DEPARTMENT OF MINES
SOUTH AUSTRALIA

ADMINISTRATION BRANCH

A REVIEW OF THE OPAL MINING INDUSTRY IN SOUTH AUSTRALIA

Compiled by C. M. Willington, 1962.

DEPARTMENT OF MINES
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Compiled by A. H. Dutton from notes prepared by C. M. Willington, Mining Engineer in 1962.

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INTRODUCTION

The need for a current review of the opal mining industry in South Australia arises from the vast economic and other changes which have taken place, either directly or else indirectly, affecting the industry during the past decade, in particular during the past seven years, wherein the value of crude opal production from the South Australian fields alone, has increased from less than £100,000 annually to a current production value of £1,000,000, and represents more than 95% of the total Australian production. This phenomenal boost to the industry has in the main been due to the entry of Japan to the opal consuming market, and to a significant, but far smaller, extent by the increased buying interest of the West German Republic, and the United States of America.

Prior to 1956 little or no Australian opal was sold direct to Japan, but subsequently, and in keeping with the ever increasing economic prosperity of this country, the market has grown to the extent that Japan for the past five years has been the principal consumer of Australian opal, and is currently purchasing 70% of total annual production, practically all in the form of rough and uncut stone. A common but erroneous belief is that this commodity is for re-export, following cutting and polishing, utilizing the advantage of cheap local labour. Although a certain amount is re-exported as cut stone to the United States, the bulk, mainly in the form of high quality stone is retained in Japan for local consumption.

This vast increase in demand for opal, attended with some degree of price increase, has attracted a large increase in population, particularly of New Australian origin to the South

Australian fields, which have now reached world prominence as the foremost sources of opal. Whereas in the past when the industry was of little or no economic or political importance, and presented few civic and administrative problems to cater for the comparatively few prospectors and miners engaged in the industry, the pattern has changed to the extent that recognition must be given to the need for review of mining legislation, civic and other matters of Government administration affecting the industry. The prime purpose of this investigation has been concerned with such problems, and government action has already been taken to put into effect some obvious needs which pertain to the industry.

A considerable number of reports, bulletins, and publications compiled by the State and Commonwealth Geological Surveys of Australia exist relating to the opal mining industry dealing in particular with the historical, geological, mining, economic and statistical aspects, relevant at the time of publication. Reference has been made to many of these reports as listed in the accompanying bibliography, and reiteration made, insofar as the subject matter remains unchanged, and also to provide a brief descriptive background on the occurrence and nature of opal, and the history of its mining in South Australia.

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COOBER PEDY OPAL FIELD

Locality and Accessibility

The Coober Pedy Opal Field is located at Lat. 29° 2' Sout Longitude 134° 48' East. Approximately 583 miles from Adelaide by road via Port Augusta and Kingoonya, and 180 miles north of Kingoonya railway station on the Commonwealth transcontinental line

The field is readily accessible by road with orthodox motor vehicles, although caution is necessary during infrequent periods of wet weather in traversing the stage between Kingoonya and Coober Pedy. An alternative shorter route is via Woomera and Mt. Eba, but prior permissions must be obtained to travel through the restricted area of the Weapons Research Establishment.

An aircraft landing strip at Coober Pedy is in use regularly by charter and private aircraft.

The field is served by a weekly mail service and radio telephone communication link; several provision, general and hardware stores and primary schooling facilities for children. A floating population of several hundred aborigines is administered by the Department of Aborigines.

History

Reference is made by the South Australian Government Geologist in 1904, vide "Record of the Mines of South Australia" 1908, to the occurrence of opal in Upper Cretaceous beds over a wide area in this region, similar to the opal horizons in New South Wales and Queensland. Charlie Swamp (Stuart Stuart's Range) J.J.

Influenced by the arid climate, lack of water and the Stewart's Range table land, beneath which the opal horizon occurs was not given serious attention until the Transcontinental railway was constructed, allowing more ready access to the field.

Whilst some exploratory work was undertaken during the latter years of World War I, 1915-1918, it was not until the post war years with re-establishment of a market, and return of servicemen that the field engaged a mild boom, reaching a production peak of opal valued at £24,000 in 1920.

To alleviate the acute shortage of water a half million gallon underground storage tank was constructed by the State Government, but because of prevailing drought, was not filled until 1926.

The post-war boom, however, was short lived and influenced by the world economic depressions of 1922 and the early 1930's, opal mining at Coober Pedy remained normally dormant, production never exceeding more than several thousand pounds in value annually, until 1946 at the termination of World War II, when world markets were re-established, production rose to an all time record value of £54,000 and has progressively increased to a current annual output value from the field of £412,000.

Population of the field over this period has increased from less than one hundred to a present total of approximately 700 people including a floating population of several hundred aborigines.

Geographical

The present extent of the Coober Pedy field being worked is over an area 20 miles N.S., and 10 miles E.W. but this comprises a small portion only of the Stewarts Range table land, the whole of which is potentially opal bearing.

The Stuarts Range escarpment 750 ft. above sea level extends 70 miles continuously in a NW - SE direction, with a sharply dissected and embayed escarpment to the North East, from which drainage flows to Lake Cadabarrawirricama, and a gentle South West slope and drainage to Lake Phillipson and lesser lakes and claypans. Rainfall is low, approximately 6 inches per annum and droughts are frequent. Day summer temperatures exceeding 100°F over protracted periods from October to March.

The area is bare of timber and vegetation within a 20 mile radius of Coober Pedy.

As there is no permanent surface water supply and local ground water is too saline for domestic use, reliance is placed on the Government underground water storage. With a succession of

drought years, this supply becomes inadequate to supply the present population and cartage of water from a bore at Mt. Willoughby 90 miles distant becomes necessary.

Occurrence of Opal

As at Andamooka for which see later, the opal horizon is comparatively flat and occurs in Cretaceous clays and sandstones at a depth of 70 feet below the uneroded areas of the table land, which is capped with quartzite "gibbers" as a mantle overlying approximately fifteen feet of hard quartzite and sandstone.

Where the table land is eroded and dissected by gullies this hard capping is eroded away so that the opal horizon may be encountered at a comparatively shallow depth of a few feet. Such conditions are encountered on the "Flat" one mile north of the town area, whereas at the "Eight Mile" field, to the west the opal horizon is at depths of from 50 to 70 feet.

The principal opal horizon occurs in a ferruginous sandstone and may range in thickness from a fraction of an inch up to 2 inches. Overlying the opal horizon is a siliceous claystone, containing seams of gypsum up to 18 inches in thickness.

Minor faulting has influenced the location of the gypsum horizon over a depth of several feet, and quite often a rich deposition of opal is found in association with the fault movement.

Within the opal bearing sandstone, another but lesser horizon has been observed in places at the "Eight-Mile" field. It is understood that vertical seams occasionally branch away from the two horizontal opal seams.

One reason for the apparent lack of prospecting outside of the known opal bearing area is the acute lack of water supply. Rainfall is less than 6" annually; there is little or no permanent surface water storage, ~~so that dependence is upon ground-water supply from Opal Creek, the main drainage channel which comes through the field. With the growth in population during a succession of drought years, this source has been overdrawn to~~

~~the extent that current water supply from a succession of mills and bores currently amounting to no more than 7,000 gallons per week. On occasion it has been necessary to supplement this supply with water brought in by tanker from Woomera, a distance of 80 miles, at a cost of £10 per 1,000 gallons.~~

Under such severe arid climatic conditions it is not practicable for prospectors to extend their activities far afield from such limited water supply.

ANDAMOOKA OPAL FIELD

Locality and Accessibility.

Andamooka Opal Field is located at Lat. 30° 26' S, Long., 137° 10'E. approximately 385 miles N.N.W. by road from Adelaide, and 85 miles by road from Pimba, the nearest railway connection on the Commonwealth transcontinental railway line.

The field is readily accessible by road, with orthodox motor vehicles, although caution is necessary during infrequent periods of wet weather in traversing the final 30 mile stage; over which the road traverses sand dunes and cane grass, swamp land. An aircraft landing strip has been constructed at Andamooka, which is regularly used by private and charter aircraft.

The field is served by a weekly mail service, and radio telephone communication links, several provision and hardware store primary schooling for childded, and is embraced in the Royal Flying Doctor medical service network.

History

The field was discovered in 1930, and was worked continuously by a small group of prospectors until 1952 maintaining a nominal output value of less than £20,000 worth of opal a year. During the past decade, however, influenced by the increased overseas demand for opal, activity has progressively increased to a current annual output value of £350,000, and population growth from less than 100 to a current 650 people.

A locally formed and active body, the Andamooka Progress Association, has been responsible for the introduction of amenities

and services now established on the field.

Geographical

The known opal bearing locality is a tableland approximately 200 feet above sea level, sharply dissected by erosion gullies in which the initial discovery of opal floaters was made. Surface topography is of low relief, with parallel sand dunes, trending NE to SW a prominent feature. Drainage is to claypans and cane grass swamps between the sand dunes. Opal Creek, the principal drainage channel through the field flows NLW. to the head of Lake Torrens, 8 miles distant.

The climate is semi-arid; rainfall averaging less than 6 inches a year and summer temperatures from November to March, frequently exceeding 100° F. during the day. On this account many people leave the field for the summer period.

As there is no permanent surface water supply, reliance is placed on underground water, and such quantities as may be caught during the infrequent periods of rain from the roofs of dewllings.

Residents of the opal field depend almost entirely on the ground water supply from Opal Creek, the main drainage channel which courses through the field. With the growth in population over a succession of drought years, this source has been overdrawn to the extent that current water supply, drawn from a succession of wells and bores along this creek amount to no more than one thousand gallons per day of brackish water. On occasion it has been necessary to supplement this supply with water brought in by road tankers from Woomera, a distance of 80 miles, at a cost of £10 per thousand gallons.

Occurrence of Opal

The most recent geological study of the occurrence of opal on the Andamooka field is contained in a report by L.G. Nixon vide Mining Review No. 109 December, 1958.

The known and proved extent of the opal horizon extends no more than within a three mile radius of the initial discovery with beds dipping radially at a very slight angle towards the centre of the basin.

It is likely that there are repetitions of such opal bearing structures over a very broad areas, of some hundreds of square miles.

The opal horizon occurs in Cretaceous shale and clay at a depth of 70 feet below the tableland duricrust capping. Over most of the area, however, this capping has been eroded away, so that the opal horizon is encountered at depths of a few feet up to fifty feet in depth, depending upon the degree of erosion.

The main opal horizon is characterised by a conglomerate bed, overlain by a seam of massive gypsum. The opal occurs as seams more or less horizontally disposed in the shale immediately underlying the conglomerate.

Minor faulting with a vertical and horizontal component of a few feet has influenced the horizon position of the opal in some localities, but in general, the opal bearing zone, together with the marker, gypsum and conglomeratic beds is contained within a depth of five feet or less.

ORIGIN OF OPAL

Since the initial discovery of opal in Queensland, and New South Wales during the 1890's and later in South Australia, a number of hypotheses have been advanced relating to its origin. All of the Australian fields have several features in common, in as much as the opal horizon occurs in association with Cretaceous clays, sandstones and conglomerate; level of the opal horizon in the Cretaceous sediments is comparable; opal bearing localities are all situated in arid regions of low rainfall, and topography of the country is similar, i.e. advanced weathering and erosion of the Cretaceous sediments into mesa like table topped, outliers and embayments.

One or more of these factors have formed the basis for the hypotheses of opal origin; but current thinking is that widespread lateritization occurred during Miocene time over the enormous area of the marine gulf extending from the Gulf of Carpenteria to the Great Australian Bight and embracing large areas of Queensland, New South Wales, Northern Territory, Western

and South Australia, in which all of the known opal fields are situated.

Prior to lateritization widespread differential movement of uplift and depression occured, giving rise to both lacustrine and marine conditions on the old Cretaceous gulf.

PRODUCTION AND MARKETING OF OPAL

The prime concept that must be born in mind relating to production, marketing, or any form of control in the opal mining industry is that opal is purely a luxury commodity; it is of no strategic value; has no commercial use; is subject to value fluctuation with the whim of fashion, and is saddled with a significant degree of prejudice and superstition as an item of adornment.

Unlike the precious metals, and less common gem stones, which have comparatively stable and recognisable standards of value, opal varies so widely in physical quality and form that no set standard of classification or value can be assigned to it, consequently value can only be assessed by "sighting". Again value assessment can differ markedly even between experienced opal buyers and dealers.

Value depends upon several basic physical characteristics of the material.

Color

Opal may contain the full range of the spectrum in color, or else one or two colors may predominate, particularly green and blue. Preference is for an even blending of colors, none predominating. There are exceptions however, and furthermore colors acceptable by one particular market may not coincide with the preferred color, or range of color acceptable elsewhere.

Color Pattern

Possibly dependent upon the amount of water contained in combination with the silica, and the difference in the refractive indices of the layering structure formed during crystallization of the opal, the internal reflective facets appear

as pinpoints, or diamond shapes, selectively reflecting different colors. This optical effect referred to as "pin fire" and "harlequin" is a much prized characteristic.

Fire

The degree and intensity of the above pattern is referred to as "flah or "Fire", and the more pronounced this characteristic is the greater the value of the opal.

Soundness

Colorless and opaque bands or streaks, and included stains, detract from the value of opal, as also do cracks and flaws. Opal from some localities is prone, with the course of time to develop a net work of hairline cracks, or "crazing", and may even fracture due to relief of internal stress during the cutting and polishing process.

A single piece of opal as mined may vary so much in the above basic characteristics, that after trimming and classification the various pieces will range, on present day value for rough uncut opal as sold on the fields, from 10/- to £200 per ounce, Troy weight.

Size of stones relative to the above basic specifications is not of paramount importance, although with all other factors considered, larger stones command a greater unit weight price in general than do smaller stones. Opal on rare occasions has been found in pieces up to several pounds in weight, but from these pieces several stones are usually cut. A particularly large stone may measure $3\frac{1}{2}$" by 2" by $\frac{7}{8}$" thick, and weigh up to two ounces, or as is more usually expressed for cut stone weight, 300 carats. Value of such a stone, dependent upon its appearance could range from £2,000 to £10,000. At the lower end of the scale, preferred size of stones ranges from 2 to 100 grams, i.e. approximately 10 to 500 carats, from which solid ring stones 12 mm by 8 mm can be cut. Rough stone of less than one gram, or five carats in weight, unless it has particularly attractive qualities, is about the lower limit of saleable individual stones. Below this weight material is regarded as chippings, and may

command a value of several shillings per ounce only.

The above statement is intended as an approximate yardstick of size, weight, and value of opal only. The commonly used standards of weight, and dimension in the opal industry are Troy ounces for uncut rough opal as mined; 12 ounces Troy = 1 Pound Troy = 0.822 Pound Avoirdupois. Particularly valuable rough stone and stone in the cut form, is sold by the carat, and sometimes by the gram;

One ounce Troy = 155.5 carat = 31.10 grams.

Dimensions are expressed both in inches and millimetres;

One inch = 25.4 millimetres.

Whereas gem stones such as diamond, sapphire, and others with a high refractive index, are cut with a variety of facet patterns to take advantage of internal light reflection, opal is invariable cut and polished to a lozenge, oval or elliptical presentation shape to take advantage of the multi colored reflection from a particular band or bands within the stone, also as it is a brittle and comparatively soft stone, ingenuity must be exercised in its mounting, and resort is often made to backing thin stones with either dark opal or glass for reinforcement, and to accentuate the natural play of color from the stone. Such stones known as doublets, although quite often equally or more attractive in color than a true solid stone, are much less highly prized. This is particularly so in Japan, our principal market.

To the layman valuation of opal in, both the rough and cut form can be most puzzling. Even experienced valuers will disagree on opal parcel valuation at times, and a particular parcel may be the basis of several buying and selling transactions before reaching the ultimate consumer. This is partly apparent in the valuation difference between rough opal as purchased on the field, and the declared value for export overseas. For example, the value of opal mined and sold from the South Australian fields to opal buyers, in accordance with their annual returns, during the past five years from 1957, amounted to £2,157,000 approx., but the value of opal, of which a very large majority was in the rough and

uncut form, exported during the same period to overseas markets, in accordance with the Commonwealth Statistician's returns amounted to £4,402,000 approx.

This value comparison is not statistically correct inasmuch as it is not possible to account for the following;

1. Opal exported in the cut form.

   No specific figures are available on the export of cut opal. The quantity however, would appear to be very small, in as much as the principal consuming countries apply an import tariff to cut stone, and the majority of overseas consumers prefer rough stone for cutting to their own specification..

2. Opal consumed within Australia.

   Again no specific figures are available. Consensus of opinion, however within the industry is that the quantity would not exceed £30,000 per annum. This is confirmed by the comparatively small number of lapidaries and cutters fully employed on opal cutting in Australia. The tendency however, is for an increase in the popularity of opal for jewellery in Australia.

3. Parcels of opal returned unsold by overseas buyers.

The accompanying Tables (1) and (2) show, the annual value of rough opal produced from the South Australian opal fields over the past decade, and the annual value of opal exported from Australia over the past decade. Over 95% of the opal exported originates from South Australia, but most of it is exported from Sydney, N.S.W. which is the principal overseas air terminal, further the principal opal buyers and dealers have their business premises in Sydney. Comparatively small quantities only, are exported from the other states.

It will be noted from a study of these two tables, that since initial entry of Japan into the Opal market in 1956-7 production and export have increased almost ten fold, with Japan as the outstanding principal market, taking at present over 70%

of the total Australian production of opal.

REVENUE FROM OPAL MINING

This matter has been the subject of a separate report, contained unpublished in D.M. 2062/58. For the sake of completeness however, and continuity of the previous subject, "Control of Opal Mining", the matter is summarized.

Existing Mining Legislation in South Australia, makes no provision for payment of Royalty to the Crown on opal won from mining operations. The only revenue at present accruing is from the issue of Miner's Rights, 5/- per annum, and registration of precious stones claims, for a present nominal fee of 2/6. Total revenue amounts to an insignificant amount of several hundred pounds annually, offset against which is an administrative Departmental expenditure annually of several thousand pounds.

If royalty on opal was levied at the more or less uniform rate of sixpence in the pound, or 2½ per cent of the gross value of rough opal as mined on the fields, as is applied to all other minerals in South Australia, then the current annual amount of royalty from opal would be approximately £19,000 an amount more commensurate with efficient administrative costs, and a more sympathetic outlook towards improvement of civic facilities on the opal fields.

Although opal is purely a luxury item dependent upon overseas market demands, the trend does not appear to be diminishing, rather increasing, so it is quite likely that the industry can expect some degree of permanency, at least on its present scale.

OPAL BUYING

The large bulk of the opal mined on the South Australian fields at Andamooka, Coober Pedy, and Mintabie, is sold to regular buyers during periodic visits to the fields. A number of the well established buyers maintain business premises on the fields, or in some cases resident buying agents. A comparatively small amount of opal, both in the rough and cut form

is sold locally to tourists and travellers passing through the fields. All transactions it is understood are carried out for cash.

No doubt the regular buyers keep a record of all transactions made for business purposes, but it is most doubtful if any such record is maintained by the majority of miners on the fields.

Although miners are obliged to register claims within 30 days of pegging and provide the Department of Mines with a return of the opal won from such claim at six monthly intervals, the obligation is more honoured in the breach than the observance. For various reasons the majority of miners, particularly the New Australians, are loth to disclose any information relative to the amount of opal being won from a claim. This is understandable from the point of view of security, and self protection in a nominally policed remote community.

At the present time the only reliable statistics relative to opal sales are voluntarily provided confidentially to the Department of Mines by the regular opal buyers. There are approximately twenty known regular buyers of opal, whose individual annual purchases of rough opal range from several thousand pounds, to upwards of one hundred thousand pounds in the case of the principal buyers.

Several buyers are engaged in both mining, buying, and overseas selling of opal. Some buyers prefer to purchase and deal in the opal from one particular field, others purchase from all fields. Opinion among both miners and buyers varies widely with regard to the quality and popularity of opal from any particular field. Production value statistics indicate that during 1961, £412,283 worth of opal was sold from Coober Pedy; £350,444 from Andamooka, and £2,325 worth from the new field at Mintabie.

It is pertinent to note that more than fifty per cent of the total opal purchased is made by interstate buyers from Melbourne, and Sydney. If, as has been proposed on several

occasions, the sale of opal be controlled through the licensing and registration of opal buyers, the above factor must be taken into account, and provision made to facilitate interstate buying and transfer of opal.

Some overseas consumers of opal, particularly those from the Japanese market, have of recent years paid buying visits to the fields; buying transactions on such occasions have been conducted through resident opal dealers on the fields, or through the Australian agency representing the Japanese business interests in Australia. Few, if any purchases have been made by independent Japanese buyers on the fields.

CONTROL OF THE OPAL INDUSTRY

Since the findings of a Royal Commission appointed in 1901 to investigate, and make recommendations on the control of the opal industry in New South Wales, then in its heyday, a reiteration of control proposals in various forms have been advanced from time to time, relative to the industry in South Australia, New South Wales, and Queensland, and also the industry as a whole.

Few if any, of the proposals advanced, have been brought into being because of three main reasons. Firstly, the latent recognition that opal is purely a luxury commodity, almost entirely dependent upon selective and restricted overseas markets, which in turn fluctuate with periods of economic prosperity and depression, and that any control in the form of export tariff, embargo, price stabilization, or interference with the marketing structure as it has naturally developed, would stifle the industry. Secondly, the opal section of the mining industry in Australia has been of comparative insignificance economically, until the past few years, amounting in total production value for the whole of Australia to less than £100,000 per annum, an amount which by any means would not justify expenditure of public revenue for administrative control, even though the objective of such control be for the betterment of the industry. Thirdly, because of the large element of chance involved in opal mining,

coupled with the small nature of the mining tenures at present available, the industry is limited in appeal to the individualist, or small syndicate, with comparatively small capital outlay. Introduction of any form of marketing control is more likely to repel, than attract such individualists to the opal mining industry

Today the economic picture of the industry has entirely changed. Whereas there have been minor booms in opal mining in South Australia in the past, notably following World Wars I and II, of comparatively short duration, demand, and in turn production, has progressively increased more than ten fold to current annual values of £762,000 for crude opal production and £1,690,000 for export. Ninety per cent of this output is taken by the comparatively stable and economically prosperous markets of Japan, U.S.A. and Western Germany, which under present world economic trends are more likely to expand, than shrink, indicating a continuing sound future for the industry, which has risen to a degree of significant importance in the South Australian mineral industry as a whole.

Expansion, not only in South Australia, but other states, also, hinges entirely upon the demand of the overseas markets. Possibly some benefit may result from greater publicity being given to South Australian, or Australian opal in general, in existing and potentially new markets. This might be done to a limited extent by individual opal buyers seeking fresh avenues of sale in the normal course of business, or on a broader scale, through a Government instrumentality, such as our Trade Commissioners or Agents General. Expenditure of public funds upon such publicity, however, would not be justified unless a commensurate return would be forthcoming from the industry.

OPAL EXPLORATION, DEVELOPMENT, AND MINING METHODS

Since initial discovery of the South Australian opal fields arising from the finding of surface "floaters" of opal in eroded gullies and creeks dissecting the table land beneath which the opal bearing horizon occurs, prospecting and mining have

continued as a simple inseparable operation of either following the opal horizon by means of adits driven from the gully slopes, or by small prospecting shafts sunk from table land level to the opal horizon, a depth ranging from ten to in some cases, eighty feet, using the simplest of equipment comprising hand windlass, pick and shovel, shear blade, or similar knife like tool for gouging opal from seams or veins fortuitously encountered.

There was a natural tendency to prospect areas where the depth of sinking required was a minimum because, although the opal horizon once reached was readily recognisable even by inexperienced miners, no guiding evidence was found, or has since been found, except minor faults and slides, in some localities to indicate directional orientation or concentration of opal deposition. Consequently the lateral development of a find has been by "trial and error" sinking on adjoining territory resulting in indiscriminate rather than planned search. Quite often shafts would be, and still are, sunk to the opal horizon and then abandoned without further lateral exploration because promising indications were not immediately encountered. Such a practice is both wasteful and uneconomic and is evident among inexperienced miners and new comers to the fields. The fact that under existing mining legislation the holder of a Miner's Right is entitled to prospect a claim in this fashion for thirty days before securing legal title to the claim by registration for a present nominal fee of 2/6 places no intrinsic value on an unproved claim, and leads in some measure to wasteful and indiscriminate prospecting.

Because of the limitation of one claim, 150 feet by 150 feet to the holder of a Miner's Right, or in the extreme case the amalgamation of four such contiguous claims by four separate holders of Miners Rights, opal mining has remained the province of the individual miner or small syndicates. This factor which prevents the acquisition of large holdings by any one person or company, together with the large element of chance involved in opal mining has to some extent deterred the investment of capital in the industry with the object of systematic and large scale mining

and prospecting.

During the past five years mechanisation of opal mining to the extent of power hoisting with air or petrol driven winches, and digging and drilling with pneumatic and electrically powered tools has become general practice on the opal fields. Also the use of explosives to speed shaft sinking and breaking of barren ground has now become general. Outlay for such plant and equipment will range from several hundred to possibly two thousand pound well within the means of the successful individual miner or mining syndicate.

Several attempts are currently being made to further mechanise operations with underground mechanical cutting and loading equipment, and earth removal by trackless haulage from adit entries The success or otherwise of these ventures yet remains to be proved It is felt however that with the comparatively high capital and operating cost involved, commensurate returns from opal won are not likely.

Mechanized open cut operations by bull dozing have also bee attempted during the past few years. The technique employed being to strip areas of shallow overburden, generally up to ten feet in depth, in order to expose the opal horizon, which is then searched in detail for opal. Again, high operating and overhead cost are not conducive to success with this method, which is both impracticable and dangerous in operation within the confines of a claim boundary because of overburden spillage on to adjoining claims or ground, and the temptation remaining in abandoned and unfilled cuts for gougers and fossickers, particularly aborigines, to undercut th opal horizon into the walls of the open cut, and cause falls of ground. A number of serious and fatal accidents have already occurred due to this practice which contravenes mining and safety regulations.

Opal mining by its very nature and occurrence, irrespective of what degree of mechanized mining is employed to expose or uncov the opal bearing horizon, must remain a slow and painstaking operation to extract with as little breakage as possible the portions o

a seam which could be saleable. In what may be regarded as a good and payable claim by competent and experienced miners, possibly eight to ten per cent of the claim area may carry payable opal, which is contained in a horizon from several to twelve inches in thickness and must be gouged piece by piece under close examination. It is estimated that to completely work out such a claim by systematic room and pillar mining, leaving boundary support and forty per cent internally as support pillars would entail the breaking and moving by hoisting and stowing of approximately 3000 cubic yards of which only 30 cubic yards would be potentially opal bearing. Hence the need for careful and painstaking search becomes obvious and also the impracticability of mechanically mining the actual opal horizon.

Such a claim systematically and thoroughly worked could fully occupy two men for two years.

Consensus of opinion among the more experienced and reliable miners on the fields is that one in ten or twelve of claims pegged and prospected, are likely to be as productive as the above example. Although prospectors have been loath in the past to prospect beyond the bounds of known opal occurrences, there has latterly been some attempt to explore further afield in improved country, using bulldozers and power driven earth moving plants. Whether such equipment will prove to be more effective than the orthodox shaft sinking and driving method of prospecting, remains to be proved by longer trial. From observations made of the several mechanised methods in use to date, it is doubtful existing methods will be improved upon.

To encourage the prospecting and development of untried potential opal bearing areas, the Department of Mines has, over the past two years, granted several Special Mining Leases. In no case to-date has the exploration of any of these leases proved to be of greater advantage to the lessee than the orthodox granting of claims to prospectors.

A problem likely to arise with the further expansion and development of the opal fields is that claims at present are haphazardly pegged with little regard to orientation or position in relation to datum points or survey stations, and that disputes might

readily arise with regard to claim boundaries and positions.

It would be of mutual advantage both to claimholders, and for administrative purposes, if survey datum points, preferably a skeleton reference grid or baseline, be clearly marked on each section of the fields being worked, and all future claim pegging be made with reference to the datum points established.

In general the attention given to claim pegging, definition and maintenance leaves much to be desired.

Compiled by A. H. Dutton from notes prepared by C. M. Willington, Mining Engineer in 1962.

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