 9d. per carat. The diamonds imported into Kimberley, being principally the finds from Jagersfontein, in the Free State, and parcels returned for sale, brought the highest price of all, viz., 32s., and the grand average was 23s. 2d. per carat for 8,000,000 carats. There is a most disproportionate and arbitrary increase of value in large stones, and they are often most difficult to dispose of. The buyers describe them as speculative, and as they frequently combine to refuse the probably moderate sum asked by the vendor, it is not unusual for such diamonds to be sent to Europe or to India for sale. Of my own finds, the highest price I obtained was for a wonderfully pure, well-shaped stone of 3 carats, viz., £10 per carat, the largest stone was 39 carats, evidently a chip from one of, at least 200 carats, this realised £254, and if free from blemish would have brought 20 times that price.

No ex-resident of Griqualand can consider any description of diamond mining industry complete without, at any rate, brief mention of the chief drawback to the profitable carrying on of the work, under which all suffer alike. The theft and illegal sale of diamonds has had at times almost a paralysing effect on digging, for, previous to the introduction of the system of searching all—natives and even white men—when leaving the mines, it was estimated that 50 per cent. of the total yield of the province was stolen, and disposed of to illicit diamond buyers (I.D.B's.), and even now, in spite of the strictest precautions the detective returns speak of the usual 25 per cent. to be added to the estimated yield for the diamonds illicitly sold.