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DEPARTMENT OF MINES

GEOLOGICAL SURVEY OF QUEENSLAND
(A. K. Denmead, M.Sc., Chief Government Geologist)

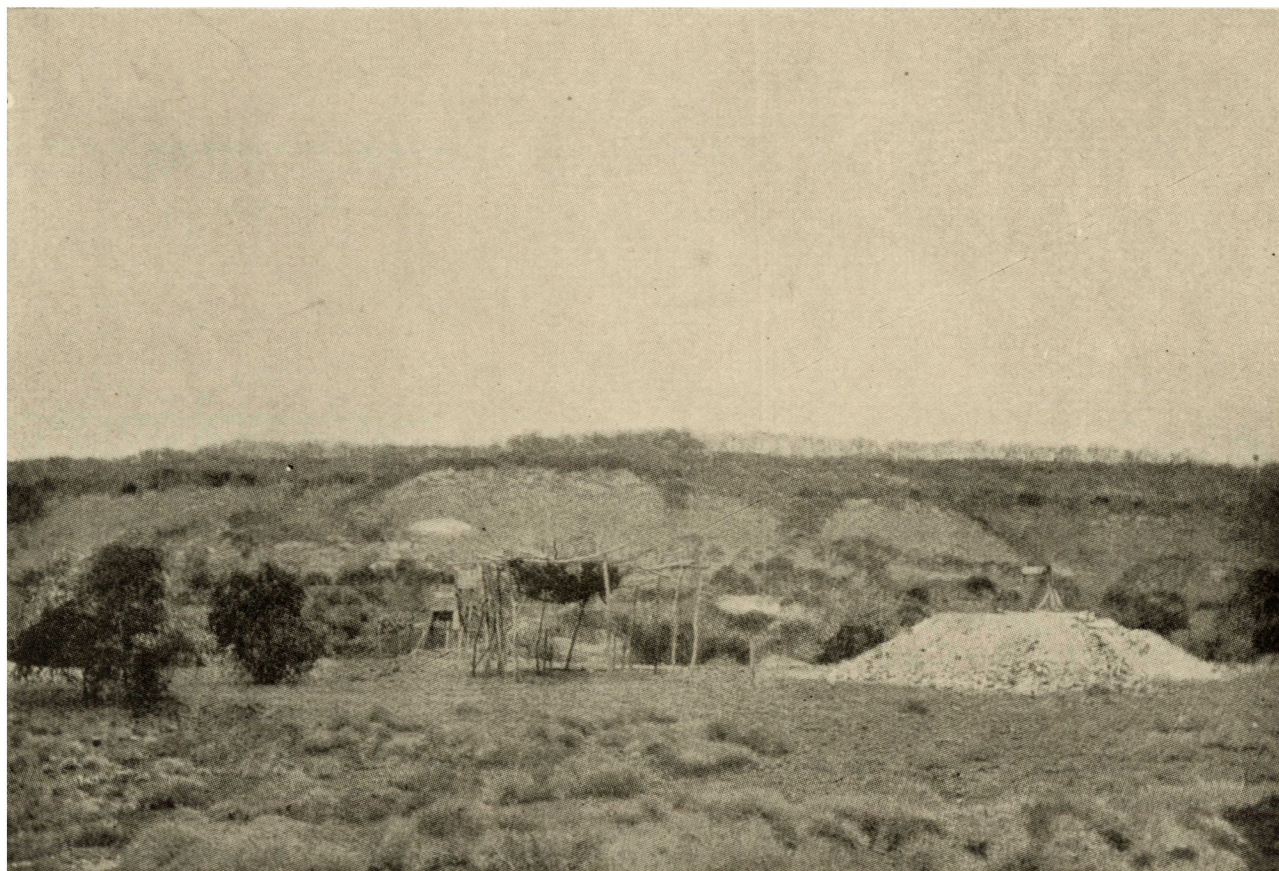
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THE OPAL-MINING INDUSTRY AND
THE DISTRIBUTION OF
OPAL DEPOSITS IN QUEENSLAND

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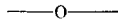


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Kynuna Opal Field.

FOREWORD.



This publication is a reprint of the text of Geological Survey of Queensland Publication No. 177 which has been out of print for many years. Though written 56 years ago the report is not really out of date, because opal mining has been almost completely neglected during this period.

The decision to reprint was prompted firstly by a persistent demand for information on our opal fields and secondly by a hope that the dissemination of the information contained in the report will bring about a revival of this once flourishing industry.

The opal fields are not worked out. The decline in the industry can be attributed to a combination of poor communications and a succession of droughts which made the country uninhabitable. Improved communications and methods of transport and increased mobility of equipment should enable the industry to sustain itself through all but exceptional droughts.

Only one of the photographs accompanying the original report has been reproduced and the geological map, which is out of date, has been omitted. However, a map showing the location of the Opal fields, as well as topographic features, roads and water locations has been published and is obtainable from the Department of Mines.

Attention is drawn to a report entitled "Opal Deposits and the Hayricks Opal Mine, Quilpie," by H. G. S. Cribb which appeared in the February, 1948, number of the Queensland Government Mining Journal and which is available in reprint form at the Geological Survey Office.

25th October, 1957.

A. K. DENMEAD,
Chief Government Geologist.

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THE OPAL-MINING INDUSTRY AND THE DISTRIBUTION OF OPAL DEPOSITS IN QUEENSLAND.

HISTORY OF THE DEVELOPMENT OF OPAL-MINING.

After a short era of prosperity there has been a very considerable decline in the opal-mining industry of Queensland, the cause of which is not far to seek.

It is entirely owing to the persistent and wide-spread drought which has prevailed over the western portion of the State for the last six years; a drought which, when at its height, was so severe as to render prospecting and mining for opal almost impossible.

There are no very reliable records of the annual output of opal in Queensland, but those at our disposal are as follows:—

| Year. | £. |
|-------|--------|
| 1891 | 3,000 |
| 1892 | 10,000 |
| 1893 | 10,000 |
| 1894 | 12,000 |
| 1895 | 32,750 |
| 1896 | 23,300 |
| 1897 | 10,250 |
| 1898 | 6,645 |
| 1899 | 9,000 |
| 1900 | 6,500 |
| 1901 | 7,400 |

and clearly show the fluctuations of the production with the seasons; the best conditions prevailing in 1895 and 1896.

The figures for 1899, which was one of the most severe years of drought, are apparently too high, but this may have been caused by the fact that the employment of labour on stations, &c., then reached the minimum, and consequently a greater number of men for a short time turned their attention to opal-mining.

At present about 295 men are engaged in the industry.

There is no record of the first reported discovery of precious opal in Queensland, but there appears to be no doubt that saleable gem stones were first obtained from the old opal mines near Listowel Downs Station, the occurrence of the mineral there being made known by some stockmen or drovers.

Probably one of the first regular opal-miners was J. Bridal, the original owner of the Little Wonder Mine, who is still mining in the same district.

The first activity in the industry took place in 1878, when the Aladdin Mine, which was portion of a freehold grant of land made to Mr. Bond for the purpose of developing the trade, was floated into a company in London by that gentleman. Before this, however, great interest was taken in the matter by the Hon. John Webber, M.L.C., of Kyabra Station.

The total value of gem stones produced from all opal-fields in Queensland is, as nearly as can be estimated, £131,000, or, up to the end of 1899, £116,000. This amount compared with £376,000—that of New South Wales, the only other producer of any quantity among the Australian States—is small, seeing that the whole of the latter amount was produced from the one source alone, the White Cliffs Opal Field, the output of which for one year was £135,000.

From the other two principal sources of precious opal—Hungary and Mexico—there are no records available of the production of the mineral, nor of that of South Australia or Victoria, where, however, it has only been obtained in very small quantities.

Precious opal occurs in Queensland in two geological formations, viz.—in sedimentary rocks of Upper Cretaceous Age, known as the Desert Sandstone Formation, and also in vesicular basalt of later geological age.

The geological conditions under which opal occurs in the former—which is analogous to the occurrence at White Cliffs in New South Wales—is wholly distinct from any previously known opal deposit in the world.

The latter mode of occurrence in a vesicular basalt is analogous to those of Hungary and Mexico, but, so far, Australian deposits of this kind have not been worked commercially.

GENERAL GEOLOGY.

The Desert Sandstone rests horizontally, and with unconformability, on the lower Cretaceous rocks or Rolling Downs Formation.

Of the latter, Mr. Jack has stated* that it marks the position of a sea which, in Cretaceous times, divided the Australian continent into two islands.

As will be seen from the geological map, it covers an area which may be roughly stated at three-fourths of the total extent of the State. It extends westward from the Palæozoic Range on the east coast, from near the heads of the McIntyre in the south, to the Palmer in the north; west of this line it occupies the whole of the State, save where it is unconformably overlaid by the Desert Sandstone, and where the Palæozoic rocks of the Clonecurry and of De Little, Cairn, and Grey Ranges rise from beneath it like islands.

Westward and southward it extends across South Australia into Western Australia and New South Wales, but except in Queensland it appears to be covered to a considerable extent by tertiary rocks.

* *Geology of Queensland*, Chap. xxxi.

As follows from its mode of origin, the Rolling Downs Formation consists of a series of sandstones, shales, and other sedimentary rocks.

Of the Desert Sandstone Formation, Mr. Jack states* that, after the Rolling Downs Formation had been laid down in the comparatively narrow sea which connected the Gulf of Carpentaria with the Great Australian Bight, a considerable upheaval took place, and the denudation of the Rolling Downs Formation followed, and must have gone on for some time.

Unequal movements of depression then brought about lacustrine conditions on portions of the now uplifted bottom of the old deep-sea strait, and in other portions permitted the admission of the waters of the ocean.

Finally a general upheaval placed the deposits of the period just concluded in nearly the positions in which we now find them.

There is abundant evidence in Queensland that the upper Cretaceous rocks of the Desert Sandstone Formation must at one time have covered almost the whole of the Rolling Downs Formation, and occupied a similar area of about three-quarters of that of the whole State, or 500,000 square miles.

Its denuded remains now occupy less than the twentieth part (25,000 square miles) of the area over which it originally extended.

The remaining portions of the Desert Sandstone are now only seen in the form of low ranges, tablelands, and isolated flat-topped hills, and such areas of the formation occur at frequent intervals, chiefly within the limits already defined in the western portion of the State. There are also other small detached patches and a large area covering the greater portion of the Cape York Peninsular.

EXTENT OF PROSPECTING.

The deposits of precious opal are found wholly in these outlying patches of the Desert Sandstone, and the country within which prospecting for the gem has so far been carried on may be generally stated as extending from the southern boundary of the State to Kynuna beyond Winton, and to be limited on the east by the termini of the main trunk railways, or, roughly, a line joining Charleville, Longreach, and Hughenden; the mean width of the area would be about 250 miles. On the accompanying map of this portion of the State the position of the principal opal-fields and deposits of the mineral is shown, and also the extent—as well as the records at present available will enable it to be mapped—of the areas of Desert Sandstone in which they occur.

These upper Cretaceous rocks, as they are now seen, have here a thickness of from 100 to 200 feet, though rarely more than 160 feet.

Stratigraphically there are two well-marked divisions consisting of soft sandstones and clays, and overlying them extremely hard siliceous rocks, the

latter having a thickness of from 15 feet to 50 feet, and remaining as a capping to the hills and outliers.

This siliceous capping, generally white or stained by oxide of iron, appears in a number of different forms, it being just above the softer sandstones for a thickness of 8 or 10 feet, fine-grained, and evenly deposited, and very frequently converted into a porcellanite.

Above this level it is generally more uneven in texture, and has the cement-like appearance of a hardened coarse clay; it is also extremely hard, and known as "Top Rock" among opal-miners.

In many places this rock assumes a kind of nodular or spherical structure, and there has apparently been a tendency to the solution and redeposition of its siliceous constituents.

The surface of the outlying hills and tablelands is frequently covered with a *débris*, consisting of rounded or ellipsoidal boulders, from 6 to 12 inches in diameter, and slag-like masses, intensely hard and flint-like, which ring like metal under the hammer, and break with a conchoidal fracture. Moreover, the rock being so intensely hard, its remains are found in the form of small, round boulders, known as "Water Dogs," which thickly cover large areas and patches of country on the flats and plains, even after the greater portion of the rest of the formation has been entirely removed by denudation. Beyond their somewhat similar appearance, however, to the ordinary water-worn pebbles, there is no reason to suppose that their form is due to the action of the water.

The same rock, which forms the summit of nearly all the outlying hills and ridges, has been described at different times as quartzite, porcellanised sandstone, &c., but there is no apparent geological reason for separating any one portion of the siliceous capping from another—from the fine-grained rock or porcellanite at its base to the hard flint-like *débris* on the surface—they being but different varieties of the same rock with characteristics produced by somewhat different conditions of deposition or subsequent metamorphism.

Of the softer sandstones and clays which underlie the siliceous capping, the thickness is variable but rarely exceeds 40 feet. The upper portion is generally harder, and has a pink colour due to the chemical form of its ferruginous constituents, while the lower portion and clays are generally yellow or grey in colour, being also very gypseous, and there is frequent evidence of false bedding in this part of the series.

The weathering of the formation is extremely rapid, and the characteristic form which the outliers present is that of a vertical escarpment, for the thickness of the siliceous capping, and a gentle slope formed by the underlying softer sandstones and clays at the base, which in weathering often give rise to flats and plains of very considerable extent.

* Geology of Queensland, Chap. xxiii.

MINERALOGY.

Opal consists of hydrous silica, the proportion of water varying from 2 to 13 per cent. in different varieties. The mineral is softer than quartz, the hardness varying from 5.5 to 6.5, while that of quartz is 7. Its specific gravity ranges from 1.9 to 2.3.

It differs also from quartz in not crystallising in any definite form. Its lustre is vitreous, often inclining to resinous, and sometimes pearly.

It sometimes presents a brilliant play of colours, and is then called precious or noble opal. Other varieties are known as common opal, milk opal, wood opal, fire opal, &c.

The cause of the play of colour on precious opal is a question which has given rise to some controversy, but there appears to be no doubt that the phenomenon is not due to chemical composition, but rather to the influence of slight differences of physical structure or its power of refracting light.

MODE OF OCCURRENCE.

The deposits of precious opal in Queensland occur almost entirely in the softer beds underlying the siliceous capping of the Desert Sandstone series, but in one or two instances the gem has been found in the porcellanite immediately overlying them.

There is everywhere a tendency to opalisation in the Desert Sandstone; common forms—wood opal, semi-opal, &c.—occurring throughout. Precious opal, however, has only been found here and there in small patches.

The opal which is found may be roughly divided into two classes, known to miners as "boulder" opal and "sandstone" opal respectively, the mode of occurrence of both of which will be fully described in detail hereafter.

Boulders are nodules of siliceous ironstone of concretionary origin which contain precious opal and occur in the opal-bearing sandstones and clay at all depths.

The opal-bearing stratum "band" in which the sandstone opal is found occurs in the falsely-bedded series of sandstones and clays at the base of the sandstone, and at its junction with the underlying clay.

It is found occasionally on the surface, but generally at some distance below, the average depth of shafts being about 14 feet. The deepest shaft is about 65 feet. As the term "band" is rather indiscriminately applied on different fields for the particular portion of the formation from which the supply of gem stones is obtained, it may be advisable to explain its most general significance.

Between the clay and the overlying bed of sandstone there is almost universally a thin perfectly defined stratum, varying from a film to 1 or 2 inches in thickness of highly ferruginous and siliceous material which can be easily separated from either the clay or the sandstone, and which is generally called the "casing."

Immediately above this casing the base of the sandstone for a thickness of from 2 or 3 to 12 or 18 inches is generally more ferruginous and somewhat hardened, and though there is no well-defined line of separation, this portion may be detached or broken down, and it parts from the main mass of the sandstone along a plane of weakness approximately parallel to its under surface or junction with the clay. This hardened portion is generally called the "band."

Precious opal is obtained in various localities from the clay, from the casing, from the band, and from the main mass of the sandstone.

Sometimes the mineral is found scattered over the surface, being set free by the denudation of the rock in which it was formed, but, as a general rule, there is little or no evidence of the whereabouts of valuable patches of mineral below. Prospecting for opal is a decidedly hazardous business, and the site for a shaft is most frequently chosen at haphazard in the vicinity where some scattered specimens (colours) have been found on the surface.

Exploratory drives are sometimes put in, but opal-miners, unless the gem is met with in the shaft itself, as a rule, do very little driving, frequently abandoning their shafts without any adequate trial, and often never even piercing the strata above the opal-bearing band.

MINING OPERATIONS.

Mining operations are very simple, the sandstone being generally soft, and requiring no more than the pick to work it. Blasting is only occasionally resorted to, as gems when won in this manner are usually cracked so much as to be worthless, owing to the shattering effect of the explosives which are not generally suitable for opal-mining.

All the tools of trade can be carried on a pack-horse, green-hide buckets and plaited ropes of the same material being frequently used, and a windlass constructed at the site.

Usually, however, a considerable quantity of stores, &c., has to be carried, and the majority of miners find a horse and dray a necessary part of their equipment.

VARIETIES OF OPAL.

There are a great many varieties of precious opal found, some of the different kinds being distinguished by their "pattern" as "pin-fire," flash-fire, or flash opal, when the colour shows as a single flash or in very large pattern, and Harlequin when the colour is in small squares or chequers, the more regular the better. The latter is the most uncommon, and also the most beautiful.

Such classification, however, conveys no idea of the innumerable and exquisite varieties assumed by the gem.

QUALITY OF OPAL.

Nearly all the different varieties of opal are found in Queensland, and there can be no doubt whatever that the quality and brilliancy of some of the best of the gem stones which have been obtained from the deposits of the State is quite unsurpassed.

More than 90 per cent., however, of all of the opal obtained is valueless, being common opal, "schnide" of the miners, or of the glassy bluish variety containing little or no colour.

MEANS OF DISPOSAL OF THE GEM.

The means of disposal of the gem are very irregular and by no means satisfactory.

The gem stones are sold to visiting buyers, of whom there are now few and amongst them little competition, and also to some of the more prosperous miners and hawkers, who become buyers in a small way. Some is even taken by the miners themselves to sell at the White Cliffs Opal Fields in New South Wales, but by far the greater proportion is sent to gem merchants in the southern States, chiefly South Australia and Victoria, and parcels of opal frequently pass several times by post before being sold.

Opal in the rough has generally more or less of the matrix attached, and sales are effected either by simple bid for the whole parcel or at so much per ounce, the price paid varying from 10s. upwards, but rarely exceeding £40 or £50 per oz. The best clean opal has been sold at from £1 to £1 5s. per carat, and occasionally higher.

There cannot be said, however, to be any fixed value for the few gems obtained of highly exceptional quality, or for opal of inferior quality, for which the price paid most often depends on the fancy of the individual purchaser. While the best variety of gem stones obtained in Queensland are in most instances readily saleable at a price comparing favourably with that obtaining elsewhere, there is no doubt that a great deal of opal is sold at a price far below its value, owing either to necessity on the part of the miners or to its quality not being recognised. The great difficulty is in finding a satisfactory market for opal, which, though very beautiful, is not of the best quality, or of fashionable variety, and which forms a large proportion of that obtained—indeed, the sole winnings of the less fortunate miners.

This has generally to be disposed of at a price in no way giving a fair return for the labour of obtaining it, and it is to be regretted that a better value cannot be obtained, and more reliable market found for it.

Though the actual commercial value of inferior opal, and the consequent profit in buying and selling it, may not be sufficient to enable it to be disposed of on the most favourable terms to the present buyers of Queensland gems, which in the ordinary course are ultimately exported to European and

other markets, there is no doubt that the usefulness of this class of opal is not appreciated, nor its value fully recognised by gem-workers and others in Australia, where very little attempt is ever made to use any opal which cannot be fashioned into the common oval shape and mounted, as is frequently the case with some cheap and poorly-designed form of setting.

With the development of the goldsmiths and silversmiths' craft, however, as an important artistic factor entirely distinct and apart from the subsidiary task of stone-setting, there is now a widespread movement for the production of jewellery on the æsthetic principles, and where stones do happen to be employed there is an increasing practice of introducing them for the sake of their decorative properties, not as formerly for the sake of the commercial value they represent.

Mere glitter and display of affluence are gradually yielding before higher considerations of beauty of form and colour; nor is it any longer deemed improper should the æsthetic effect of juxtaposition demand to set diamonds or other valuable gems side by side with common and inexpensive stones.

In these colour combinations, since flash and transparence are become of minor esteem, jewels instead of being cut in facets are not unfrequently polished in their natural shape—"enchabocon" or "tallow cut," as it is called—the irregularities of formation in many, such as pearl blisters, &c., which are very frequently used, imparting not a little to the barbaric richness of the ornaments in which they occur.

Moreover the taste for colour effects in jewellery has led to an enthusiastic study of the special peculiarities of many precious stones not hitherto much sought after, nor very precious, yet, like the commoner and less fashionable varieties of precious opal sufficiently rare.

The inferior though beautiful opal which forms so large a proportion of that obtained by opal-miners in Queensland as well as the numberless pieces which, even though of really good quality, are rather thin, or for other reasons unsuitable for shaping into the ordinary production of the lapidary, undoubtedly possess those peculiar qualities of chameleon iridescence or depth of lustre, that render them admirably appropriate for quaint and picturesque settings; and I feel convinced that both these products are much too readily discarded.

One great advantage of the use of these less perfect gems is that on account of their comparative cheapness one does not scruple to diminish and divide and fashion them as may best serve the purpose to hand, whereas in the case of the more precious stones, like diamonds, where cost, *ceteris paribus*, increases proportionately with size and weight, one shrinks from impairing their commercial value, and consequently is apt to preserve them whole, very often at the sacrifice of decorative effect.

The irregular methods of disposal of opal at present existing makes it quite impossible to maintain any reliable record of the value or output from the various sources, or to accurately gauge the progress of the industry or its value to the State, and for these reasons it would appear advisable that by some means the process be regulated.

Though the opinion of a number of those engaged in the industry seems to be averse to any restriction being placed on buyers, I believe that the registration of all buyers, as well as opal-cutters, would be advantageous in many ways, not only to promote the regulation of the disposal of opal, but also to enable statistics to be collected with greater accuracy.

A similar recommendation was made by the Royal Commission appointed to inquire into the opal-mining industry at the White Cliffs, New South Wales,* and it would no doubt be advisable to adopt the suggestion contained therein, that the process of registration be made easy, and the fee a small one.

The occupation of an opal-miner is more in the nature of fossicking than mining, since he works over an extremely large tract of country, quitting one place for another, either because unsuccessful in finding the gem, or compelled to move on account of the scarcity of water. Moreover, much the greater proportion of opal-mining is not within the limits of any proclaimed mineral field, thus:—

| Mineral Fields. | No. of Opal Bearing Localities. | No. of Miners. | Production for 1901. |
|---|---------------------------------|----------------|----------------------|
| Cunnamulla | 4 | 41 | £ 2,000 |
| Paroo | 11 | 83 | 1,750 |
| Opalton | 13 | 74 | 2,100 |
| Windsor | 3 | .. | 100 |
| Not in any proclaimed mineral field | 69 | 95 | 1,450 |

and there is no doubt that existing conditions are somewhat different to those anticipated when framing the regulations under which the industry is carried on.

While it would obviously be impossible to bring all the opal deposits within a proclaimed mineral area, it would appear advisable that the tenure provided by the Mining Act be made better applicable to more or less permanent mining of this class on certain portions of Crown lands leased for pastoral purposes, wherein are most of the deposits which are outside the four declared mining fields.

Moreover, owing to the shallowness of the deposits, and the ease with which the opal can be mined, it is not advisable that any large areas be allowed to be held, and conditions being somewhat analogous to ordinary alluvial mining, the general consensus of opinion seems to be in favour of the maximum area allowed not exceeding from 50 feet to 100 feet square.

*Report of the Royal Commission appointed to inquire into the Opal mining Industry at the White Cliffs, New South Wales, 1900.

PROGRESS OF INDUSTRY.

The great difficulty in the way of progress to the industry at the present time is the great scarcity of water, and under the drought of the last five years opal-miners and prospectors have had to work under extreme disadvantages and hardships, rations being very expensive, and even difficult to obtain.

The more established fields have generally a small fairly permanent supply of water in the old shafts and wells, but the majority are less favourably situated.

As a general rule, the men rely on waterholes in the beds of the shallow creeks, and camp on those nearest to the deposit they are working, but as these quickly dry up they have to move from one to another further away, and frequently abandon their work entirely until the next rains.

It is no uncommon thing to see men walking 4 and 5 miles daily to work, and in one instance I saw a man walking over 6 miles and carrying a day's supply of rations and water, of which the daily consumption in the dry western country often exceeds a gallon.

PROSPECTING.

All efficient search for the mineral is therefore limited to a radius of a few miles round the most permanent waterholes, and there is a very large area of country practically out of reach of ordinary prospectors.

There is no doubt that the discovery of new fields would give a much needed impetus to opal-mining, and there is a unanimous feeling on the part of opal-miners that the industry is entitled to participate in the fund for the aid of prospectors.

While there is no reason why existing fields and the country within reach of the prospector should not yet furnish considerable supplies of opal, there are certainly large areas, similar in every respect so far as their geological formation is concerned, where there is every reason to believe that the gem would be found in just as great quantity as elsewhere; but owing to the large extent, frequent scarcity of water, and cost of obtaining provisions and necessaries, there is very little likelihood of thorough and extensive prospecting being undertaken by the individual miner, or by private enterprise, and it would without doubt be advantageous to devote a certain sum to the exploration of the country difficult of access to the ordinary miners, or to the better exploration of existing fields.

PROSPECTING UNDER GOVERNMENT AID.

Since from the very nature of the occupation every opal-miner is a prospector, the question of the encouragement of prospecting under Government aid is a difficult one, and the present time, on account of the abnormal conditions of drought, I fear inopportune. I am, however, of opinion that the most beneficial means of allotting such aid would be in the equipment of small prospecting parties of about four men, and as ensuring that the members of such

parties should be experienced opal-miners, and as also tending to create a sense of trust and confidence in the undertaking, the participants might be advisedly selected by the miners engaged in the industry or by some committee or association representing them, and I understand that some such body exists at most of the principal opal-mining centres.

DESCRIPTIVE REGISTER OF QUEENSLAND
OPAL-FIELDS AND OPAL-BEARING
LOCALITIES, WITH GEOLOGICAL
MEMORANDA.

PREFACE.

In compiling the following description of the various opal deposits of Queensland no previous information on the subject was available, and recourse was had to visiting the deposits themselves, a work of some magnitude, which unfortunately was undertaken at a rather unsuitable time of the year.

At the time, however, there were indications that the drought conditions which had prevailed for so long would improve, but these hopes were not realised, and consequently the greater number of opal-fields were found entirely deserted. Observations had also to be curtailed and were greatly hampered by the scarcity of water and feed for horses.

A good deal of the information respecting these temporarily deserted opal-fields had to be gathered from conversation with miners met with on other fields, and as such, is liable to inaccuracies.

It was nevertheless the best that could be obtained, so that such figures and amounts as are given can only be regarded as serving to indicate the magnitude of the operations which have been carried on in any locality for comparison with that of others.

The distances given, unless otherwise stated, are always those of a straight line, and are merely to fix the position of the various deposits, which can be located on the map attached hereto.

The distance by road from each place is in every case considerably greater.

The dates given are also subject to inaccuracies, and the "present time," when mentioned, refers to October and November, 1901.

There is a prevailing and universal custom amongst opal-miners to refer to all opal-bearing localities, whether the workings consist of a trench, single shaft, or group of shafts, as a "mine," generally adding the name of the prospector who worked there originally, or obtained the greatest value of gem stones, in the possessive case; and this custom has been retained in the following pages.

The Yowah Opal Field is in the Cunnamulla Mining District 28 miles W.N.W. of Eulo, and is situated on the northern side of Sheep Station Creek 10 miles from its junction with Yowah Creek of which it is a tributary.

The usual means of access to the field is from Eulo, a distance of 37 miles, and the country in the vicinity is generally flat or gently sloping.

The rock consists of the pink sandstone of the lower strata of the Desert Sandstone series, and this, in many places, is covered by the characteristic débris of hard round boulders, derived from the denudation of the harder upper beds which still remain capping several outlying hills. The underlying beds slope gently off and gradually merge into soft red plains and flats formed by their débris. The country is scantily timbered with mulga, leopard wood, &c., and fringing the creeks and waterholes are several species of eucalyptus. The mean annual rainfall is about 12·7 inches and the minimum 6·2, recorded in 1900. The field is dependent for its supply on the waterholes of Sheep Station Creek, which lasted well even in the year of minimum rainfall (1900).

As a rule, water can be obtained within a mile of the workings, but occasion has arisen for carting it from a dam 4 miles from the camp. The area of Desert Sandstone in which this field is situated extends north for probably 56 miles, joining the small area which is marked on the map just to the east of Toompine. South it extends about 16 miles, probably joining the Willies Range which then trends off in a south-westerly direction for about 40 miles. The mean width is about 16 miles. The whole thickness of the formation is not *in situ* throughout the whole of this area, but outlying hills, on which the topmost beds still remain, occur at frequent intervals.

The surface of Mount Blakeney, 4½ miles S.S.W. of the field, like that of Mount Wallaroo, 4 miles to the east, is covered with a débris of boulders of the intensely hard quartzitic looking rock, and beneath this is a hard white siliceous rock.

An analysis of the latter, at the base of which were here and there small patches of conglomerate, gave—

SiO₂, 73·4 per cent.; and Fe₂O₃ +
Al₂O₃, 22·4 per cent.

These rocks have a total thickness of from 40 feet to 50 feet, and give rise to a vertical cliff face frequently weathering into large caves.

Beneath are beds of coarse reddish and yellow sandstone, an analysis of which gave—

SiO₂, 58·1 per cent.;

and these latter contain beds of clay and thin bands of highly ferruginous sandstone, there being frequent evidence of false bedding in the series which has a thickness of about 60 feet. With the exception of Mount Wallaroo and Mount Blakeney, the upper beds in the vicinity have everywhere been removed by denudation, and the surface of the country is covered with the rounded nodules—"water dogs."

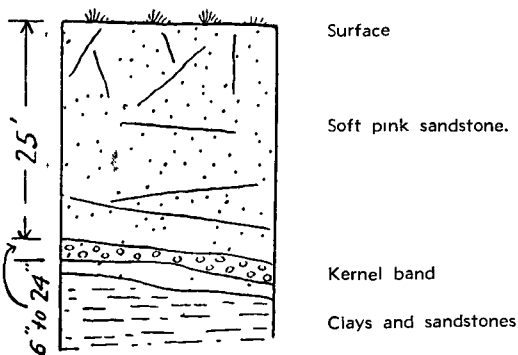
The precious opal obtained from the principal "claim" of this field, which is situated on a low ridge about 40 feet above Sheep Station Creek, is found forming the centre or kernel of small nodules of siliceous ironstone—"kernel boulders."

The discovery of opal at the Great Extended was made by Mr. W. Evans when deepening an old shaft that had been left by some former prospector, and it is now one of the richest deposits which is being worked in Queensland. It was first held as a claim, but owing to disputes was subsequently taken up as mining lease No. 6 by Evans, Tullie, Cornthwaite, and Wollaston. This is now the only mineral lease for opal which holds good. The main shaft on the lease is about 26 feet deep, and passes through a soft pink sandstone. At about 25 feet the rock becomes rather harder and has a yellow colour, and the kernel band is met with.

This consists of a bed of concretionary nodules closely packed in soft clayey sandstone.

Beneath it are beds of soft grey sandstone and clay.

The beds have a slight dip of about 10 degrees, but this varies in different parts of the workings.



Section of Great Extended Shaft, Yowah Opal Field.

The upper portion of these sandstones or falsely-bedded strata are as a rule harder than the lower, and near the base of the series thin beds of fibrous gypsum (kopi), varying from $\frac{1}{4}$ -inch up to 2 inches or 3 inches in thickness, are of frequent occurrence. Such beds also occur in the clays beneath the opal band, and in the band itself encasing the boulders.

Detached scattered nodules of siliceous ironstone are seen above the main band as high as 8 feet, and in some cases a second band or nest of nodules is seen about 2 feet above the main one.

These, however, have no appreciable extent, and generally lie at a different angle, and run into the main band.

Examples of opal being found as the kernel of concretionary nodules occur on several of the opal-fields, but the occurrence of the nodules in such numbers in the form of a definite bed or stratum is altogether unique.

The compacted mass forming this bed of kernel boulders varies from 6 inches up to 2 feet in thickness, and has a conglomerate-like appearance. The

matrix consists of a somewhat friable sandy mass containing a large proportion of clay in irregular masses and rounded lumps.

An analysis of the sandy portion gave—

SiO₂, 70·8 per cent.; Fe₂O₃ + Al₂O₃, 20·6 per cent.;

and of the clay—

SiO₂, 55·7 per cent.; Fe₂O₃ + Al₂O₃, 30·1 per cent.; H₂O, 4 per cent.

The kernel boulders are undoubtedly of concretionary origin formed *in situ*.

They vary from about a quarter of an inch up to 6 or 8 inches in diameter, and have generally a somewhat spherical or ellipsoidal shape, the chocolate or brown colour being due to the presence of oxide of iron.

They have evidently been deposited from the outside towards the centre, having alternate rings of dark and light-brown colour, and varying in composition from a siliceous ironstone to a rather ferruginous opal.

An analysis of the rim of a large solid boulder gave—

SiO₂, 27·6 per cent.; Fe₂O₃ + Al₂O₃, 67·0 per cent.; H₂O, 0·64 per cent.

In the centre is generally a kernel of pure opal, which, when of the precious or noble variety, forms the source of the gem. Occasionally there is a layer of opal between the outer skins or at the outer edge, and veinlets of opal often ramify through the matrix. The centre of these boulders is not always filled in the same manner, and examples occur of the kernel being composed as follows:—

- (a) Of precious opal;
- (b) Of common opal, smoky, clear, or glassy, yellowish, or resin opal, white, yellow, and black;
- (c) Of the same material as the outer portion sometimes shot through with veinlets of precious opal;
- (d) Of opal, generally of the glassy variety, but having the kernel quite loose in the shell;
- (e) Of a fine white powder, an analysis of which gave—

SiO₂, 60·4 per cent.; Fe₂O₃ + Al₂O₃, 27·8 per cent.; H₂O, 1·8 per cent.;
- (f) Of a small quantity of fluid like water;
- (g) Or the boulders may be quite hollow and have no kernel.

I did not actually see an example of one containing any liquid, but in several that were broken the fine white powder was quite moist, and did not fill the shell.

Mining operations on the field are extremely simple, the soft pink sandstone being easily removed with pick and shovel, and the method of working is roughly as follows:—

A shaft is sunk until the opal-bearing or boulder band is met with, and the material for about 3 feet or 3 feet 6 inches above it is then removed. No system of drives is employed, but the opening out is done in an irregular manner, the band being left on the floor, to be afterwards removed and examined for gems. The sandstone above being fairly compact stands well, and only a few pillars are left here and there to support the roof, assisted by occasional vertical struts with cap pieces. Leopard wood is frequently used for the latter purpose (so-called on account of the peculiar markings of the bark), and this material is found to stand best underground. The shafts are descended in the usual manner common to all opal mines—viz., steps cut at intervals in the walls. A miner can well remove enough of the overlying sandstone in a few hours to supply him with a sufficient quantity of the opal-bearing kernels for examination for the whole day. The band is broken up from the floor with a pick, and the portion removed is either searched for gems in the mine or sent to the surface for examination. As any nodule of this conglomerate-like mass may contain a gem stone, the process of examination must be conducted very thoroughly. The mass is broken to pieces, each nodule being separated by hand, and with a small hatchet and chopping-block the miner proceeds to crack or chop the end off the boulders. Sometimes precious opal of very fine quality may form the kernel of perhaps one in every 50 or 100 that he cuts—a truly fascinating pastime, but crude in its extravagance, as frequently, owing to the brittle nature of the material, most valuable gems are lost, destroyed, or broken in such a way as to be useless. In nearly every case the kernel of precious opal is damaged, or reduced in value and size by the process. A number of the miners are provided with a rough lapidary's wheel, wherewith they cut and polish opal, and also, by their ignorance of the craft, frequently spoil valuable stones. No doubt a lot of gems are either missed, or spoiled by rough breaking.

The extent of the kernel band is somewhat difficult to estimate, as, owing to the falsely bedded nature of the strata in which it occurs, it is not continuous. In some of the surrounding shafts a similar band has not been met with, but the sandstone at its junction with the clay was found to be more ferruginous and hardened by partial opalisation into a "sandstone band," which also contains opal in the form of seams and pipes.

In Evans' claim, however, seventeen trial shafts have been put down at different points, and these all "bottomed" on the same formation, the bulk of which remains yet to be removed. The same formation has also been worked just outside his boundary, and is also found about 3 or 4 chains to the east, but in most other places the ordinary hardened sandstone band has been met with.

Owing to the characteristic tendency to opalisation of the sandstone, common opal is met with almost anywhere that a shaft is sunk, but the precious opal is by no means so plentiful. The opal-bearing band and ferruginous concretions being so much harder than the sandstone, their fragments are left on the surface after the surrounding rock has been denuded away, and the small pieces of opal they contain shining on the surface, give rise to the so-called "colours." Occasionally the origin of these can be traced to the outcropping band, but owing to the false bedding of the strata, the finding of the original outcrop is often very puzzling.

There are now nearly forty men on this field, the largest number which have yet been there at one time, and the chief activity is centered in the successful claim belonging to Mr. Evans. The most extensive working, however, has been done in the past on what is known as the Old Flat, which adjoins Evans' lease to the east. Several claims are in operation here, but no very regular mining is carried on. Men come and remain for a short time, working out the old pillars left by previous miners. The shafts are here of variable depth, some being as much as 24 feet, while on the eastern edge of the flat the band is close to the surface.

The workings cover the whole of this flat, which is about 5 or 6 acres in extent, and there is very little solid ground left. The other chief workings in the vicinity are those known as the Southern Cross Field, which is about half-a-mile east of the Great Extended. Opal was first found here in 1883, and the ground was subsequently taken up as a lease, and floated with others into a company by Mr. Bond. Work was carried on for several years, and one dividend said to have been paid, but soon after the death of the manager operations ceased.

Work has since been done, however, at intervals by various miners, who have obtained a good deal of opal.

About 4 miles S.S.W. of the Great Extended Mine there are some workings known as the 4-Mile, the shafts, &c., covering about three-quarters of an acre.

Only about £80 worth of the gem was obtained from here, the best of it being bought by Mr. Evans; and the mineral was in a sandstone band, no boulder or kernel opal being found.

Just to the east of this locality is another similar outcrop, and about an equal amount of work has been done.

About 4 miles south of the Great Extended Mine are some fissures in the Desert Sandstone filled with siliceous ironstone, which are believed by Mr. Evans to contain small quantities of gold, but this I think unlikely, and the mode of occurrence would not lead one to suspect a gold-bearing deposit.

The Koroit Opal Field is in the Cunnamulla Mineral District, and lies about 55 miles from Yowah, more exactly 48 miles in a direct line N.N.E. of Eulo, and the easiest means of access is from Cunnamulla direct. It is situated in an area of

Desert Sandstone, which extends in a north and south direction for at least 80 miles, and has a mean width of about 10 miles.

At the north-west corner of this area some of the upper beds of the Desert Sandstone still remain, forming what is known as Moriarty's Range. The occurrence of opal in this locality seems to have been first determined about 1897, when a syndicate was formed by the manager of an adjoining station to work the deposit.

Only a small quantity of opal was obtained, and early in 1900 a larger syndicate was formed, including most of the original members, when more extensive work was carried out at a greater depth. About £800 worth or £900 worth of gem stones is supposed to have been obtained, but this is little more than mere rumour.

During the period of greatest activity some twenty or thirty men were engaged on the field, but the scarcity of water, which in the dry season was carted 12 miles from the Paroo River, ultimately prevented further profitable work, and the place is now quite deserted.

Six miles from *Koroit*, in an easterly direction towards Bando, good prospects of opal have been obtained, but the bulk of that found so far has been of the glassy-blue variety, and valueless.

The Fiery Cross Field is just outside the boundary of the Paroo Mineral Field, and is situated 25 miles from Yowah in a north-westerly direction. It may best be reached from the latter place by following Yowah Creek as far as Dundoo Station, from which it lies 12 miles almost due west. This field is in a portion of the same area of Desert Sandstone as the Yowah Field, and the whole of the series has apparently a slight dip to the east, of probably less than 1 in 2,000. The workings are situated in a gorge, where the upper beds have been removed by denudation. There are a number of shafts sunk closely together over an area of about 2 acres, and they pass through a soft pink sandstone, which no doubt corresponds to that at the Yowah Field. The shafts are from 10 to 15 feet deep, and after piercing the sandstone enter a rather siliceous clay. Here, as at Yowah, the opal was obtained chiefly at the junction, but in the hardened band at the base of the sandstone and not in kernel boulders.

The sandstone is here very soft and rotten; and, unlike Yowah, a considerable amount of timbering was necessary to support the roof.

All the work seems to have been confined to one area, and I am of opinion that more thorough prospecting of the locality—especially in the deeper ground—would be worth undertaking.

At the time of my visit the field was quite deserted, the few men who had been working there for some months having recently gone to the Duck Creek Field. The country in the vicinity is extremely barren, and the site of the old camps, in another

gorge, is about a quarter of a mile distant near a spring or rock hole. Although a good deal of work was done, the quantity of opal obtained is not believed to have exceeded £1,000 in value.

The Duck Creek Opal Field is in the Paroo Mineral District, and lies about 40 miles towards the north from Yowah. It is also on Yowah Creek near its head, and is most easily accessible from Eulo by road, a distance of about 76 miles. It is situated on a low ridge, which separates those waters, which drain into Yowah Creek and thence to the Paroo River, from those which reach the same river more directly by Box and Beechal Creeks. The surface of the country is almost quite flat.

Some very extensive mining for opal has been done in this neighbourhood, and the prominent features consist of the main Duck Creek workings, the different portions of which are known as the "New Field" and the "Old Field" respectively. There are besides this a number of surrounding camps and localities where opal-mining is carried on, and for which the main camp at Duck Creek forms a kind of centre.

The New Field is not at present being very extensively worked. The shafts, which are deeper towards the northern and eastern boundary of the workings, have an average depth of about 14 feet, and pass through soft pink sandstone into hard grey or white clay. The hard ferruginous band or casing at the junction varies from a film up to several inches in thickness, and the underlying clay has also become extremely hard in many places, by partial or complete opalisation in its mass, it being then known as "flint band" by the miners. Precious opal is found in small clean pencil-like pieces or pipes near the base of the sandstone, in the band or casing, and in the clay. The junction of the sandstone and clay is not regular, but frequently takes dips and bends as though the overlying portion were laid down on an uneven surface. Colourless or common varieties of opal form the largest proportion of that obtained, and with this, though the mode of occurrence is the same, the forms are usually much larger and more massive. The methods of mining are very similar to those previously described, only the opal-bearing portion of the formation is left on the roof instead of the floor, and broken down for subsequent examination. After the shafts are sunk the miners put in drives or chambers by removing the clay for a sufficient depth to enable them to work in a crouching position, an operation known as "ky-outing," and the band is afterwards broken down from the roof for examination.

The Old Field is really a continuation of the workings previously described, as it adjoins them. It is, however, the oldest portion of the field, from which a very large quantity and some of the finest opal was obtained. Conditions are similar to those described at the new field, and the whole of this portion of the workings has been very thoroughly searched.

Though there is very little workable ground left, some splendid opal is found here yet, a good deal obtained by turning over and searching the old heaps and mullock—"noodling." A number of men often make a good living at this occupation, which is also indulged in by the children and women of opal camps.

Goodman's Flat is situated $2\frac{1}{2}$ miles to the N.W. of Duck Creek. A number of shafts have been sunk here through a sandstone, beneath which is a hard white sinter-like material, probably a sandy clay hardened by partial opalisation. The precious opal was partly obtained from boulders at the base of the sandstone, and partly from the underlying rock called "cement" by the miners; but the total production has been limited to a few stones.

The One-mile Workings, east of Duck Creek Old Field, consist of several shafts from 15 to 40 feet deep, from which about £200 worth of opal is said to have been obtained.

Sheep Station Creek workings are situated at the head of Sheep Station Creek about 5 miles S.W. of Duck Creek. The credit of having discovered opal in this locality is given to Peter Nixon, a civilised black, who has been prospecting in the district for a great number of years.

At the portion of the workings where operations are now in progress, the shafts passed through 8 feet of pink sandstone, and there was then a bed of clay 3 feet in thickness, and another bed of sandstone whiter in colour. The latter has a thickness of 4 feet 6 inches, and has beneath it another clay bed. Opal was found in the "band" at the base of the upper bed of sandstone, in the clay, and also in the second bed of sandstone. Boulders occur in both beds of sandstone, and when in the lower one are termed "floaters." They can also be seen weathering out on the surface.

The portion of the workings where most of the opal was obtained originally is about 150 yards to the S.W., and the total value of it is estimated to have been £600. Some was of very fine quality, and was taken to be sold at the White Cliffs Opal Field in New South Wales.

The Emu Creek workings are situated 4 miles S.E. of Duck Creek, and the finding of the gem here is also attributed to Nixon. His discovery, however, of surface specimens was only made just prior to my visit, the camp being then known as the "New Rush." There was some excitement over the matter, and a number of shafts were being sunk, but none had reached bottom, though some were 25 feet deep. No doubt some gem stones have since been found here, but from reports which reached me I have reason to believe that results did not come up to expectations. Besides the localities already described, prospecting is carried on at intervals at *Johnson's Mine*, 15 miles distant, on Ardoch Station Run; and at the *Golgonda Mine*, about the same distance from Duck Creek, on Dundoo Run.

The Pride of the Hills Mine, in the Paroo Mineral District, is 12 miles N.W. of Duck Creek, or 13 miles east of Toompine. These workings are near the western margin of the large area of Desert Sandstone, in which are situated all the fields already described. Here the formation is seen in the form of ridges and spurs, and the workings are situated on the northern slope of one of these spurs. The upper beds, which remain as a capping, are from 15 feet to 20 feet in thickness.

A number of shafts have been sunk on the slope which passed through the sandstone at about 20 feet and entered the clay in which most of the opal was found. This clay contained a good deal of iron, and concretionary nodules or boulders were found in it. Masses of the clay have also become hardened and converted into a kind of semi-opal in a similar manner to that described at Duck Creek. The opal was nearly always found in the softer clay, but occasionally in the hard portions and also in the sandstone in the usual way. Owing to surface configurations, portions of the opal-bearing band are to be seen weathering out on the slope near the foot of the hill, and their presence, no doubt, gave rise to the discovery and opening up of the mine.

As is not unusual in such cases, a number of shafts were first sunk on the flat ground considerably below the level of these surface specimens. Very large quantities of the blue and colourless varieties of opal were found here, but the value of gem stones obtained has not exceeded £200 or £300.

The mine is difficult to work owing to the scarcity of water in the vicinity, and, in fact, can only be worked for a few months after rains. There were three men at work there in October, 1901, and they were depending for their water supply on a rock hole about 2 miles distant.

The Lushington Mines, also in the Paroo Mining District, is 6 miles north of the Pride of the Hills, and, like the latter, is situated on an outlier of the main area of Desert Sandstone. The first group of shafts met with are spread over about an acre, and 250 yards to the east are other similar workings. At the present time the locality is completely deserted, no work having been done for three or four months.

The field was first worked in 1893, and about fifteen was the highest number of men ever engaged there. Except just after rains the scarcity of water is almost a bar to mining operations, and, in order to continue work, at one time water was being carted from Toompine, a distance of over 9 miles.

The sandstone is soft and rotten, and the shafts having all fallen in could not be examined. The uppermost beds of the Desert Sandstone series have here a thickness of 35 feet. Opal was obtained from boulders and from sandstone casing or band, and the total value obtained was not more than £1,000.

The Bull's Creek Opal Field is situated 70 miles almost N.W. of Toompine, but the easiest means of access is from Adavale, via Gunnedorah, thence branching west through Niccavilla Station across

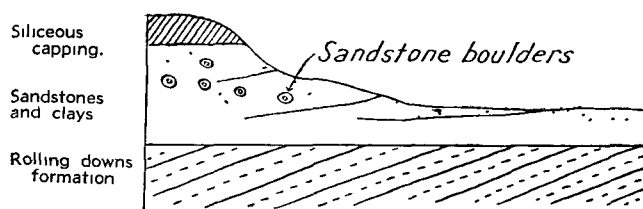
the Grey Ranges. This road distance would be about 94 miles. The field is situated in a large extent of poorly-watered country on the western slopes of the Grey Range, which is drained by Kyabra Creek.

The discovery of opal in the locality was probably made by the owners of "Ray," a neighbouring station, and its mining history appears to date from about 1885, when some boulder opal was obtained and sold for £40. For some time operations have been very limited, there being not more than three or four men engaged at one time, and the class of work being chiefly that of working out old pillars, &c. In October last there were only two men there who had just arrived, another party of miners having forsaken the field some weeks previously.

The conditions of mining and the occurrence of opal are here somewhat different to those previously described. The rock in which the mineral occurs though a sandstone of very similar variety is harder and has not been pierced by any of the shafts. The opal is found in large boulders called by the miners "sandstone boulders," which occur irregularly in the mass of the sandstone. They are spheroidal or ellipsoidal in shape, varying in size from a few inches upwards, and are of concretionary origin, apparently having been formed by an arrangement of the siliceous and ferruginous constituents of the rock in a series of shells. No nucleus is ever found, and they are either composed of the same material throughout, or the interior is a loose white sandy substance.

Opal is found in thin layers between successive shells of these boulders, or in somewhat larger veins and irregular masses filling joints and fissures therein. Opal is also found in thin seams or films in the joints of the rock. Another mode of occurrence of opal here is in what are known as "mud pipes" by the miners. These are pencil-like pieces of considerable length formed in the mass of sandstone, the silica being apparently derived from the rock itself immediately surrounding which has become soft and powdery for a radius of 2 or 3 inches. The soft stone is carefully scraped out with the ordinary scraper used for blasting purposes, and the pipe of opal thus obtained clean and undamaged.

The sandstone has been worked in search of boulders largely by open cuts, from which drives have been put in in all directions, from the surface down to about 18 to 20 feet. The upper portion of the sandstone being hard and compact often requires the use of explosives, and hence the field is not, as a rule, a profitable one. To the south and west of the workings, the hard white capping "top rock" remains covering the sandstone, and in this the silicified remains of trunks and branches of trees are frequently found. It seems probable that an opal-bearing band would be found at the base of the sandstone, and that trial shafts sunk deep enough to reach the underlying clay might yield profitable results.



Section of Opal-bearing Country at Bull's Creek.

The work which has been done at Bull's Creek is very considerable, and is distributed over an area of about 15 acres. That known as Huxley's claim was the richest, and perhaps the "Bona Venture" the largest.

The field is but poorly provided with permanent water, the supply of which is derived from a small spring, which fails when the dry season becomes at all prolonged; and on this account the deposit has several times been unworkable. It is said that the total value of the production lies between £2,000 and £3,000.

Prospecting has been carried on at *Bowra Creek*, 14 miles S.W.; and at *Moble Creek*, between Bull's Creek and Toompine. *Barry's Mine* is 2 or 3 miles to the east.

The Marble Arch Mine, about 7 miles N.E. of Bull's Creek, is said to have been first worked in 1883 by Batty and Gilbert. It is now deserted, but has been worked off and on since its discovery for a total production of about £1,000.

The Valdare Mine is 12 miles north of Bull's Creek, just over the boundary fence dividing Niccavilla Station and Ray. It is a very old mine, having been in existence nearly twenty years ago, and the first work was probably done by Cole and Harvey, who obtained boulder opal. The mine was afterwards worked by a syndicate consisting of the owner of Ray Station and several others, and called the Valdare Company. Labour was employed to work the mine. Operations were carried on for about two years, and appear to have resulted in the winning of a large quantity of opal, but the company ultimately had to cease work, and the last of the profits were absorbed in lawyer's expenses.

Opal was found chiefly in sandstone boulders, as at Bull's Creek, some of them being of very large size, and it may be remarked that boulders of this kind occur as large as 9 feet in length. The sandstone at the Valdare Mine is rather hard and compact, but can generally be worked with a gad and bar.

Like Bull's Creek, none of the workings are more than from 5 to 15 feet deep, and it is not improbable that deeper sinking would lead to profitable results. The cost, however, of sinking in the hard rock is rather more than the ordinary prospector can undertake.

Between Bull's Creek and the Valdare Mine are a number of smaller prospecting workings, of which the Boulder Mine is about 2 miles and the Sandstone

Mine about $1\frac{1}{2}$ miles south of the Valdare, and probably £10 or £12 would represent their output.

The group of mines which are sometimes included under any of the general names of the Erounghoola, Keeroongooloo, or Kyabra Fields, though they are not in any declared mineral field, comprise some of the oldest mines. They are rather widely separated from any previously described, being much further west in the country draining into Cooper's Creek.

The Little Wonder Mine is situated 35 miles west of Erounghoola Station, or the township of Eromanga, which adjoins it, and is accessible by road either from Thargomindah or Charleville. This mine has been one of the richest of the opal mines. It was purchased from the discoverer for a small sum by J. Bridal, who was the original owner, and whose name has been always associated with it. In 1891 it became, with other leases, the property of the South-western Queensland Opal Company, of which Bridal was a member. At one time 50 men worked and lived at the Little Wonder, but its total production cannot be estimated. The original owner, however, obtained £14,000 worth of opal from the mine. The deposit is on the western slope of what is known as McGregor's Range. The country is drained by Bargeró and Cunnavalla Creeks, but the supply of water for domestic purposes is derived from some of the old shafts which have been filled during rains.

The opal was here chiefly found at the base of a bed of sandstone, there being a bed of hardened clay beneath it, and both are apparently at a higher level in the series than those previously described. The ferruginous casing is very hard and has an average thickness of about 2 inches, but it may widen out or become a mere film. The clay is of a light brownish colour, in some places hardened so as to be almost porcellanised, and the labour of removing it is very considerable. This hardening generally occurs in the upper portion of the clay for a depth of about 2 feet 6 inches, the lower portion near the floor of the drives being generally of a soft grey variety. There is generally a thin stratum of ferruginous material separating them.

The total thickness of the bed of sandstone is here about 20 feet, and of the uppermost beds of the series, which are seen on the hills to the south, about 35 feet. The surface is also covered by the same intensely hard debris of siliceous rock, and the whole of the capping is of similar composition to that described elsewhere. Fine examples of the remarkable weathering of this rock, which must be extremely rapid, are to be seen in the vicinity. There are very few shafts, the method of exploring the junction of the sandstone and clay being universally by tunnels. The workings are very extensive, the drives being widened out and extended irregularly in all directions, and the whole of the end and eastern side of the ridge on which they are situated has been almost completely worked out. Two men are working here at present exploring or

prospecting the south-eastern extremity of the workings, but the deposit is supposed to have been worked out and for some years has been practically deserted. The country immediately surrounding has naturally been fairly well prospected, and a number of other deposits located which have been worked at different times.

The Yellow Nell, so called from the colour of the sandstone, is about $3\frac{1}{2}$ miles to the east, on the road from Erounghoola Station; and the *Pinnacles Mine* is about 7 miles from the Little Wonder, also close to the road.

Pott's Mine is about 10 miles towards the south-east, and *Laman's Mine* about 12 miles from the Little Wonder in the same direction. Both are on Mount Margaret Run, and are "sandstone boulder" mines, and neither is at present being worked. The production of the former was about £3,000 in value, and of the latter, where the opal was not of such good quality, about £300.

The Old Cunnavalla Mine is situated about 8 miles north of the Little Wonder, and is also rather celebrated amongst opal mines. Its history dates from about 1888, when, under the name of "Mascotte II.," it formed, with the Southern Cross at the Yowah Opal Field, one of twelve leases which were floated into a company by Mr. Bond. The opal was obtained almost exclusively from sandstone boulders, and there appears to be no doubt that the mine was a rich one, but the amount of its output cannot now be estimated. At the period of its most successful working, about 1891, it supported a considerable number of miners, but the locality has gradually become totally deserted, on account of the unfavourable conditions for grass and water which have prevailed for so long.

The Quart-pot Creek Field is 16 miles from Erounghoola or Eromanga, approximately north-west, and may be reached by following the Kyabra telephone line until it crosses Quart-pot Creek. The workings are about half-a-mile west of the dam at this crossing, and are, comparatively speaking, of recent origin. The main camp is situated close to the dam near the head of Quart-pot Creek, but this, though it provides good water for about two months after rains, is by no means a permanent supply. This field is also situated on the margin of the area of Desert Sandstone known as the McGregor Range, and the plains of the Rolling Downs Formation are to be seen about $1\frac{1}{2}$ miles to the east; but the slope from one to the other is so gradual that a difference of level is almost difficult to detect.

There are in all about twelve shafts varying from 10 to 15 feet in depth, and in places the sandstone shows well-marked lines of stratification.

The opal was chiefly obtained in sandstone boulders, some of which were of considerable size and contained very massive common opal, generally on the lower side and sometimes in irregular veins $\frac{1}{2}$ -inch in thickness. Some precious opal was obtained in a similar manner, though in veins of much smaller dimensions. Common opal was also

obtained from a band at the base of the sandstone in the usual manner. In one shaft where the common variety of opal was found in this way deposited as pipes or veins, those round the outside edge had a black margin or casing, the constituents of which were chiefly silica, oxide of manganese, and oxide of iron. The total value of the opal obtained here is supposed to be about £150. /

Mulcahy's Mine, which is the oldest in the district, is about 3 miles south, and is being worked by two men, and 3 miles west of Quart-pot Creek there are also two men at work, but so far not very much has been done.

The eight mines just described, with the exception of Laman's Mine and Pott's Mine, are all situated on Yeroungoola Run, which is portion of the Kyabra Lease, and hence are often referred to as the Kyabra Opal Fields.

The following deposits are all on Keerongoola Run, and are generally worked from main camps which are situated at the most reliable waterholes:—

The Mascotte Mine is about 14 miles in a direct line from the Quart-pot Creek camp, or 30 miles N.W. of Eromanga from which it is accessible by road in a distance of 38 miles, and it is situated on another of the twelve leases which formed the property of the company previously mentioned. Boulder opal was exclusively sought, and no shafts were ever attempted. After the company ceased operations the lease was abandoned, except by occasional fossickers, until early in 1901, when three men sank a shaft and opened out on the junction of the sandstone and clay. This is known as Chippendale's Shaft, and is the deepest opal shaft which has been worked; the lowest portions of the workings being 65 feet below the surface. The shaft passes through coarse yellow sandstone for 45 feet, and then into a compact clay, a considerable amount of opening out having been done at the junction. This junction is very uneven, and has apparently been cut at the nearest point to the surface, as each of the drives dip away from the shaft at about 1 in 3 or 1 in 4. The dark-coloured casing of siliceous ironstone is found as usual varying here from 1 inch to 2 inches in thickness, and the sandstone immediately above it for a distance of from 6 inches up to 2 feet is full of nodules and lumps of clay. The mass has a conglomerate-like appearance, and is called by the miners "Mottled Sandstone," or often "Cuckoo Sandstone." The underlying clay is stained by oxide of iron, and is very similar, though not so hard, as that at the Little Wonder Mine. It often contains pipe-like concretions, which are sometimes solid, or have a core of common opal. Opal also occurs in the ironstone casing, but more particularly just above it in the mottled sandstone, where common opal and opal that is not quite saleable is very plentiful.

The amount of precious opal obtained so far has not been very large. The old boulder workings of the Mascotte Mine are about 5 chains N.W. of

this shaft, and occasional stones are still found there. The total amount of precious opal obtained from this locality has probably not exceeded £150 in value.

The Gladstone Mine, about 1 mile to the east, is on the slope of a small circular hill, and the workings are in the upper portion of the same bed of sandstone as those of the Mascotte Mine. The value of the opal obtained was £700.

The Gem Mine, 2 miles N.E. of the Mascotte, and another of the leases originally held by the South-western Queensland Opal Company, was worked entirely for sandstone boulder, and is said to have been a rich deposit. The workings are extensive and closely crowded, covering about 1½ acres.

Malone's Mine is about three-quarters of a mile north of the Mascotte Mine.

Peppin and Webber's Mine is another well-known deposit, and is about 1½ miles N.N.W. of the Mascotte. It flourished about the same time as the Little Wonder and Cunnavalla, and, like the latter, is now entirely deserted. It is thought by a number of the opal-miners that further quantities of opal would be obtained from it if it could be worked, but on account of the extremely rotten nature of the sandstone rather extensive timbering is necessary, which is beyond their means.

The workings are round the southern point of a ridge, and the opal-bearing band exposed by denudation was evidently found at the toe of the slope, and followed in towards the deep ground until the over-burden became excessive. Workings were then started a little higher up the hill, large square pits being put down, and from these pits tunnels and drives, which must have been many hundred feet in extent, were put in along the junction of the sandstone and clay in all directions. There was generally a small cutting to allow the mullock to be brought from the drives to the surface, and the object of this method of working was apparently to enable the drives to be commenced in more solid rock, which had not been so much affected by weather.

In one place there were eight drives leading from one of these pits, but except in one or two instances they were all in a condition too dangerous to explore. The same hard casing is present in the base of the sandstone, which is of a soft yellow variety with vertical fissures and joints running in all directions, and the bed is about 20 feet thick. Above it on the crown of the ridge is a bed of porcellanite about 25 feet thick. This mine is supposed to have been discovered by a half-caste prospector, and was owned by Messrs. Peppin and Webber, proprietors of the original Kyabra leases. Labour was employed at first, but it was afterwards worked under a kind of tribute arrangement. It is not known how much opal was obtained from it, but it is generally believed amongst the miners of the district that the value of the production was about £9,000.

The last five mines are generally worked from a main camp near some waterholes known as Rossiter's Lagoons, but in October last this supply had given out and the camp was moved to a water-hole on Monkey Coolah Creek. There were six regular miners in the camp and two prospectors, and to the principal mine in operation the distance was over 4 miles.

The following mines are worked from a main camp known as the Gum Holes, which is situated about 5 miles N.E. of Rossiter's Lagoons, or may be reached direct from Eromanga in a distance of 35 miles.

The Scotchman Mine is 5 miles N.W. from the Gum Holes Camp, and the workings are situated round the eastern slope of an outlier of Desert Sandstone, the height of which is 150 feet. The beds are here arranged as follows:—The capping of the outlier is 35 feet in thickness, and beneath it 25 feet of yellow sandstone, very hard at the top of the bed; then a bed of yellow and white partially porcellanised clay and then softer sandstones and clays.

There are some short tunnels at the junction of the upper clay and overlying sandstone, but all the work is now carried on in an irregular manner by shallow digging in the talus round the slopes of the hill, where loose fragments of boulders and broken pieces of opal-bearing band-carrying precious opal are found in the débris. A considerable amount of this kind of mining has been done with fairly profitable results. It is probable that the broken pieces of band in the débris were derived from the sandstones underlying the upper bed of clay, which have never been properly prospected by means of shafts.

The Aladdin Mine is situated on an outlier 400 or 500 yards to the east, which originally formed part of the Scotchman Hill. The slopes are covered by talus and large masses which have slipped to a considerably lower level, and still retained the beds in their relative positions. The opal was found in the débris, and in opal-bearing boulders *in situ*. The Aladdin is one of the oldest mines, and work here is interesting as marking the beginning of activity in the opal industry. A company was floated in London by Mr. Bond for £2,500, in which this mine was the first holding under a freehold grant. It might be mentioned that this freehold is under "*The Mineral Lands Act of 1872*," and comprises 40 acres.

The story regarding the mine is that the opal-bearing boulders were removed without being broken, being then loaded into a large tank, and carted away either as exhibits or for the purpose of obtaining the opal by cutting with better appliances. Hence the statement sometimes made that a wagon load of opal was obtained there.

Mat's Hard Mine is about 2 miles north of the Gum Holes Camp, and the occurrence of opal there is somewhat different, the gem being found in thin

veins in a small bed of porcellanised clay near the top of the series, and on account of its hardness and the hardness of the sandstone very little attempt is made to work it. Explosives were tried, but owing to their shattering action any opal in the rock was generally destroyed. The gems obtained were of very good quality, and about £150 worth are all that have been got from the mine.

The Two Jack's Mine is three-quarters of a mile east of Mat's Hard Mine, at a considerably lower level. Nothing more than a little very imperfect prospecting was done here, and though a great deal of common opal was obtained in a sandstone band, only one or two pieces were good enough to sell.

The Hen's Nest Mine, about 1½ miles further west, has been worked to about the same extent, and with about the same result. It might be mentioned that *kernel boulders* are found here occurring in nests at the junction of a small bed of porcellanised clay and the sandstone beneath it. None, however, have been found perfect, the kernel being either only partially filled or the opal being mixed with ferruginous material.

Hammond's Mine is in a gully about a quarter of a mile further south, and opal was chiefly obtained from boulders in the softer sandstone beds at a lower level. The deposit was discovered by the owners of Hammond Downs Station, and is a very old one, supposed to have been very rich.

McGeorge's Mine is about 1½ miles from the main camp, situated under some high cliffs where the country is thickly timbered with mulga, and is difficult to find without a guide. A little boulder opal and sandstone opal was found here, but prospecting has been very inadequate, and only a small quantity of valuable mineral can have been obtained.

The Scotchman, Aladdin, and other mines described, within a radius of 5 or 6 miles, are all worked from the only water supply—the Gum Holes—and are tried on and off by the same group of miners who carry their windlass, barrel, and mining-tools from one to another.

In October last there was about three months' supply of water at this camp, and the horses were grazing 7 or 8 miles distant and returning every day or two for water.

The Stoney Creek Camp is 5 miles north and a little west of the Gum Holes.

The Stoney Creek Mine was one of the properties held by the South-western Queensland Opal Company. The workings are situated on a large flat, the opal having been obtained under the sandstone at a depth of about 8 feet. All the shafts are now "mullocked" up, and being full of water could not be examined. The water supply for the main camp, which is situated on the edge of the workings, is derived from these shafts.

The area of ground worked is about 2 acres in extent, but all the valuable opal was apparently obtained from a very small area. The mine was

worked for some considerable time by the company, and must have been rich, as men were afterwards put on to turn over and re-examine the old mullock heaps.

Reliable information with regard to the output cannot be obtained, but there is no doubt that it must have been worth a good many thousand pounds, and comparable perhaps with that of the Little Wonder and Cunnavalla Mines. No work is carried on there now, owing partly to the fact that the flood-waters of Stoney Creek were turned into the old shafts by the miners, and this for a number of years has formed the most unfailing supply of water in the district.

De Lazra's Mine is really part of the Stoney Creek Mine, and lies about a quarter of a mile to the S.W. It is named after the fortunate Italian who found most of the gem stones. Some of the workings are here at a higher level than those of Stoney Creek, being situated on the S.E. slope of a circular hill, but the largest quantity of opal was found on the eastern side of this hill, in shafts sunk to a depth of from 8 to 30 feet. The sinking was easy, but the underlying clay very compact, and the sandstone contained quantities of gypsum in beds from $\frac{1}{4}$ -inch up to 6 inches in thickness.

The workings cover an area of about 2 acres, and the value of the opal won was between £6,000 and £7,000.

The Bung Bung Mine is about 2 miles N.W. of Stoney Creek, and was also worked by an opal company. It is said to have been sold to this company in 1891 by the discoverer for £300, and it proved to be a valuable mine.

The output has been variously stated at from £8,000 to £10,000. The workings vary greatly in depth, 40 feet being the deepest, but the bulk of the opal was obtained at a depth of about 20 feet.

The mine was abandoned for a considerable time and the shafts filled with mullock, but some men are now engaged in cleaning out the old drives from which the bulk of the opal was obtained, with the intention of working out some of the pillars and solid ground which was left by previous workers.

The Gap Mine lies about half-a-mile east of the Bung Bung, and the workings consist of a few shallow shafts. Close to this deposit is another occurrence of *kernel boulders*, which, however, are subject to the same deficiencies as those at the Hen's Nest Mine.

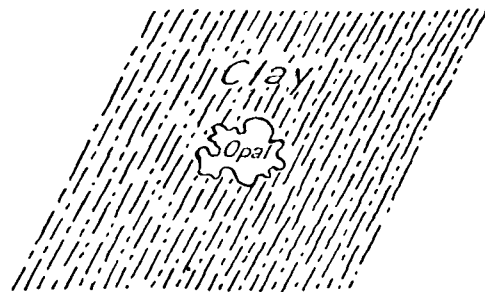
The Union Mine is 3 miles from Stoney Creek, and is said to have produced £200 or £300 worth of opal. There are also all within a radius of a few miles workings known as the Scotch Lass, the Last Chance, and Fort Hill, from all of which occasional stones are obtained by prospectors.

The Exhibition Mine is 6 miles west of Stoney Creek. Precious opal was first found here fourteen or fifteen years ago, the original prospector or discoverer being probably E. Bourke, and after being

abandoned by him it was taken up by the South-western Queensland Opal Company in 1889. The actual value of opal obtained by the company before they ceased operations must have been several thousand pounds.

Opal, occurring in rather an unusual manner, was recently discovered here by the original owner, who returned to work the mine in September, 1901. The original workings are situated on the slope of a hill, the top of which is composed of a bed of hard sandstone about 12 feet thick, and immediately beneath it is a bed of extremely compact clay about 7 feet thick. This clay, which is stained by oxide of iron, contains a little magnesia, and its fractured surface has a rather greasy feel.

Precious opal of very good quality is now found occurring in the mass of this clay in small irregular-shaped, pea-like segregations as large as a quarter of an inch in diameter, thus—



Opal in Clay—Exhibition Mine.

occurring, perhaps, as frequently as three or four to the cubic yard.

The mine is unfortunately very badly placed for water, &c., the nearest supply being at present in the old shafts at Stoney Creek, 6 miles distant. It was in October last being worked by one man, who walked this distance twice daily carrying with him necessary water and provisions.

The next main camp is that known as the Fish Ponds, and derives its name from the dam on Keeroonghoola Run, which as a water supply is the ultimate resource of the miners in the district, though by no means absolutely permanent. There are no camps actually round this dam, but several of the mines obtain water therefrom by carting, and it forms a convenient base from which to reach any of them. The dam is situated about 13 miles N.W. of the Gum Holes, and 24 miles south of Keeroonghoola Station.

The Friday Mine is 7 miles N.W. of the Fish Ponds Dam, and is situated in what is known as Friday Creek or Friday Gully, but, like many other so-called creeks in the district, it is difficult to distinguish any fall in the country or anything to mark its course.

The opal is found in a sandstone band, and mining operations are almost entirely carried on by open surface works along an opal-bearing sandstone band, where owing to the false bedding of the strata

it crops out at the surface, having a strike approximately N.W. and S.E., and a dip of about 10 degrees. A number of shafts have been sunk at the back of the outcrop up to a depth of 15 feet, but nearly all the opal was obtained at the shallow depth of 4 or 5 feet, and the value of the total production is supposed to have been about £1,000.

There is generally a small camp here on account of the supply of water which is obtainable from the shafts.

The Breakfast Creek Mines are 6 miles N.N.W. of the Friday Mine, but there being no available water they have been abandoned for the present. These mines were also one of the properties held by the South-western Queensland Opal Company in 1889. Some of the gems which were obtained from here were of the very finest quality, but unfortunately the locality is particularly affected by dry seasons, and there is said to be never more than a few months' supply of water. In fact, the same may be said of the whole of the N.W. portion of the Coleman Range, where the deposit is situated, and where there are several others which have yielded very fine opal.

At the present time none of this country can be prospected, and the minimum rainfall of only 2.5 inches was recorded last year (1900); the mean fall is 10 inches.

Coleman's Cave Mine is also in the same vicinity, and was worked for boulder opal, but the sandstone was hard, and it has been deserted for a good many years. These deposits were those referred to by Mr. Jack in the Geology of Queensland as being in the neighbourhood of Costello Creek.

Pitt's Mine is $1\frac{1}{2}$ miles east of the Friday Mine, and is worked for sandstone opal. The clays are very solid, and contain in places small lenticular beds of soft sandstone or sandy clay in which good opal has sometimes been found.

The gems from here are of very good quality, and the total value obtained up to the present is about £120 worth. The men working there, however, were on the point of abandoning the mine in October last, the water supply having given out.

Hausington's Mine, or the Havelock Mine, is situated $5\frac{1}{2}$ miles north of the Fish Ponds, or about 20 miles south of Keeroonghoola Station. Next to the Great Extended, at the Yowah Field, this mine is at present the most successful of the opal mines, and is owned and worked by Westhead and Party, in all four men.

The mine was first worked by Hausington, who had to leave on account of the drought, and the present owners began work in June, 1901. For the six months to the end of that year they obtained a little over £500 worth of opal, and the total production of the mine is said to be about £2,000. It is situated on the southern slope of a spur which runs in a N.E. to S.W. direction, and the country drains into Keeroonghoola or Costello Creek.

A great variety of different kinds of opal is obtained, some being of very good kind, but the mine is remarkable for the quantity of saleable opal yielded rather than the quality. The ridge or spur on which it is situated is of similar formation to the numbers of others already described, the capping of porcellanised clay being from 10 to 15 feet thick. The deposit has been worked by a tunnel driven at the junction of the sandstone beneath it with an underlying clay. The characters of the sandstone at the junction is precisely similar to that described at the Mascotte Mine, but the clay is not quite so hard and in places rather loose and sandy. The opal is found almost entirely in the clay, in these loose sandy patches, and both there and in the sandstone there is a strong tendency to the formation of concretions of siliceous iron, which contain opal. The clay also contains a little magnesia, and is somewhat damp and greasy to the touch. A good deal of driving was done before any opal was obtained. The tunnels and drives are very extensive, amounting in total length to fully 400 or 500 feet, and in contrast to most other opal mines this one has been much more efficiently and extensively worked.

I believe the greater success obtained here to be largely on this account, which tends to show that if the miners would combine their efforts for work on a more extensive scale more opal would be found.

Baker and Connell's Mine adjoins Hausington's on the south, and is worked by three men, who have put in about 100 feet of drives. So far, however, only very little saleable opal has been obtained.

Scanlan's Mine is about 6 chains to the N.E. of Hausington's; and the *Aurora Borealis Mine* about a quarter of a mile east, but the amount of opal obtained from either did not exceed £50 in value.

This group of workings, which are so close together on the junction of the same bed of sandstone and clay, and from only one of which any appreciable quantity of precious opal has been obtained, is a striking illustration of the patchy nature of the occurrence of the gem.

The main camp of from twelve to sixteen men is situated in the immediate vicinity of Hausington's Mine, and water is carted from Catho, a fine waterhole 5 miles to the N.E. on Keeroonghoola Creek.

Stanley's Mine is another very old deposit not far from this spot.

The Jundah Opal Field is 17 miles W.N.W. of Jundah township, but the nearest distance by road is by a roundabout route of 25 miles. This field is situated in the Opalton Mining District. Precious opal was being obtained at Jundah for some years before 1888, but the bulk of the work was done about 1898, when the drought was being severely felt elsewhere, but when, there happening to be feed for horses in the mining reserve of this district, there was an influx of men from other fields where conditions were less favourable.

In 1900 there are said to have been about 100 men on the field. Most of the work done here has been concentrated at two points which are known as the Old Field and the Black Mine, which adjoins it on the east. The workings are all on a large flat of soft sandstone country, and the composition of the strata is very similar to that described at the opal-fields further south. The workings vary from a few feet up to 30 or 40 feet in depth, the greatest thickness of strata being at the eastern end of the Old Field and at the Black Mine.

At the Old Field, often called the *Top Flat*, opal is found in the hardened base of the sandstone and in the clay, and the usual thickness of the ferruginous casing of siliceous ironstone which separates them is about a quarter of an inch. The base of the sandstone also contains, in many places, a large quantity of clay in lumps or nodules—the so-called mottled or “cuckoo” stone. The band here, of variable texture, is composed of angular fragments cemented by partial silicification, and it occasionally exhibits signs of bedding, which, seen in the section, show in the form of fine black lines like pencil marks, the colour being due to the presence of oxide of manganese. It is then known as “pencil band.”

Precious opal is also found here in what are known as “brick pipes.” These are of approximate cylindrical shape, and vary from $\frac{1}{8}$ inch to 2 or 3 inches in diameter, and are often 5 or 6 feet in length. They are filled with a hard siliceous, clayey material, coloured by oxide of iron, which has very much the appearance of red brick. Common opal ramifies through them in all directions. These brick pipes very probably owe their origin to trunks and portions of trees which have become replaced by opalising solutions and fragments of the enclosing rock. Lenticular beds of gypsum also occur in the sandstone and clay.

Boulders are to be seen in the overlying sandstone, but as far as I could learn very little precious opal was ever obtained from them.

The Black Mine is about half-a-mile to the east of the Old Flat, and conditions are here very similar, though the mining is somewhat deeper. The same brick pipes occur here, and they are sometimes found passing out of the sandstone into the clay beneath. Sometimes also the opal is found in veins in the band surrounded by a black casing or margin coloured by oxide of manganese, and similar to that at Quart-pot Creek. These workings are of very considerable extent, and the shafts and mullock heaps are scattered over 8 or 10 acres.

The Old Field was getting worked out, and the Black Mine, which has since been the principal producer, began to be worked in 1893. As far as is known, the largest find of opal of about £3,000 in value was made in 1899 at the eastern end of the Old Flat. The production of the field for 1901 is estimated to be nearly £1,300, and this is exclusively from the Black Mine workings, and includes £800

from a number of shafts on that portion known as Johnson's Claim. The gem stones obtained here are certainly of very fine quality.

The existence of a fairly large camp on this field for a number of years—a fact, however, partly due to there being generally grass and water for horses within reasonable distance on the mining reserve—is evidence in favour of its permanency as a centre of opal-mining. The want of water for ordinary use is nevertheless keenly felt; and, owing to the great distance west of the railway terminus, the price of rations is very high. The water for drinking is now derived partly from a small spring $3\frac{1}{2}$ miles to the S.E. by carting, and partly from the “Gibber Holes,” 11 miles distant, and it is only the fact of there being horse feed within a reasonable distance that enables this carting to be done. There is also a supply of water used for washing, &c., obtained from the old shafts, but this contains too high a percentage of the salts of lime and magnesia for drinking.

There are generally from fifteen to twenty-five miners in the camp, and also women and children.

Mick's Mine is 11 miles west of the Jundah Field, and is supposed to have yielded £170 worth of opal; and *Tomkin's Mine*, 8 miles, £150 worth. *The Tommy Dod Mine* is about 13 miles west of the Jundah Field, *The Magic Mine* 30 miles N.W., and *Dyson's Mine* 5 miles S.E.

There are also some prospecting operations in progress about 50 miles E.N.E. of Jundah on the Johnstone Range, between Swan Vale and Mount Marlow.

The Opalton Field often called the Fermoy Field, is about 100 miles further north. The nearest railway terminus is Winton, from which the field is situated in a direct line 60 miles S.S.W., but it is almost just as easily reached from Longreach. This field is also in the Opalton Mining District, on Warnambool Downs Run, the mean rainfall being 12 inches, and the minimum 3·5 inches.

The Opalton deposit, which was one of the largest and most extensively worked in Queensland, was discovered in 1888, probably by some stockman of Warnambool Downs finding opal on the surface. The gem, however, was found before this date at Horse Creek, some 28 miles to the south-west, which deposit was being worked in 1888.

No opal-mining of any importance was done at Opalton until 1893, when some specimens were brought to Fermoy Station, and a man named McLenan went out and commenced operations at what is known as the “Brilliant Claim.” As a result of this first activity about £800 worth of opal was obtained. Other finds were made, and Conway's Claim was discovered in 1895, and a small rush took place. In 1896 there are said to have been between 500 and 600 men on the field. The rush was partly due to the good seasons prevailing, and with abundance of horse feed and water available, the township was in a flourishing condition.

The value of the total production is a matter which can only be guessed at, but it would not be very far from the mark to say that it must have been at least £30,000 or £40,000. The field, however, is now practically abandoned, and, save for a few old residents, the township is deserted.

The police have been recalled, and there are not more than eight or ten miners living at the old camp. A good many of them are engaged in searching the old mullock heaps for stray stones. There are several outlying prospecting camps for which Opalton still forms a centre, but the whole number of miners engaged in the district is only about forty-five.

The topography of this field is very similar to that of Jundah, and the shafts, which are of about the same average depth, were sunk through a similar soft sandstone to the clay beneath. Boulders are found in the sandstone, and weathering out on the surface. The greater proportion of opal was won here from the old flats just to the east of the township, where the workings or mullock heaps cover from 60 to 70 acres, and different portions of these flats are known by various names of local significance. One of the richest claims was probably that known as the "Little Wonder," and the flat in this vicinity for 8 or 10 acres is practically all worked out. The Little Wonder Claim yielded opal to the value of £4,000.

Most of the mineral at Opalton occurred in the ordinary sandstone band, but the "brick pipes" and "pencil band" of the Jundah Field were also found. Numbers of other claims lie to the east of the Little Wonder, amongst others the Brilliant, from which the first gems were won.

Conway's Claim is about a mile from the old flat towards the east and south, and was a very rich deposit. Nearly all the mineral was found in one claim, which is now surrounded by shafts which extend over nearly 3 acres.

The Bald Knob Workings are about 4 miles east of Opalton, and at present two men are engaged there. A good deal of work was done here some years ago for an output of £1,000 worth of opal. A great deal of common opal or "schnide" was also obtained, some of it, though opaque and cloudy, being of very fine appearance. A parcel of it is said to have been sold and sent to Germany for making beads.

The Opalton miners have all been following the occupation for a number of years, and most of them are provided with a lapidary's wheel, wherewith they cut and polish their gems. The field is dependent for its water supply on the waterholes of a small creek which drains into Blue Bush Creek, a tributary of Vergemont Creek, the waters of which flow to the Thompson River. The supply from these holes is very poor, having at different times completely given out, and water has been carted as much as 14 miles.

A number of Opalton miners recently determined to examine the country to the south of Opalton, and for this purpose moved their camps to

a place called Mayneside, an old out-station where there is a large waterhole, and where they intend to work in the vicinity of Horse Creek and Hyde Park Creek. Not much had been accomplished up to the beginning of December last, but it was hoped that with the season of storms approaching they would be able to operate in a number of localities where work was carried on some years ago.

The Horse Creek Mines are 25 miles south of Opalton in a direct line, Horse Creek being a tributary of Hyde Park Creek, which runs into the Mayne River, ultimately to the Diamantina. As already stated, this is the locality where opal was first discovered in this district, probably the oldest mine being that known as Cragg's Mine, worked in 1888. The Poison Mine, Carlyle's Mine, and several others in the vicinity of New Year's Creek are about 7 miles further south.

The waterhole at Mayneside forms a convenient base from which these may be reached, and where there were from fifteen to twenty men camping in December last.

The Kynuna Field is in the Windsor Mining District, 18 miles south of Kynuna township, or about the same distance west of the New Dagworth Station, and is accessible by road from Winton, the nearest railway terminus. It is situated on an area of Desert Sandstone lying between the heads of Cadell Creek and Crescent Creek, the country being drained by the latter. At the present time (January, 1902) the field is quite deserted on account of the scarcity of water, the nearest supply being that of Dagworth No. 1 Bore, about 10 miles distant. Several miners were working the field at the end of 1901, but had to abandon it, leaving their drays, tools, and appliances until rains enable them to return. The field was discovered about the year 1894 by Peter Karff, a prospector of the district. Karff's claim was afterwards sold to the owner of Dagworth Station, who floated a company to work it, but their operations did not meet with very great success. The total production from this deposit since its discovery is supposed to be about £3,000, and that for the past year is estimated at about £50.

The composition of the strata is here similar to that described at Opalton and Jundah, the siliceous capping of the surrounding hills having a thickness of from 20 feet to 30 feet. A fine typical example of the occurrence of this rock is to be seen between the opal-fields and Dagworth, where the capping remains like a castle on the apex of Pinnacle Hill.

The shafts at the Kynuna Field are, as a rule, quite shallow, but there are two or three which are from 20 to 30 feet deep.

The field has never been very extensively worked. The chief workings are those known as the Company's Claim, Macpherson's Claim, and Stuart's Claim. There is also a claim known as Hudson's, which is the most westerly of the workings, and which was worked for boulder opal, boulders being very numerous, weathering out on the slopes of the spurs in the upper portion of the sandstone.

Opal from the other claims was all obtained in the usual way from a hardened sandstone band, which had the characteristics of that found at Jundah. A little prospecting has also been done on the Desert Sandstone ranges, about 3 miles south of the new Dagworth Station, but though a good deal of common opal was obtained, not more than perhaps one or two small gem stones. There are some surface workings and also a few shallow shafts, sandstone opal being sought for.

The so-called "red brick pipes" of Jundah are also found, and in some cases here portion of the original tree structure can still be seen, thus furnishing an interesting example of their derivation.

THE SPRINGSURE OPAL DEPOSIT.

The Springsure Opal Deposit is situated about three-quarters of a mile S.W. of Springsure, which is the terminus of a small branch railway running from Emerald on the Central Railway. Springsure is situated about centrally in a small area of basaltic rock, which is shown on the State geological map to extend in a N.W. and S.E. direction for about 45 miles, and to have a mean width of about 16 miles.

The deposit of precious opal here is interesting, as being entirely different from those previously described, the opal being found as amygdaloids in a vesicular basalt or trachyte. Moreover, the deposit is also interesting as being the only occurrence known in Queensland where the gem is found under similar geological conditions as in other parts of the world—i.e., the famous Hungarian mines, where it occurs in an amygdaloidal andesite, and the Mexican mines, where it is found in a similar manner in a porphyritic rock. The Hungarian mines are situated at Dubrick and Cservenicza, on the eastern slope of the Labanka Mountains, the workings and waste heaps stretching for nearly $1\frac{1}{2}$ miles. While the Mexican and Honduras stones, which are beautiful when new, but soon lose their beauty, are found at Esperanza, Amaeleo, and Real del Monte. Opal occurring in a somewhat similar manner is found in New South Wales near Rocky Bridge Creek, and in several other parts of Australia. Valueless varieties of opal and hyalite in basalt are of common occurrence.

The opal-field at Springsure was probably first discovered in 1872 by O'Brien, an employee of Hinton Bros., storekeepers at Springsure. It was afterwards held under a lease by F. Batho, the officer in charge of telegraphs there, at a rental of £18 per year. This lease expired in 1896, and since then work has only been done spasmodically by casual prospectors. Batho is supposed to have sold gem stones from here on two occasions in London, in 1879 and 1886, and a gem sold in 1886 is said to have fetched £150. It is believed by some that this stone really came from Rainworth, near Wheeler's selection some miles distant.

The main deposit near the township is situated close to the Tambo road, at the top of a spur which runs in a S.W. and N.E. direction. The height of this spur is about 230 feet, it being composed of lavas and tuffs, and the opal is found in the more acidic lava which forms the capping, the volcanic focus of which was probably Mount Boorambool, which lies just to the north. The trachyte contains in many places large numbers of vesicular cavities, small thin veins and cracks, &c., filled with the different varieties of opal, which have been formed by infiltration of siliceous waters from the rock mass. The common forms are very plentiful, but occasionally the opal in the cavities is of the precious or noble variety, and gems so found are said to exhibit very brilliant colouring.

So far as prospecting has gone at present, they have been of rare occurrence, and though this opal rock is of very considerable extent, it is doubtful whether it would pay to work for opals commercially. As very little work has ever been done on the deposits, however, they seem to be worthy of further attention by prospectors, as it is possible that if the rock were properly opened up, the gems would be found to be of more frequent occurrence. The work done up to the present has been chiefly confined to breaking the loose pieces of rock on the surface.

There is another similar deposit of opal in the basalt about 9 miles from Springsure, close to the Taroom road. This deposit is about 300 yards from Wheeler's house, just over the boundary fence dividing Wheeler's selection from Rainworth Run.