HAVELOCK ASBESTOS MINE
SWAZILAND
1535

A GREAT ASBESTOS ENTERPRISE

£750,000 TO BRING THE HAVELOCK MINE TO PRODUCTION — MINING METHODS AND FEATURES OF THE PLANT — ASBESTOS INDUSTRY'S LATEST DEVELOPMENTS

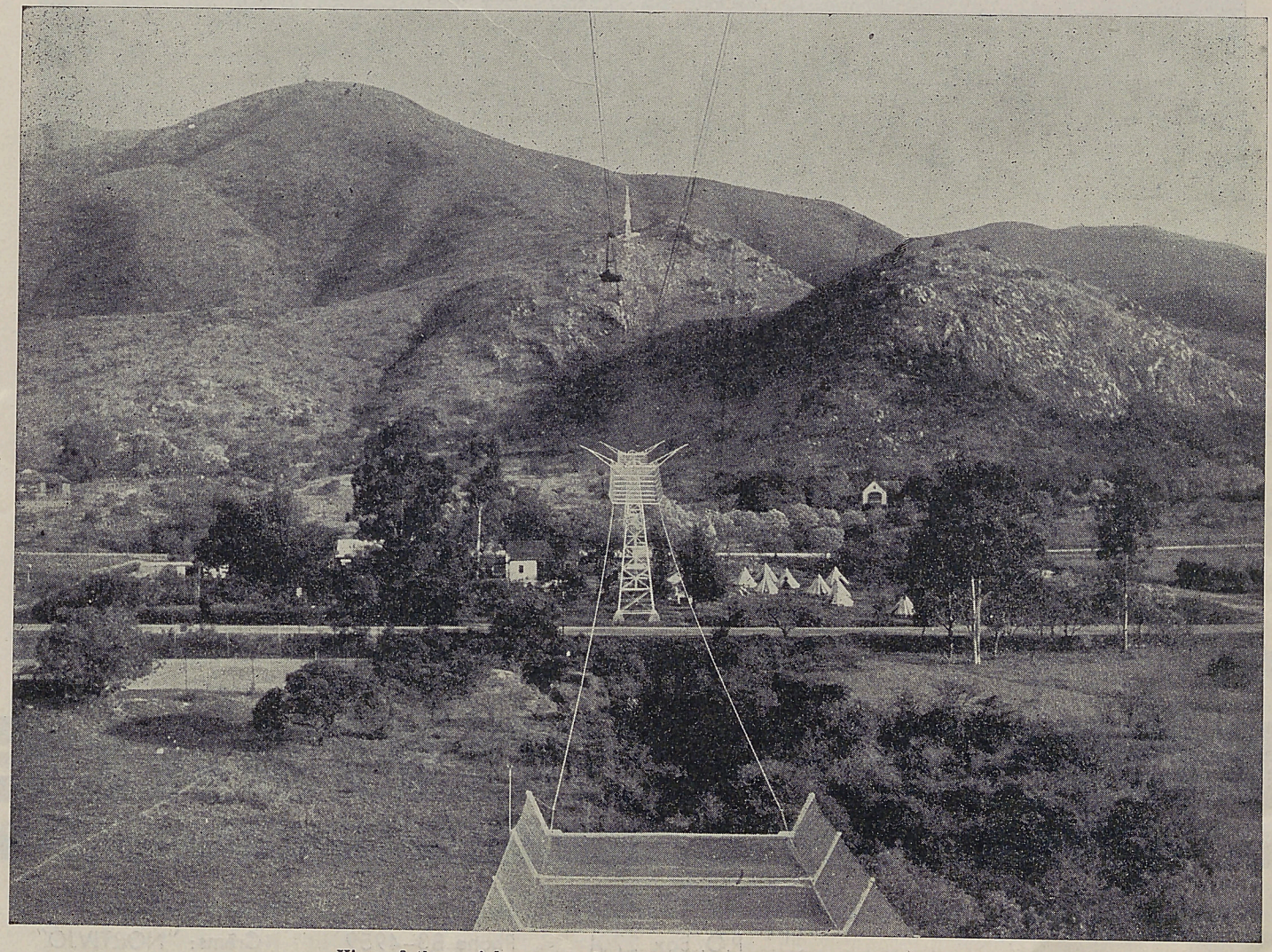
In the Information Circular "Industrial Minerals," published by the Union Department of Mines for the quarter ending December, 1938, the following reference to the production of chrysotile asbestos in the Union of South Africa is made: "The two principal producers of chrysotile asbestos have virtually ceased operations owing to the depletion of the known ore reserves. The Havelock Mines, situated just over the Transvaal border in Swaziland, have, however, commenced production." The laconic announcement that the Havelock Mines have entered the producing stage is no doubt ample information from the angle of view of a departmental circular, but behind all that lies a story of a great enterprise, both financial and technical, as no less than three-quarters of a million pounds have been expended in bringing the Havelock proposition to the producing stage. The Havelock mine is the latest undertaking of the great overseas asbestos group, Messrs. Turner & Newall, Ltd., a concern with subsidiary companies in England, Canada, the United States and Southern Africa, and which has an issued capital of £6,500,000. Two of these companies, the Rhodesian and General Asbestos Corporation and the New Amianthus Mines, Ltd., control, in the case of the former, the largest asbestos producers in Rhodesia, whilst the New Amianthus Mines, Ltd., own the Havelock Mines; thus Turner & Newall virtually control the chrysotile asbestos industry in Africa south of the Zambesi.

Mr. Roland Starkey and Asbestos Developments

Mr. Roland Starkey, M.I.M.M., the outstanding figure in the South African asbestos world, director in Africa for Messrs. Turner & Newall, and consulting engineer for all that company's interests, has been the guiding factor of the Havelock enterprise from its inception. In the first instance he was responsible for taking up the prospecting option, and subsequently bought the 100 base metal claims, which now comprise the Havelock mine, for £240,000, the largest amount ever paid in South Africa for a base mineral prospect.

Prior to the purchase of the claims, a most intensive campaign of prospecting work was carried on during the last eight months of 1929; the thorough nature of this work during the option period can be gauged by the fact that no less than 3,300 feet of driving and cross-cutting were done in the ore body, which, measured on the strike, has a length of 4,500 feet and an average width of 110 feet; this work was no mean achievement when it is considered that the prospect was situated in exceptionally broken country. In 1929 approach to this inaccessible spot was through some of the wildest scenery to be found anywhere in the Union or Swaziland. These conditions did not, however, deter the consulting engineer from making use of the aeroplane on his visits from Rhodesia, time being a most important factor.

At the time when it was necessary to arrive at the decision regarding the payment of such a large amount, the world was in the middle of a financial crisis following upon

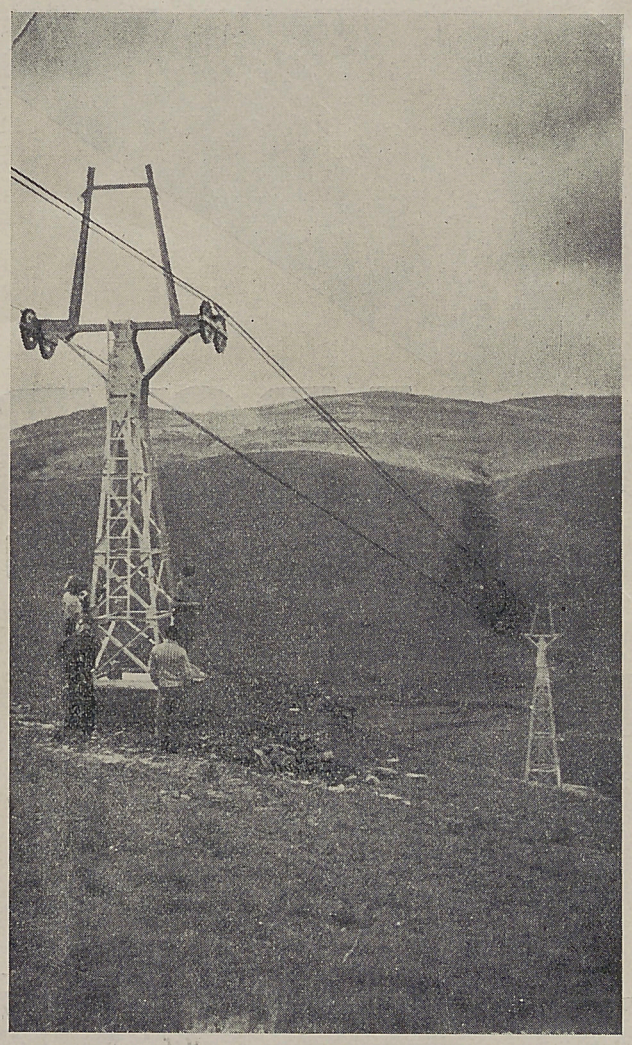


View of the aerial ropeway from the Barberton terminal station

the Wall Street debacle and all markets had fallen away; nevertheless, in the words of one authority, "Turner & Newall could not afford to miss Havelock"; thus from the commencement great hopes have been entertained of the Havelock proposition, and in the light of subsequent events these have been well founded.

Construction of Plant Begun

Not until seven years later, however, was work to be resumed at Havelock; owing to the life of the Amianthus Mine at Kaapsche Hoop drawing to a close it became necessary to prepare the Havelock Mine for production. Serious work commenced in April, 1937, following upon a very heavy rainy season. The first consideration, and one upon which the economic and rapid carrying out of the large construction programme depended, was an all-weather road from railhead at Hectorspruit to the mine. The Transvaal and Swaziland Governments combined with the mine to provide this highway for a total distance of 55 miles; several low-level bridges and one main bridge over the Lomati



Typical tower of the Havelock aerial ropeway

River were constructed, the latter being most essential as transport by wagon could be held up here for weeks at a time. The last 12 miles from Pigg's Peak to the mine over most difficult country was built by the mine. With the completion of all this work it was possible to bring eight-ton motor vehicles right on to the plant site. Altogether some 10,000 tons of building material, plant and equipment have been handled in twenty-one months over this road.

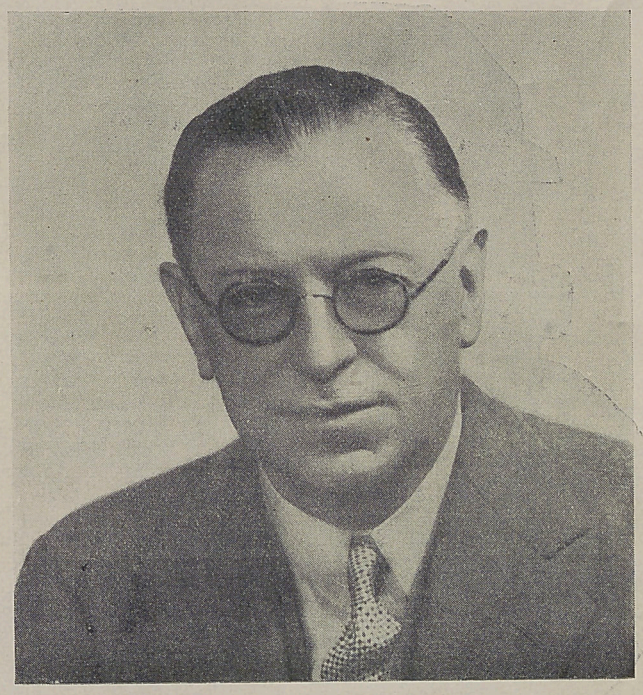
European and Native Accommodation

The first portion of the construction programme was directed towards providing suitable accommodation for the staff and the employees. No effort has been spared to provide modern type houses fitted with every convenience. An imposing building has been erected for the recreation club, and here, tennis courts, billiards, a well-equipped library, a weekly cinema show and other amenities, cater for the amusement of the employees and visitors to this at present remote mining camp. The nearest village to the mine is Pigg's Peak, whilst M'Babane, the capital of Swaziland, is 50 miles away. A road is now in course of construction from the Barberton side, but it may be some time before this will be completed. It will pass over some of the most wonderful scenery to be found anywhere in South Africa, and will, incidentally, provide a short route to Natal for all residents in the Barberton-Nelspruit areas.

Altogether some 50 married quarters have been erected and single accommodation has been provided for 40 employees; a well-designed mess-house caters for the single men. The total number of Europeans to be permanently employed is 90. A native compound of the single-hut type has been laid out in regular lines, and provision has been made to accommodate 2,400 natives; a fair proportion of these are married and have their families at the mine. A well-equipped hospital has been provided, which is controlled by a resident medical officer. Havelock is thus one of the most populated settlements in Swaziland, and it is estimated that the sum circulated annually in that country by way of wages, purchase of stores, native food supplies, etc., will reach £200,000.

Latest Developments at the Mine

Since September, 1937, following upon the installation of compressed air equipment, development in the mine has



Mr. ROLAND STARKEY,
who is in charge of the great asbestos interests of Messrs. Turner & Newall, Ltd., in South Africa.

been rapidly pushed ahead. A main shaft has been sunk at an incline of 40 degrees for a distance of 850 feet. After encountering very bad ground in the first 200 feet of sinking owing to the great depth to which the serpentine in the footwall of the ore body has been decomposed, it was necessary to employ the Francois cementation process to control the ground movement. Connecting with the main shaft is a drainage adit which has been driven a total distance of 3,800 feet.

The shaft headgear is situated at the top of the hill on which the rock plant bins have been erected. The steel headframe, on account of its height and situation, is a conspicuous landmark for miles around. The shaft has two winding compartments and a travelling way; the skips have a capacity of five tons each and weigh $3\frac{1}{4}$ tons, making the total hoisting load $8\frac{3}{4}$ tons. Development to date has resulted in opening up for stoping 14 million tons of ore reserve, all of which is situated above the horizon of the drainage adit.

Winding Engine

The double drum electric winding engine is interesting as being one of the few Ward-Leonard installations outside

of the Rand. The mechanical portion was manufactured by the Carron Hoist Company of England, and consists of two cylindrical drums 7ft. in diameter and 3ft. wide driven through machine-cut gears and mounted on a steel girder bedplate. The brakes are of the post type and are operated by a compressed air brake engine. The winder is driven by a direct-current motor with a 395 peak horse-power rating, and this motor in turn obtains its current from an A.C.-D.C. motor-generator set of 325 kw. peak rating. The flexibility and ease of control of the winder are particularly noticeable, as distinct from the A.C. induction motor drive which is usually fitted to a unit of this size.

Mining Methods

The mine will be worked to a certain depth by quarrying operations. To prepare for this it has been necessary to remove the " overhang " on the south wall of the lode. The hanging wall section dips at an angle of 50 degrees, and the overburden and country rock will have to be removed until the slope of the ground or the " batter " has been taken back to a safe point when no falls or slides of ground into the quarry can occur. This work will entail the removal of no less than 4,000,000 tons of wall rock and overburden. All ore broken in the quarry will be gravitated to the shaft loading pocket through winzes sunk in the ore body; these are connected with the main haulage level, thus handling of the ore in the quarry will be reduced to a minimum. From the third level of the mine regular stoping will be commenced. A special method of stoping has been evolved by Mr. Starkey and his staff at the Shabanie Mine of the Rhodesian and General Asbestos Corporation. This has been particularly successful for the mining of asbestos ore, especially in respect of the subsequent milling process. This method—a modification of which will be employed at Havelock—is a combination of " shrinkage " stoping and " top slicing," and enables the ore to be sorted underground. From 50 to 60 per cent. of waste can be sorted out and used for stope fill.

Mining costs by this method have been brought to the low figure of 1s. 6d. per ton.

The Power Plant

The power station, probably the largest crude oil engine generating station in Southern Africa, contains engines with an aggregate of over 2,800 brake horse-power. These engines, supplied through Messrs. Hubert Davies & Co., of Johannesburg, consist of five units of 440 brake horse-power sea level rating, type 8VER Ruston Hornsby eight-cylinder engines, direct coupled to 300 kilowatt alternators. There is also a 5VE Ruston Hornsby five-cylinder engine driving a 150 kw. alternator through "V" belts. All the alternators are manufactured by the Lancashire Dynamo and Crypto Company. There are also two oil-engine-driven compressor sets—one a Crossley four-cylinder engine of 200 b.h.p. driving a Belliss & Morcom compressor through "V" belts, and the other a Crossley-Premier engine and Fullerton compressor arranged *vis-a-vis*. The combined output from the compressors is 1,550 cubic feet of free air per minute at a pressure of 80 lb. per square inch.

The oil engines are started by compressed air at a pressure of 250 lb. per square inch, which is supplied by two auxiliary compressors, one being driven by a separate oil engine and the other by an electric motor.

The cooling water supply to the engine jackets is a closed circuit; the water circulates through the jackets and is then elevated to a cooling tower by means of two centrifugal pumping units, where it is cooled and again gravitated to the engines. The total fuel oil consumption of the power station on full load will be in the neighbourhood of 35,000 gallons per month. In order to provide for an ample reserve of fuel oil and so guard against any interruption in the supply, three tanks have been erected at the mine with a total storage capacity of 96,000 gallons, or nearly 450 tons of oil. Alternating current electric power is generated by the power station at 2,200 volts, and is transmitted by cable to the main sub-stations at the mine and mills. The sub-stations are equipped with transformers, which reduce the voltage to 550 for the smaller motors and to 220 and 110 volts for mills and mine lighting. The larger motors receive their power at the generated pressure of 2,200 volts.

Transport by Aerial Ropeway

Perhaps the most impressive portion of the Havelock equipment to the outside world is the aerial ropeway. Travellers entering Barberton by road or rail cannot fail to be impressed by the tall aerial terminal and big storage shed at the Barberton station terminus. Painted in aluminium, the lofty pylons carrying the stationary rope can be seen as landmarks on the mountain range behind Barberton. The line rises sharply to the top of the " Saddleback " some 2,500 feet above the old mining town.

General view of the Havelock Mine

The aerial ropeway is 12·6 miles in length. It was erected under the supervision of Messrs. Fraser & Chalmers, of Johannesburg, and was designed and manufactured by Messrs. Bleichert & Co., of Leipzig.

About halfway to Havelock the line is deflected at an angle of 12½ degrees to avoid crossing the high point of the Enlembe Mountain, which is the highest point in Swaziland. The line also reaches its highest point on the shoulder of this mountain and then falls 2,000 feet down to the Havelock Mine.

Ropeway Equipment

Much ingenuity has gone into the design of the 52 supporting pylons, which vary in height from 15 feet to 165 feet. In addition to five tension and four anchoring stations, all the portions of the various structures were purposely made in small sections to enable them to be carried by natives over the precipitous country. The spans between the pylons vary from 400 to 4,000 feet. The ropeway is known as the Bicable system. A fixed suspension or carrying rope is used with a separate traction rope, the transport cars being run on wheels along the former. The

suspension rope is of special spiral construction in high-grade steel; the traction rope is three-quarters of an inch in diameter; the total length of the two ropes is more than 50 miles.

Eleven lengths comprise the suspension rope, each length being kept taut by suspension weights. The speed of the traction rope is about six miles per hour. Each of the travelling cars carries a load of 300 lb., which is the weight of two bags of milled asbestos fibre, and the cars are specially designed to take these.

The capacity of the ropeway outwards from the mine terminal is 7·5 tons of bagged asbestos per hour, whilst returns loads are sent over in every second or third car. Special cars are provided for carrying fuel oil, and there are special carriers for long lengths of timber and other mining material.

Special Problems

The ropeway being in two sections, driven by separate motors at the mine terminal and at the Barberton terminal, each motor being 60 horse-power, introduced several special problems, such as control and signalling in the event of power being inadvertently cut off in one section and simultaneous breakdown of the telephone signalling device in the other section—a contingency quite possible with heavy thunderstorms in such a mountainous country. In these circumstances the cars on the still-running section would be switched over at the angle station to the return side of the ropeway. As their return to the terminal would at once indicate trouble, that section of the ropeway would then be stopped and the cause investigated. Loop lines are also provided at the angle station, so that the full cars could be sidetracked temporarily from the moving section in the event of the other section being out of commission.

This method of returning cars on the moving section of the ropeway, in the event of the other section being out of commission, has been devised to eliminate elaborate automatic braking facilities. By this provision, abnormally unbalanced loading of the ropeway or the possibility of "running away" in either direction is obviated; however, mechanical braking arrangements are also provided by means of an electro-magnetic brake, which is brought into operation if the current is cut off unexpectedly, whilst the driving mechanism is also fitted with a very substantial hand-operated brake at each terminal.

The Barberton terminal is located on the South African Railways station reserve. The main storage shed has space for 1,000 tons of bagged fibre, and there is also storage for crude oil, coal and general mining stores.

The ropeway was brought into commission in October, 1938, and it is a great credit to the erecting staff and to the running staff on the mine that the ropeway was started up without a hitch and has been operating satisfactorily right through the very heavy rainy season during the first few months of 1939; in fact, had it not been for the ropeway being in commission during the heavy rains, there would have been a very serious condition created at the mine. All road transport was completely held up owing to the bridges on the main road to Hectorspruit having been washed away, and there could have been a critical shortage of food supplies.

Treatment Plant

During Sir Samuel Turner's visit to Rhodesia in March, 1937, and speaking at a dinner given in his honour at Shabani, he referred to the treatment of asbestos ore at the Shabanie Mine. He said: "The process you have evolved at Shabanie is the most scientific mining and milling practice in relation to raw asbestos at present known in the world. Your technique is, in my opinion, far superior to that of Canada or Russia—the only other areas which now produce significant tonnages of raw asbestos. . . . This technique will have the result of adding many years to the economic life of the Shabanie Mines, and it represents a valuable contribution to the world's scientific knowledge. . . ." Since that speech was made still further remarkable improvements have been brought about, particularly in the finishing processes of the fibre treatment. These have been evolved as a result of exhaustive research work in connection with the Havelock ore, in which the fibres are more delicate than in the Shabanie ore. It is certain, therefore, that the milling process at Havelock will rank as the most scientific and economic one in the world.

The Komati River-Swaziland Goldfield

SOUTHERN EXTENSIONS OF THE BARBERTON MOUNTAIN LAND — NUMEROUS UNDEVELOPED GOLD OCCURRENCES — FAVOURABLE GEOLOGICAL CONDITIONS — A WIDE AREA AWAITING BETTER DIRECTED EXPLORATION

The accompanying map, which covers the greater portion of the areas known as the Steynsdorp and Komati goldfields and the Gold Belt of the Pigg's Peak and Forbes Reef district, shows the geological features and distributions of a section of the Barberton country and adjacent parts of Swaziland which are said to be again attracting some attention in financial circles, here and in Britain. Here, it will be seen, a broad belt of the Moodies Series, flanked upon each side with a fairly wide development of rocks of the Jamestown Series, both of them important economic components of the Swaziland System, stretches southwards for many miles along the joint Transvaal-Swaziland border. Westwards is a wide-spreading area of rocks of the Onverwacht Volcanic Series, of the same system, while upon the eastern side is the Older Granite, upon the intrusions and other magmatic processes of which the varied and occasionally very rich gold and other metalliferous occurrences have obviously been dependent, as in the other parts of the Barberton district. The great southerly belt of altered sedimentary and basic rocks of the Moodie's and Jamestown Series, folded up into massive ridges to a height of between two and three thousand feet above the level of the adjacent country, forms what is broadly known as the Ingwenya Mountain Range and is a local extension of the Barberton Land in which are situated the majority of the gold mines and prospects of this part of the Transvaal.

The Gold Occurrences

Taking the Transvaal side of the range, to begin with, it will be seen to include what are known as the Komati and Steynsdorp goldfields. The discovery and opening up of the occurrences in this area began about the year 1885, and considerable activity prevailed, both in mining and alluvial operations, for several years, until the greater attractions and the general facilities of the Witwatersrand gradually led to the practical abandonment of the field. Upon the south side of the Komati River, around and to the north of Steynsdorp, were a number of moderately-sized workings from which high grade was taken in many places, until the richer shoots and patches were exhausted, when a want of geological knowledge and adequate financial support put an end to such further undertakings as would have been sufficiently justified by the available evidence and the tangible results already obtained.

Among the mines of which the names are still remembered in the Steynsdorp field are the Comstock, St. George, Maureen, Glen Effer, Contractors, Grace, Homestead, Monarch and Gipsy Queen. Upon the flanks of the