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BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS.

RECORDS

1959 No.135

RADIOACTIVE INVESTIGATIONS AT WOLFRAM CAMP, QUEENSLAND

by

J. DALY

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ILLUSTRATIONS.

(Above illustrations taken from Morton and Ridgway, 1944).

ABSTRACT.

At the request of Kensington (Australia) Ltd., tests were made with a portable scintillometer detector over workings at Wolfram Camp, to determine whether or not the orebodies showed any well defined radioactivity which could be used as a means of prospecting for new deposits. The results were negative.

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1. INTRODUCTION.

Early in 1959, an approach was made to the Bureau by Kensington (Australia)Pty.Ltd., supported by the Department of Mines, Brisbane, to enquire if geophysical methods could be used to discover molybdenite ore bodies at Wolfram Camp, about 14 miles north west of Dimbulah, North Queensland. Upon examination of available geological information, it appeared that there was no scope for the use of conventional methods. The reasons for this conclusion are discussed below. However, it was known that slight radioactivity is associated with molybdenite from many Australian molybdenite deposits, and it was considered that the possibility of using this fact as the basis for a prospecting method should be tested.

A brief test was made at Wolfram Camp in connection with geophysical surveys being made in the Chillagoe district. Two days were spent in the area.

2. MOLYBDENITE MINING IN AUSTRALIA.

In order to appreciate the particular problems involved in establishing reserves of molybdenite, a brief note on the history of molybdenite mining in Australia is relevant.

Until about 1900, molybdenite was of no commercial value. At that stage, a market developed, and until 1920, Australia was the world's largest producer, with an annual production of about 200 tons. The production came from a number of deposits containing wolfram, molybdenite, and bismuth, most of which had already been developed to some extent for wolfram. (Other types of deposit are known, but so far have not proved capable of economic production). Most of these deposits occur in extremely rough country and mining was confined to rich ore, which could be profitably extracted by small syndicates. It is usual for this type of mining to be followed by the exploitation of low grade ores on a larger scale. Geological reports suggest that several Australian fields have possibilities in this regard which have not been investigated. A number of factors have prevented any attempts along these lines. After 1920, molybdenite mining ceased, due to the cumulative effects of the collapse of the world metal market, and the opening of the Climax Mine, which produces 15,000 tons of molybdenite concentrates per year, and has completely dominated the world molybdenite market ever since.

Some production of wolfram is obtained when the market price is high enough. However, capital expenditure on the development of large scale wolfram mining is discouraged by the notoriously erratic nature of the wolfram market. There is, therefore, no prospect of a significant production of molybdenite as a by-product of wolfram mining. Reserves of molybdenite are present in several deposits and it is probable that more could be found. However, on present indications, there is no possibility of the existence of a deposit large enough to be able to compete on the world market with the Climax Mine. It seems probable that Australian consumers will prefer to rely on the assured production from overseas, so that there is little prospect of a revival in mining from Australian deposits.

3. GEOLOGICAL NOTES ON MOLYBDENITE DEPOSITS.

The whole significant production of molybdenite in Australia has come from a number of deposits which are geologically closely similar. The main deposits are shown in the following list, together with references to geological accounts.

(1) Wolfram Camp, Q. (Morton & Ridgway, 1944)

(2) Bamford, Q. (Ball, 1915)

(3) Wonbah, Q.

(4) Kingsgate, N.S.W. (Andrews, 1916)

(5) Whipstick, N.S.W. (Andrews, 1916)

(6) Deposits near Deepwater, N.S.W. (Andrews, 1916)

(7) Wunglebung, N.S.W. (Andrews, 1916)

(8) Everton, Vic. (Fisher, 1953).

Of these, Wolfram Camp and Kingsgate have been the main producers. There has been little production from Wunglebung, which due to its inaccessibility, has not been very much prospected. It is mentioned here, on account of the unusually strong and widely disturbed radioactivity in the area.

In all these cases, the geological setting is similar. The deposits occur in granitic rocks, which have intruded porphyries. Along a relatively narrow zone in the granite adjacent to the porphyry, pipe-like bodies have developed, composed of quartz, and felspar, mineralised with wolfram, molybdenite and bismuth with occasionally minor amounts of cassiterite and sulphides. The dimensions of the pipes vary greatly. The largest diameter recorded is about 40 feet, but individual pipes are subject to sudden variations in dimensions and direction and they are often very difficult to follow. The mineralisation is erratically distributed in the pipes. In general, the valuable minerals are segregated, and only a small portion of the thickness of the pipe may be worth mining. It is apparent that reserves cannot be proved in such deposits, so that they are quite unsuited to company operations. As mentioned previously, however, certain of the fields contain areas of disseminated mineralisation of lower grade, which might be worth investigation under favourable economic conditions. The number of pipes may be quite large. For example, upwards of 50 pipes have been opened at Wolfram Camp and Kingsgate. The relative amounts of wolfram and molybdenite vary. Wolfram Camp and Bamford have produced considerably more wolfram than molybdenite. Kingsgate and Whipstick, however, have been mainly molybdenite producers.

The deposits at Wonbah and Everton are somewhat different in character. Although the geological setting is similar, the pipes are few in number. They are larger in dimensions than the average on other fields, and are fairly uniform in dimensions and aspect.

Also, the mineralisation which is mainly molybdenite, is of lower grade, and disseminated more uniformly over the section of the pipes. They are therefore more suited to systematic mining. Each deposit has been mined systematically on a small scale under favourable economic circumstances and each is believed to contain reserves sufficient to enable further small scale exploitation.

The presence of radioactivity associated with many specimens of Australian molybdenite was discovered during the course of a systematic examination of mineral specimens in Australian museums (Daly, 1955). Of the areas mentioned above, it was found that molybdenite ore from Wolfram Camp, Bamford, Wunglebung, Kingsgate and Whipstick showed slight radioactivity. Samples from the other areas mentioned had no detectable radioactivity.

The cause of this activity has only been investigated in a preliminary way (Daly, 1956). It appears that, in some cases at least, the activity is due to uranium which may be connected with the molybdenite in some way, but which does not concentrate in a molybdenite concentrate preparation by flotation. Much more extensive tests would be necessary to warrant any definite conclusions.

None of the localities mentioned has appeared worthy of serious consideration as a possible source of uranium, so that detailed ground investigations have not been made. However, brief visits have been paid to several deposits as opportunity offered, when parties were travelling to other areas, and radioactive tests made using portable Geiger counters. In general, the tests have given completely negative results, even in areas from which museum samples have shown definite radioactivity. Thus, at Whipstick and Kingsgate, no anomalous radioactivity was observed, other than the slight erratic variations usually encountered over granitic rocks. At Wunglebung on the other hand, the radioactivity was very definite (up to 8 times background on a portable Geiger Counter), and present over considerable areas. The distribution of radioactivity over portion of the area is shown in a report by Daly (1953), from which it appears that the activity, though not uniform over the whole area, is certainly not confined to the neighbourhood of the known pipes. Further investigation is necessary to discover the significance of this activity. Until the present tests, Wolfram Camp had not been visited.

4. APPLICABILITY OF GEOPHYSICAL METHODS.

From the previous description, it appears that these pipe like deposits are particularly unsuited to the use of conventional geophysical methods, for the following reasons.

(1) The shape of the deposits is unfavourable. The maximum diameter of a pipe may be about 40 feet, but in order to be effective, a survey would have to detect a pipe of diameter 5 feet. A pipe of smaller diameter could be significant, as its diameter might easily increase at depth. To be sure of discovering circular bodies of such small dimensions, the area would have to be covered in very close detail. However, these deposits occur typically in country so rough that a survey in such detail would be quite impossible.

(2) . The material of the pipes has no physical properties which could enable detection by geophysical methods. They generally contain no magnetic minerals. There is no reason to expect the pipe to have electrical properties which would differentiate it from the country rock. The gangue minerals are quartz and felspar which are the main constituents of the surrounding granite. Of the metallic minerals, wolfram and bismuth are non-conducting. Molybdenite, though a sulphide, is not a particularly good conductor, and the total proportion of molybdenite in a pipe is so small that it would have no effect on the overall conductivity of the pipe. Other better conducting sulphides, such as pyrite and pyrrhotite, occur only vary sparingly.

The only physical property which offers any possibility of distinguishing a pipe from the surrounding rock is the slight radioactivity associated with the ore. As mentioned in the previous section, tests on other fields generally give no reason to expect that this property would be of any value. However, the example of Wunglebung shows that it is at least possible that detectable radioactivity is associated with the deposits, though in this case the association is far from clear. It was considered desirable, therefore, that the distribution of radioactivity at Wolfram Camp should be investigated.

5. TECHNICAL DETAILS.

Plates 1, 2 and 3 show plans of the mining area at Wolfram Camp, reproduced from the report by Morton & Ridgway (1944). Plate 1 is a general plan, and plates 2 and 3 detailed plans of smaller areas. They show the large number of openings and the tortuous character of the workings. The workings are generally confined to the contact zone, except for a group of workings in Mulligan and McIntyre's section, which lie in the granite about one half mile south of the contact. At the time of the party's visit, the only miners on the field were two tributers operating in the Larkin Amalgamated lease. Miners of Kensington (Australia) Limited had carried out testing in several areas, but had suspended their operations just prior to the arrival of the Bureau party.

The tests were made using a scintillation detector type EH 135S manufactured by Electronic Associates Limited of Toronto, modified in the geophysical laboratory to correct a mistake in the original design. The instrument has a crystal 1½ inch in diameter. For comparison with readings on a Geiger ratemeter of the ordinary type, it may be taken that the sensitivity of the scintillation detector is about three times that of the Geiger counter, in terms of the ratio of observed count minus background count to background count. Tests were made on dumps around the workings, and on rock types at various places in the neighbourhood of the worked area. The contact zone was investigated approximately from Corker's workings to Pepper's workings. The area around McIntyre and Mulligan's workings was also visited.

The results were negative. All readings ranged between 70% to 150% of background count, and no systematic changes in radioactivity covering areas of any extent, or associated with particular workings or rock types were observed.

A secondary purpose of the visit was to obtain specimens of radioactive molybdenite for laboratory investigation. No good specimens were visible on the dumps, and it appears that these have been carefully picked over. However, a small dump of freshly broken stone from the Larkin workings was carefully examined. It was found that stone showing molybdenite freely, generally gave a slight increase in count rate, and one specimen was found which could definitely be classed as weakly radioactive. Specimens were taken from the dump for later investigation.

6. CONCLUSIONS.

There is no prospect that radioactive measurements would be of any use in detecting deposits of molybdenite in this area. The general level of activity is extremely low, and the variation observed no greater than could be found in areas containing unmineralised rocks.

7. ACKNOWLEDGMENTS.

It is desired to acknowledge information and assistance supplied by Mr. Cudmore of Kensington (Australia) Ltd. and by Messrs. Milligan and Tudehope, miners on the field.

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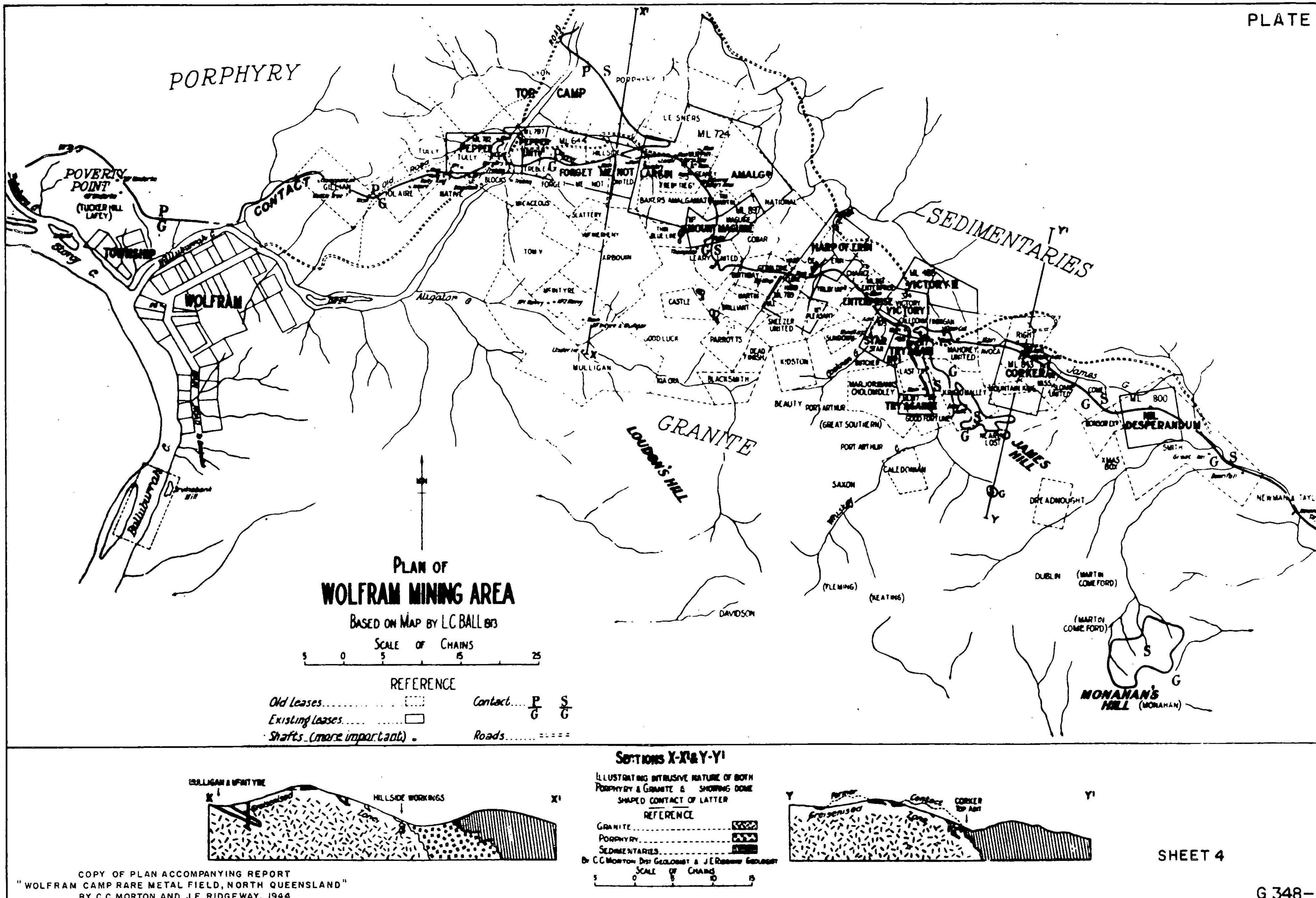

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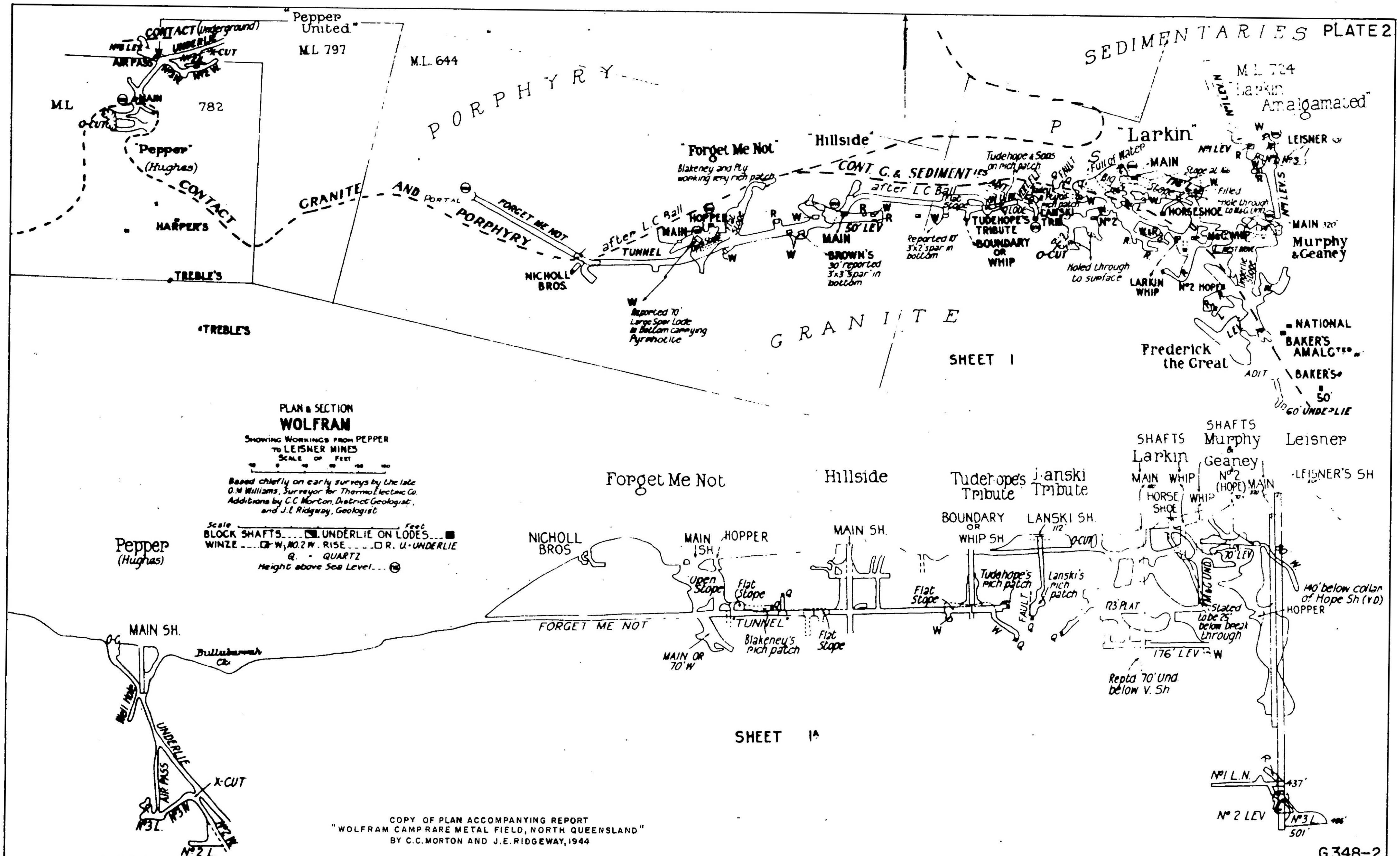

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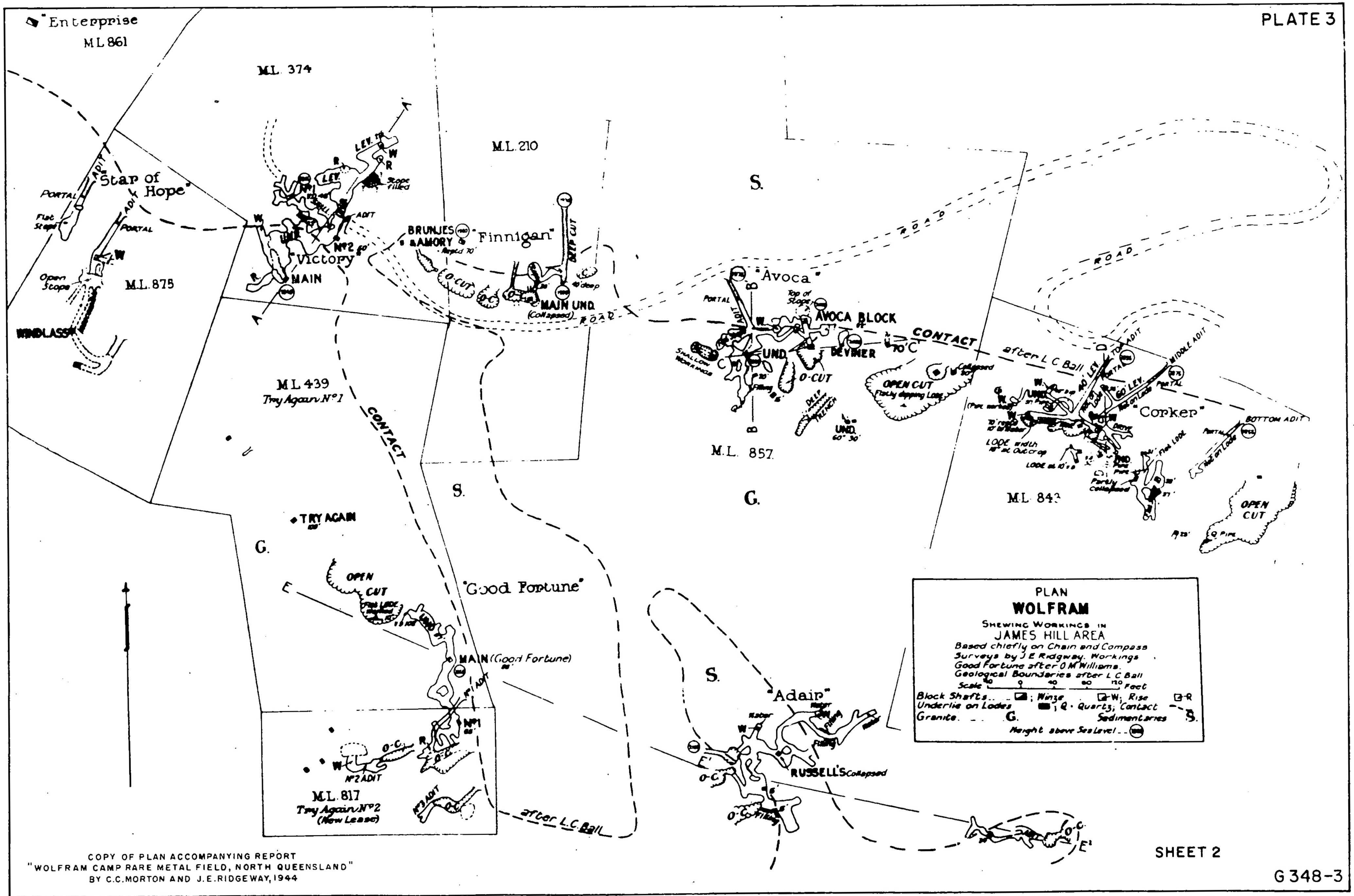

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