COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1962/41

RECORDS OF THE GEOLOGICAL BRANCH LABORATORY
JULY - DECEMBER 1961.

Compiled
by

G.J.G.Greaves and S.Baker

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PART II. CHEMICAL INVESTIGATIONS

RECORDS OF THE GEOLOGICAL BRANCH LABORATORY

JULY-DECEMBER 1961

PART I. PETROGRAPHIC, MINERAGRAPHIC AND X-RAY INVESTIGATIONS.

INTRODUCTION

The reports have been placed in chronological order and each has its date of completion and the relevant file number above its heading.

Officers responsible for these reports are:

W. B. Dallwitz, W. M. B. Roberts, R. Bryan,
G. J. G. Greaves and L. V. Bastian.

Report No. 11 will appear as an appendix to a Record on Magnetite Sands on Bougainville Island, New Guinea, by J.E. Thompson.

In addition to these reports the following records were compiled:

Records 1961/105: "Selected rocks from the Tennant Creek Area, Northern Territory with special reference to the Origin of Magnetite and Talcose Rocks," by W.M.B. Roberts.

Eleven records 1961/112, 115, 126, 127, 128, 129, 131, 132, 133, 134, and 139 were compiled by W.M.B. Roberts, G.J.G. Greaves and Robert Bryan. These covered the petrographic and mineragraphic investigations carried out at the Geological Laboratory for the period 1956 to June 1961.

A paper entitled "X-ray, Optical and Morphological Observations on Hodgkinsonite from Franklin Furnace" by W.M.B. Roberts and F.M. Quodling was prepared for publication, and another entitled "Formation of Chalcopyrite by the Reaction between Chalcocite and Pyrrhotite in Cold Solution," by W.M.B. Roberts was published in Nature, Vol. 191, No. 4788, pp. 560-562, August 5, 1961.

Report No. 1 130N/1

5th July, 1961.

STAINING OF GRANITE USED AS FACING STONE ON DEFENCE BUILDINGS, RUSSELL HILL, CANBERRA

by

W. B. Dallwitz and G. J. G. Greaves.

Introduction

At the request of Mr. C. Gustavsen, Site Manager at Russell Hill for Civil and Civic Contractors Pty. Ltd., we visited the Russell Hill Defence Buildings on two occasions to inspect rust-brown stains on light grey granite used as facing stone. Some slabs show no staining, some are almost wholly stained, some show patchy staining, and on some the staining takes the form of long, narrow, vertical streaks obviously related to the flow of liquid. The staining is readily apparent when observed from a distance, but is less obvious when inspected closely. Inspection with a lens showed that nearly all of the staining is due to a discontinuous film of hydrated iron oxide, but in a few places the staining is due to particles of whitish clay and brown iron oxide lodged in small crevices in the sawn face. We were told that the staining gradually developed some time after the stone had been treated with dilute acids and washed with water to remove concrete and dirt adhering to the surface. The aggregate used in the concrete was clayey red-brown sand obtained from one of the local sand quarries - probably the Honeysuckle deposit. The clay particles adhering to the rock most probably lodged there during storage and handling on the building site.

In a few slabs isolated grains of pyrite (FeS_2) and chalcopyrite ($CuFeS_2$) were visible; the largest of these grains measured about 1 mm. Iron-staining extends outwards from such grains for only a few millimeters, at most, but the overall staining of the rock is certainly not due to these minerals. In fact, grains of pyrite and chalcopyrite were noted on faces which were free from overall staining.

We were told that the sub-contractors who erected the facings claimed that the staining was due either to dirt picked up during handling or to pyrite in the dirt or to both.

The rock used for the facings is the so-called Harcourt Granite, which was cut into slabs in Victoria and then transported to the site by road.

Summary of McInerny's Report on the Harcourt Granite

McInerny (1929) described the rock as an adamellite; it is light grey, and consists mainly of white feldspar, glassy quartz, and biotite mica. Dark clots rich in biotite and averaging about two square inches in area are scattered through the rock, and small veins - about half an inch wide - consist of quartz and feldspar alone. Specimens from all parts of the quarry and even from places ten miles to the north are very similar in mineral composition and grainsize.

Microscopically the ratio of quartz to feldspar to biotite was found to be about 4:5:2; the ratio of plagioclase feldspar to orthoclase feldspar is about 3:2, and the plagioclase is andesine. Accessory minerals noted were apatite, zircon, and magnetite.

After four days' immersion a block of the rock absorbed 0.11% water by weight. A chemical analysis was carried out, but sulphur was not determined.

McInerny reports that the very light grey colour of the rock must be recorded as a defect, because it quickly becomes unsightly in a city atmosphere. Nevertheless, no other granite has been used to the same extent for building, ornamental, and monumental purposes in Melbourne.

Examination of the Opaque Minerals in the Harcourt Granite

Several polished sections were made of the granite, and were examined by one of us (Greaves).

Pyrite occurs as scattered grains measuring up to 0.6 mm. across. These grains are shattered and partly oxidized; red iron oxide extends outwards from them along cracks for about 2.5 mm. The pyrite grains tend to be associated with biotite. The average size of the pyrite grains is about 0.04 mm. - very much less than the maximum size of 0.6 mm. A few minute grains of chalcopyrite are associated with some of the pyrite. The sulphides make up about 0.02% of the rock.

Grains of magnetite and ilmenite up to 0.1 mm. in diameter amount to about 0.1% of the rock.

Laboratory Tests on Sawn Fragments of Harcourt Granite

Samples of clayey red-brown sand aggregate and of concrete were taken from the building site to be used in laboratory tests.

The strengths of acids specified for use in cleaning the facing stone at Russell Hill were: hydrochloric, 1:20; sulphuric, 1:32. Acids of similar strengths were prepared in the laboratory. Two small heaps of red-brown sand and two of concrete were then placed on sawn pieces of therock. Diluted sulphuric acid was placed on one heap of sand and on one heap of concrete, and diluted hydrochloric acid was placed on the other two heaps. After one hour the pieces of rock, together with sand, concrete, and acids, were placed in an oven for one hour at 160°C. The dried sand and concrete were then brushed off, and the granite was found to be only slightly stained by a yellowish substance. The stains were easily removed by washing and rubbing under running water.

Another experiment was then carried out with the same materials, but the conditions were varied as follows:

(1) The acids, sand, and concrete were allowed to remain on the sawn rock for two hours before drying in the oven for one hour at 160°C.

(2) After removing the sawn rock from the oven the dried sand and concrete were brushed off, and the rock was left exposed to the air overnight.

In this experiment the following points were noted:

(1) Yellowish staining was more distinct than in the first experiment, and was particularly marked with hydrochloric acid and sand.

(2) On standing overnight the stains became distinctly brown, and were much more difficult to remove by washing and rubbing.

When more concentrated acids were used the stains formed were much heavier.

To find out whether soil or clay would cause staining on the granite a suspension of clay, formed by /the clayey mixing/red-brown sand with water, was poured over the granite and allowed to dry. The red-brown stain formed on the rock was easily removed by scrubbing.

Conclusions

Following are the conclusions reached from observations on the building site and from tests carried out in the laboratory:

(1) The overall staining is not due to the small quantities of sulphides present in the granite. The fact that the stone has been so widely used suggests that, in general, there has been no trouble from sulphides.

(2) Treatment of the granite - to which concrete, soil, or red-brown sand may be adhering - with acids will leave a yellowish to pale brown stain unless the face is thoroughly washed immediately after the acid treatment.

(3) If the face is not thoroughly washed the iron (ferric) chloride and sulphate formed during treatment with acid will slowly hydrolyse on exposure to air and moisture, resulting in the formation of a brown stain of ferric hydroxide. The formation of ferric hydroxide from the chloride and sulphate is a fairly slow process; we were told that the brown staining showed up only some time after the granite had been treated with acid.

(4) Dirt picked up during handling can be removed by brushing with water, but if acids should come in contact with the dirt brown stains will form unless the face is thoroughly washed with water.

(5) There is no possibility that staining could be attributed to the presence of pyrite in soil or red-brown sand aggregate, as pyrite could not have survived in such highly oxidized materials.

Suggested Method for Removal of Stains

It would be difficult to remove the ferric hydroxide stains from the rock, even with fairly strong hydrochloric acid. It is suggested that the stains could best be removed by treatment with dilute (3-5%) oxalic acid; this acid forms a stable, almost colourless, highly soluble compound with iron. The oxalic acid should be brushed or sprayed on to the rock and left overnight or longer; the face should then be washed with water to remove the iron compound and excess acid.

Reference: McINERNY, K., 1929 - The Building Stones of Victoria, Part II: The Igneous Rocks. Proc. Roy.Soc.Victoria, 41 (N.S.), Part II, pp. 121-159.

Report No. 2 130N/1

19th July, 1961.

REPORT ON A ROCK FROM THE AUSTRALIAN BLUE METAL QUEANBEYAN QUARRY.

by
W. B. DALLWITZ.

Introduction

Two specimens were submitted for examination by Australian Blue Metal Ltd. These specimens were taken from the Company's quarry about 4 miles south of Queanbeyan along the old road to Royalla.

The purpose of the examination was to find whether the rocks can be described as granite. A Melbourne architect has prescribed crushed granite as aggregate for finishing a concrete surface in Sydney, and the Australian Blue Metal Queanbeyan quarry is, apparently, the nearest working source for the supply of crushed rock of a kind which might reasonably be described as granite in the widest sense of the term.

Description of Specimens

The specimens examined are medium-grained, grey to very pale grey rocks which, in thin section, were found to consist very largely of albite feldspar. Minor constituents are quartz and chlorite, and accessories are carbonate (dolomite and calcite), leucoxene, zircon, and apatite. The quartz occurs as distinct pockets and does not appear to be an original constituent of the rock; it may represent either fragments or veins introduced after the rock had solidified.

The rock originally had a texture resembling that of granite, but its appearance has been modified by partial brecciation; in the less severely brecciated parts the twin lamellae in the albite are bent, and the mineral shows strong wavy extinction. The spaces between the fragments have commonly been filled by chlorite in the darker of the two specimens. Dolomite and calcite occur mostly as sub-parallel veinlets less than 0.06 mm. wide, and leucoxene commonly occurs in a similar form.

Conclusion

The rock may be described as a partly brecciated albitite. Although the rock is not a granite, it may be considered as such for all practical engineering purposes. The specimens almost certainly represent a minor rock-mass formed as a differentiate from one of the nearby larger granitic bodies. It is possible that one or more variants of this rock are present within the mass being quarried.

Report No. 3

106Q/4/1

26th July, 1961.

ROCKS FROM EMERALD 4-MILE SHEET AREA, QUEENSLAND

by

W. B. Dallwitz.

Brief descriptions of three specimens of rocks from the Emerald 4-mile Sheet area submitted by J. J. Veevers, are given below.

Specimen EM1/1, Registered Rock No. R8827, Slide No. 7231, Emerald 4-mile, Run 2, Photo No. 19, described as "aplite, overlain by Permian".

A medium- to fine-grained igneous rock in which very pale buff feldspar and glassy quartz can be distinguished in handspecimen.

In thin section the rock is found to consist of about 60 percent feldspar and 40% quartz. Its texture is like that of a granite. Feldspars present are perthite and subordinate albite-oligoclase; they are moderately kaolinized, and a little sericite has formed in a few of the grains. Rare iron oxide and very rare muscovite are the only accessories.

The rock is a normal granite aplite.

Specimen EM16-3A, Registered Rock No. R8828, Slide No. 7232, Emerald 4-mile, Run 4, Photo No. 17, described as "granite".

A medium-grained, reddish granitic rock consisting of pink feldspar, quartz, and dark patches of iron oxide.

In thin section the rock is seen to consist of quartz, albite-oligoclase, perthite, sericite, hydrated iron oxide, chlorite, accessory muscovite, and rare apatite, listed in order of decreasing abundance.

The plagioclase is commonly strongly altered to sericite, and in many places the alteration is complete. Quartz shows strong strain-effects. The original ferromagnesian mineral, possibly biotite, has been replaced by hydrated iron oxide and colourless chlorite in about equal amounts. Potash feldspar is slightly kaolinized and sericitized.

The rock is probably best described as an altered granodiorite or trondhjemite.

/Specimen EM16-3B ...

Specimen EM16-3B, Registered Rock No. R8829, Slide No. 7233, Emerald 4-mile, Run 4, Photo No. 17, described as "white rock (?) hornfelsed by "granite". "

In both hand-specimen and thin section this rock is similar to specimen EM1/1. The following rather minor differences were noted:

(1) The rock is somewhat coarser-grained.

(2) Muscovite is a prominent accessary and it commonly shows marked strain-effects.

(3) Plagioclase appears to be slightly more plentiful.

(4) Quartz shows quite strong wavy extinction.

The rock is a granite aplite or an aplitic granite. If the body of rock which the specimen represents is a large one the second name would be preferable.

Report No. 4 120PNG/1 27th July, 1961.

PETROGRAPHIC NOTES ON ROCKS FROM THE MAGIN 1-MILE AREA, AND SOME OBSERVATIONS ON THE DETERMINATION OF PLAGIOCLASE.

by

W. B. Dallwitz.

Introduction

M. D. Plane, of the Geological Office, Wau, has forwarded ten rocks from the Magin 1-mile area for thin sectioning. He intends to do his own petrography, but I have made some brief notes on the rocks and given them a name, and have pointed out some features which will need further study.

Petrographic Notes

M.14, Registered Rock No. R8777, Slide No.7080.

Probably an altered palagonite tuff. Slightly altered glass has R.I. well above that of balsam. Fragments of quartz are probably extraneous, but some fragments of probable altered basalt seem to provide a useful clue to the origin and identity of this rock. Amygdales (in hand specimen) and veins contain unidentified (?) zeolites.

M.15, Registered Rock No. R8778, Slide No. 7081.

Vesicular basalt, as named by you.

Report No. 4 continued:

M.17, Registered Rock No. 8779. Slide No.7082 Gabbro. Clear brownish white grains with low D.R. & R.I. and minerals in veins may be difficult to track down. Prehnite with orange-yellow and yellow interference-colours in veins near end of slide adjacent to blank label.

M.18, Registered Rock No. 8780, Slide No. 7083. Partly serpentinized dunite. Abundant residual olivine.

M.20, Registered Rock No. 8781, Slide No. 7084. Augite norite. Plagioclase has negative sign and high relief (for feldspar), and is probably bytownite, but no determination apart from optical sign has been made; it could be anorthite. Hypersthene generally occurs as large, colourless grains with low D.R., and contains thin lamellae of clino-pyroxene. Lack of pleochroism in the hypersthene (sign is negative) is hard to explain, but this peculiarity has been noted by us in a number of gabbros and dolerites.

M.32, Registered Rock No. 8782, Slide No. 7085.

Sheared limestone or schistose limestone.

M.37, Registered Rock No. 8783, Slide No. 7086.

Greywacke, greywacke-breccia, or volcanic breccia, possibly in volcanic fissure or vent. (Plane states that the rock is intrusive).

M.41, Registered Rock No. 8784, Slide No. 7087. Partly serpentinized olivine pyroxenite or augite peridotite. I am not sure how much olivine is in this rock. The olivine has a negative sign, but is difficult to distinguish from pyroxene. My quick impression is that olivine is the more plentiful mineral, thus making the second suggested name the more appropriate.

M.43, Registered Rock No. 8785, Slide No. 7088. Olivine-bearing bytownite gabbro. Plagioclase (probably bytownite) has high relief and negative sign, but no other determination has been made; check whether it is anorthite. Olivine is veined with black iron oxide.

M.43a. Registered Rock No. 8786, Slide No. 7089. Same as M.43. Some serpentinization of olivine and/or pyroxene.

PLAGIOCLASE IN SPECIMENS M.20, M.43, and M.43a, AND SOME GENERAL NOTES ON PLAGIOCLASE DETERMINATION.

The sign of the plagioclase in the above specimens is negative, and the optic axial angle seems to be so high that the anorthite content is likely to be between 70 and 80 percent (see standard graphs showing variation of 2V and sign with anorthite content.). However, it will be necessary to measure some extinction angles to make sure that the composition does not fall between An_{80} and An_{100}. No observations have been made on the plagioclase in specimen M.17.

Report No. 4 continued:

Following is a description of an empirical method for checking whether extinction angles for albite twinning are greater or less than 45 degrees. This check will be needed in determining bytownite and anorthite. It is assumed in the ensuing outline that the polarizer is so oriented that biotite shows its deepest pleochroic colour when its cleavage is parallel to the N-S crosshair. Here, then, is the method:

(1) Orient albite twin-planes parallel to N-S crosshair. (If extinction is anywhere near symmetrical, the two sets of twin-lamellae will be evenly illuminated in this position, and the edges of the lamellae will be sharp. This condition of even illumination will occur in all 90° and 45° positions - i.e., in 8 positions altogether.)

(2) Insert gypsum plate. One set of lamellae will become purple, blue or green, the other yellow, orange or red (depending on the D.R. of the grain and the thickness of the slide).

(3) Extinction angles are then to be measured as follows:

(a) Rotate the stage to the right until the blue lamellae are in extinction (remove gypsum plate after differentiating lamellae), and measure the extinction-angle by rotating the stage to the left until the twin-lamellae are again parallel to the N-S crosshair.

(b) Rotate the stage to the left until the yellow lamellae are in extinction and measure the extinction-angle by rotating the stage to the right until the twin-lamellae are parallel to the N-S crosshair.

(The rule is : "blue to the right, yellow to the left".)

If possible one should find grains showing both albite and Carlsbad twinning and do the determination by the combined albite-Carlsbad method. Even then, the measurements should be made on more than one grain; erroneous results are obtained if the apparent Carlsbad twinning is not, in fact, Carlsbad twinning.

It is not advisable to rely entirely on the method of maximum extinction for albite-twinning. In any event, in dealing with albite-Carlsbad twins, it is necessary to follow the "blue to the right, yellow to the left" rule in case the extinction angles in one half of the Carlsbad twin should be greater than 45°. Incidentally, one can use that half of the twin which shows the higher extinction to check on the composition by the maximum extinction angle method - that is each half of the grain is simply treated as a distinct grain which shows albite twinning alone. It sometimes happens, also, that one half of the Carlsbad twin shows no albite twinning but a determination by the albite-Carlsbad method can still be made provided that the other half shows symmetrically-extinguishing albite twinning.

The composition of different zones in the plagioclase can also be determined by the albite-Carlsbad method.

In my opinion the only grains of feldspar (excepting sanidine and anorthoclase) worth trying for an interference-figure are those showing the lowest double refraction - they should be as near as possible to isotropic. These will give a centred or off-centre (depending on how low their D.R. is) optic axis figure in which one can observe the direction (and degree) of curvature of the isogyre, unless, of course, the optic axial angle is close to 90°. It is generally impossible to diagnose and distinguish, with any degree of certainty, even more or less centred obtuse and acute bisectrix figures in minerals whose optic axial angle is greater than about 70°.

Finally, it should also be pointed out that, in the general methods here described, it may be necessary to get an idea of the average R.I. of the plagioclase relative to the R.I.'s of quartz and Canada balsam. This can be an important help in getting some idea of the composition for plagioclases which show poor twinning or no twinning. Reference to one of the standard graphs will indicate the use of the method in distinguishing between plagioclases which have the same signs but different R.I.'s - e.g., oligoclase-andesine, on the one hand, and bytownite-anorthite, on the other; or, again, albite-oligoclase and andesine-labradorite. Such comparisons may also provide a useful control during the search for maximum extinction angles in albite twins.

The above instructions and suggestions of course apply particularly to plagioclase determination without the universal stage. They may appear difficult to follow, but a little practical application will make them seem far less formidable and will demonstrate their usefulness. Incidentally, another student and I worked out the "blue to the right, yellow to the left" rule in third year geology. It may be self-evident to many petrographers, but I have never seen any printed reference to it and I have long since forgotten the theoretical basis for it, but it certainly works in practice (for albite, not pericline, twins).

Report No. 5

46Q/1
28th July, 1961.

THIN SECTION EXAMINATION OF SPECIMENS OF ASSUMED BEDROCK, RETURN CREEK, MT. GARNET, NORTH QUEENSLAND.

by

W. B. Dallwitz.

Introduction

J. G. Best has submitted for petrographic examination three specimens of rock taken from below 50 feet depth in a percussion borehole put down by Tableland Tin Dredging, N.L. The Company is searching for downstream extensions, in Return Creek, of ground formerly worked for alluvial tin. The site of the borehole is about 4 miles south-west of Mt. Garnet on the western side of Return Creek, east of the Gunnawarra Road, and is marked as point A2020 on aerial photograph No. 5015, Run 11A, Atherton 4-mile Sheet area (E55/5).

Report No. 5 continued.

The drillers regard rock of the type submitted for examination as bedrock, and the object of the present study is to find whether the specimens represent weathered bedrock or cemented alluvial material forming a "false bottom".

Description of Specimens

Specimen A2020, Registered Rock No. 8810, Slide No.7167.

A somewhat friable, porous, red-brown and rust-brown rock consisting of grains of sand cemented by ferruginous and argillaceous material.

In thin section the rock is seen to consist mainly of angular, subangular, and subrounded grains of quartz set in a red-brown and golden brown matrix of reconstituted ferruginous and argillaceous material. Apart from quartz, the rock contains a few fragments of fine-grained sedimentary rock (e.g., quartz siltstone), vein quartz, and altered feldspar, and rare pellets of hematite or hydrated iron oxide. Sorting of the grains and fragments is extremely poor; the range of grainsize represented in the thin section is 0.03 mm. to 1.8 mm.

Pore-space makes up about 10 per cent of the rock, matrix 45 per cent, and fragmental material 45 per cent.

The rock is a ferruginous and argillaceous quartz sandstone.

Specimen A2020A, Registered Rock No. 8811, Slide No. 7168.

A somewhat porous, friable, pale grey, pale rust-brown, and buff-coloured rock consisting of sand grains in an argillaceous and slightly ferruginous matrix.

In thin section the rock is seen to consist of angular to sub-angular grains of quartz set in a matrix of buff-coloured reconstituted argillaceous material containing a small proportion of hydrated iron oxide. Feldspar, fragments of siltstone and felsite, black iron oxide, leucoxene and rare zircon, muscovite, (?) topaz, and tourmaline are accessory constituents.

Quartz makes up about 45 percent of the rock, and its grainsize ranges from about 0.03 mm. to 0.75 mm.

The rock is an argillaceous quartz sandstone.

Specimen A2020B, Registered Rock No. 8812, Slide No. 7169.

This rock is very similar to specimen A2020, and does not warrant a separate description.

It is a ferruginous and argillaceous quartz sandstone.

/Conclusions ...

Report No. 5 continued:

Conclusions:

According to Best the true bedrock in the area from which these specimens were obtained is likely to be either Upper Palaeozoic granite or Middle Palaeozoic greywacke.

The percentage of quartz in the rocks is too high for normal granite, and it is, therefore, unlikely, for this reason alone, that the specimens represent decomposed granite. Furthermore, the texture of the rocks bears no resemblance to that of granite, and nothing that could be described as weathered feldspar, in the amounts to be expected in granite, can be seen in them. In fact, although rare grains of altered feldspar are present in specimens A2020 and A2020B, the more plentiful feldspar grains in specimen A2020A are only slightly altered. Finally, the most decisive argument of all against the rocks being decomposed granite is that they contain sub-rounded and rounded fragments of fine-grained sedimentary rocks, felsite, and vein quartz and/or quartzite.

The possibility that the rocks represent highly weathered Palaeozoic greywacke or other sedimentary rock is more difficult to dismiss, especially without examining specimens of bedrock from the vicinity. However, if one tries to visualize the original nature of the rocks, assuming that they might be weathered bedrock, the inevitable conclusion is that their composition, apart from the ferruginous material in two of them, is nearer to that of quartz greywacke than that of greywacke. However, the proportion of argillaceous material is far too high, especially in specimen A2020A, for quartz greywacke, and the presence of so much ferruginous material in two of the specimens is certainly not easy to explain. Finally, I have not so far noted the texturally distinctive matrix of reconstituted argillaceous and ferruginous material in rocks which are older than the Mesozoic. In fact, this texture is characteristic of many soils and alluvial materials. These last two points are, in themselves, not especially convincing, but, when considered in conjunction with the other points mentioned above, they tend to give weight to the suggestion that the rocks under consideration are not weathered Palaeozoic greywacke or a similar sedimentary rock.

It is therefore concluded that the rocks from the borehole are of alluvial origin, and that they are of much more recent age than the true bedrock of the area.

Report No. 6

198PNG/1
8th August, 1961.

MINERAGRAPHIC DESCRIPTION OF A COPPER ORE FROM WARIA RIVER, NEW GUINEA.

by

G.J.G. Greaves.

Following is a description of a specimen of copper ore (G.120) collected from the bed of the Waria River, half a mile downstream from Sako Village, New Guinea. The specimen was submitted by J. E. Thompson.

/The hand ...

Report No. 6 continued:

The hand specimen is massive, and consists mainly of brassy yellow sulphide and milky vein quartz.

Sulphides form about 30% of the specimen; they consist of 95% chalcopyrite and 5% pyrite and covellite.

Irregular chalcopyrite grains up to several centimetres in diameter have been extensively shattered and subsequently recemented by quartz. Minor alteration to hydrated iron oxides has taken place along the fractures.

Subhedral pyrite grains having a maximum diameter of 0.3 mm. are enclosed in iron stained quartz near the chalcopyrite grains.

Irregular covellite grains in quartz were very difficult to polish. The maximum size of the plucked covellite grains is about 1.5 mm. in diameter. When viewed in air the pleochroism, compared with normal covellite, is subdued; between crossed nicols, the mineral shows an anomalous blue interference colour as well as the typical pale orange and reddish-brown interference colour. Under oil immersion, the pleochroism was still subdued, but the interference colours were normal.

Subhedral grains of magnetite up to 0.4 mm. long and 0.07 mm. wide are enclosed by quartz and to a minor extent by chalcopyrite. Hydrated iron oxides have formed between the magnetite and quartz.

A semi-qualitative X-ray spectrographic determination for nickel by W.M.B. Roberts showed that 25-75 ppm.Ni was present. A similar determination for gold was inconclusive.

Report No. 7

130PNG/3
16th August, 1961.

NOTES ON HAND SPECIMENS FROM THE UPPER RAMU RIVER HYDRO-ELECTRIC PROJECT AREA, PAPUA

by

Robert Bryan.

Five hand specimens from the Upper Ramu river hydro-electric project area were submitted by E. K. Carter for petrological examination. These rocks occurred between the proposed intake and the proposed power station site on the Upper Ramu River Project, Papua, and were to be tested for strength and stability in engineering structures, and for suitability as aggregate. A thin section examination was made on each specimen.

R.8813 T.S. 7170 Field No. 6
Altered gabbro or dolerite

This rock consists of augite, tremolite-actinolite, andesine-labradorite, black iron oxide and a little biotite. The rock consists of anhedra of augite up to 3.0 mm. across set in a fibrous aggregate of tremolite-actinolite. Amphibole also commonly surrounds the pyroxene crystals. Some elongate twinned laths of plagioclase are present, and probably are relics from the original rock.

Report No. 7 continued:

There can be little doubt that the rock was originally a feldspar-poor gabbro or dolerite that has been subjected to either late magmatic deuteric alteration, or low grade regional metamorphism.

No sign of shearing could be seen, nor any minerals that would be likely to cause any trouble. But as a precaution the rock should be tested for any reaction with high-alkali cement, if it is to be used as aggregate.

R.8814 T.S. 7171 Field No.24
Slightly metamorphosed greywacke.

Approximately half the rock consists of fine matrix material now converted to epidote, sericite and fine feldspar. Of the remaining half of the rock, two-thirds is albite and the one third quartz. Some iron oxide also is present. No bedding is apparent, but the rock has been sheared quite strongly, and the planes of movement have been filled with analcime - a sodium zeolite. These zeolites very readily exchange ions - especially sodium or calcium - so this change could be expected if used as aggregate. I have no knowledge of the implications of this exchange on strength and permeability.

The original greywacke, apart from being sheared, has suffered low grade regional metamorphism, but apart from the veins, no unsuitable minerals were seen.

This rock should be used with caution, as this infilling of the shears may be only local, and elsewhere the shears may be unfilled.

If used, the rock certainly be tested with high alkali cement.

R.8815 T.S. 7172 Field No. 26.
Hornblende-biotite granodiorite

Rock consists predominantly of oligoclase, with orthoclase and much less quartz. The mafic minerals are biotite and smaller amounts of hornblende. Iron oxide, prehnite and apatite occur in accessory amounts. The texture is typically granitic.

The rock has been slightly altered; the biotite has been chloritised, some plagioclase saussuritized slightly, and some secondary amphibole produced. The orthoclase has been moderately kaolinised.

No shearing was apparent, nor any soluble minerals detected; but the rock should be tested with high alkali cement in case some amorphous silica is present.

Report No. 7 continued:

R.8816 T.S. 7173 Field No. 46
Altered andesite or basalt

This rock originally consisted of phenocrysts of plagioclase and (?)pyroxene set in a mass of fine laths of plagioclase, (?)mafic material, and (?)quartz. It was probably a porphyritic andesite or basalt.

At present the original constituents are meshed by fine tremolite-actinolite, biotite, and a little epidote. A great deal of leucoxene is also finely disseminated through the rock. Quartz in the matrix is very common but there is no indication whether it is primary or not.

The rock is quite likely to be suitable as aggregate. A test with high alkali cement is desirable. There is no sign of any shearing in the rock.

R.8817 T.S. 7174 Field No. 51
Amphibolite

This rock consists of tremolite-actinolite porphyroblasts up to 2mm. across set in a fine granular groundmass of quartz, with some plagioclase (probably albite) biotite and iron oxide. An accessory amount of apatite is also present.

The rock is metamorphic, derived from an impure (?dolomite) sandstone. The grade of metamorphism is not really high enough for the amphibolite facies, for the amphibole is probably non aluminous; rather it falls within the albite epidote amphibolite facies, resulting from low grade regional metamorphism.

No shearing, or soluble minerals were seen, but if this rock is to be used as aggregate, a test with high alkali cement should be carried out.

General Conclusion

Apart from R.8814 none of the rocks are sheared nor do they contain minerals that would make them unsuitable in engineering structures. But before using any of these types as aggregate, it would be desirable to test them with a high-alkali cement.

Report No.8

120PNG/1
22nd August, 1961.

NOTES ON SPECIMENS FROM WATAN RIVER, MANUS ISLAND, NEW GUINEA.

by Robert Bryan.

Two specimens collected by J. E. Thompson as boulders from the Watan River, Manus Island, New Guinea area, were submitted for petrographic examination. Apart from the descriptions, the interest lay in whether the two types could be genetically related.

Report No.8 continued:

R. 9105 Slide 7236 Field No. G.213
Augite hornblende diorite

This rock consists of andesine, sanidine or anorthoclase, hornblende and quartz, lesser amounts of augite and black iron oxide, and accessory amounts of biotite and apatite. The texture is typical of diorite, with the plagioclase laths being rather better formed than in the more acid rocks.

Plagioclase makes up 60-70% of the rock; it is of strongly zoned andesine and forms subhedral laths, commonly enclosed by later untwinned potash feldspar. The latter is probably sanidine, as judged from its very small 2V, but it could possibly be anorthoclase. Potash feldspar makes up 15-20% of the rock.

A very pale green variety of hornblende is the predominant mafic mineral. It has the pale pleochroism of tremolite-actinolite, but an extinction angle of at least 32°. This large extinction together with the obviously primary nature of the mineral make it an alumina- and iron-poor variety of hornblende. It forms about 15% of the rock.

Augite and biotite both occur in only very small amounts and are primary.

The only unusual feature of the rock is the nature of the potash feldspar; the only implication that can be drawn from this is that possibly the final stages of crystallization took place at a rather higher temperature than is usual in granitic rocks.

R. 9106 T.S. 7237 Field No. G213A
(?)Hornblende augite andesite

This rock contains phenocrysts of andesine, augite, black iron oxide, and very altered (?)hornblende, set in a finely crystalline groundmass of plagioclase, clino-pyroxene, tremolite-actinolite and quartz, possibly associated with some glass.

The texture is porphyritic, with the groundmass constituents showing intergranular texture. Phenocrysts make up about half the total rock.

Andesine phenocrysts vary from strongly zoned to almost unzoned, and make up 2/3rds of the phenocrysts; together with the plagioclase in the groundmass, it comprises 70% of the rock.

Augite makes up about 25% of the rock and forms subhedral phenocrysts which grade downwards to groundmass size. It is commonly fractured. Some relics of phenocrysts are found, now made up of chlorite, iron oxide and secondary amphibole; these may originally have been hornblende.

The composition and alteration of this rock is typical of andesite, but the intergranular texture of the matrix is more common in basalt than in andesite.

Conclusion: The two rocks are both intermediate in composition, but the andesite is probably more basic than the diorite. The diorite is a medium-grained rock that is probably plutonic, whereas the andesite seems to be a volcanic rock.

Report No. 9 198NT/1

30th August, 1961.

MINERAGRAPHIC NOTES ON SELECTED SAMPLES OF ARSENIC - LEAD - COPPER ORES FROM CORONET HILLS, NORTHERN TERRITORY.

by
G. J. G. Greaves.

A group of specimens from the Coronet Hills Area were submitted by B. P. Ruxton for examination. The collection was a random one and the selection for study was left to the discretion of the microscopist.

The specimens selected are described below under the heading of their field numbers.

No. 195312: Sulphides from the dump at No. 3 South Extended Shaft.

The hand specimen is massive and consists mainly of metallic grey sulphide, pale brassy yellow sulphide, greenish-white oxidation products, and white vein quartz.

Sulphides form about 95% of the specimen; they consist of 90% arsenopyrite and 10% pyrite. The arsenopyrite grains are subhedral and have been shattered and partly recrystallised as shown by the mosaic intergrowth of small crystals being in random optical arrangement. The whole has been subsequently recemented by quartz. The measured diameter of the arseno--pyrite grains in optical continuity vary from 0.02 mm. up to 2 mm. Pyrite grains form masses measuring up to 3 mm. in diameter; the individual pyrite grains have an average diameter of 1 mm.

No. 195319: Sulphides from the dump at "Extended" Shaft.

The hand specimen is massive and consists of metallic grey sulphide, minor brassy yellow sulphide and green surface staining.

Sulphides form about 85% of the specimen: they consist of 90% arsenopyrite, roughly 5% chalcopyrite, with minor digenite, bornite and pyrite together forming less than 5% of the total. The arsenopyrite is massive and contains inclusions of chalcopyrite which range up to 1.5 mm. in diameter; these inclusions have been altered around their margins and along fractures to digenite, containing small particles of bornite. Some pyrite is present in the chalcopyrite where it forms small grains. In places arsenopyrite is fractured and recemented with quartz and digenite.

No. 195314: Sulphides from stringers in the footwall of the lode at No. 1 Adit 48 feet from the portal.

The hand specimen is a massive dark grey to black rock with green and brown surface stainings. Milky quartz and minor sulphides are dispersed throughout the specimen and some irregular boxworks are evident.

Sulphides form about 5% of the specimen; they consist of 60% pyrite, 10% arsenopyrite, 20% covellite and 10% digenite and are concentrated along a fissure 1 mm. wide. In the vein pyrite forms grains up to 0.3 mm. in diameter and covellite forms irregular grains varying in size from 0.015 mm. to 0.2 mm. Randomly distributed throughout the body of the specimen are small grains of pyrite and covellite the largest of which measure 0.05 mm. across.

Report No. 9 continued:

No. 195315: Sulphides from the dump at entrance of No. 1 Adit (probably from the base of winze).

The hand specimen is massive and consists of metallic grey sulphides and milky white quartz. Sulphides form about 70% of the specimen; they consist of 98% of arsenopyrite and minor sphalerite. Arsenopyrite forms equidimensional grains up to 1 c.m. in diameter. These are fractured and recemented with quartz containing minor sphalerite. In places the sides of the fractures do not match and in addition the embayment along the edges of the crystals suggest that replacement of the arsenopyrite by quartz has taken place.

No. 195316: Sulphides from stringers in the back of No. 1 Adit. Adit 170 feet from the portal.

The hand specimen is a massive dark melanocratic rock containing a small amount of randomly distributed milky quartz.

Sulphides form about 60% of the specimen; they consist of 65% arsenopyrite, 30% covellite and very minor pyrrhotite, pyrite and chalcopyrite. The original rhomb-shaped arsenopyrite crystals up to 4 mm. across have been largely altered to fine grained covellite and a dark grey mineral which could not be identified in polished section. Rounded grains of pyrrhotite and chalcopyrite which range up to 0.04 mm. in diameter form small inclusions in arsenopyrite.

No. 195321: Selected specimens of sulphide ore from the dump at No. 2 Adit.

The five hand specimens are all massive, consisting of varying proportions of metallic grey, silver and brassy yellow sulphides and quartz.

Sulphides form 50% to 90% of the specimens and consist of varying proportions of galena, chalcopyrite, marcasite, pyrite, arsenopyrite and sphalerite. Galena forms irregular equidimensional grains which measure about 6 mm. in diameter. The grains are enclosed by quartz and they contain small quartz inclusions. Galena is also present in quartz-filled fractures and forms small inclusions in arsenopyrite. Chalcopyrite in places forms a groundmass, over an area 6 mm. in diameter, for grains of arsenopyrite and pyrite; irregular grains of this mineral up to 5 mm. in diameter occupy positions between quartz grains and also form inclusions in arsenopyrite. Marcasite forms a very fine grained groundmass for the other sulphides. Arsenopyrite and pyrite have the same habit as the previously described specimens but are less abundant. Sphalerite is associated with chalcopyrite as small rounded areas and as larger irregular grains containing exsolution lamellae of chalcopyrite.

Report No. 9 continued:

No. 195323: Sulphides from the lode 30 feet along North Drive in No. 2 Adit.

The hand specimen is extremely friable. It is banded with alternating brassy yellow and black sulphides.

Sulphides form roughly 90% of the specimen; they consist of 40% pyrite, 20% arsenopyrite, 20% marcasite, 15% chalcopyrite and minor sphalerite, which all tend to be segregated into bands. Arsenopyrite grains which measure 1.5 mm. in diameter have been fractured and recemented with quartz. Chalcopyrite forms irregular masses in pyrite measuring up to 3 mm. in diameter. The pyrite and fine grained marcasite form the groundmass for the other minerals. Sphalerite is a minor constituent forming irregular inclusions in the pyrite.

Report No. 10. 84NT/10A.

20th September, 1961.

EXAMINATION OF A RADIOACTIVE SPECIMEN FROM HAMILTON DOWNS, NORTHERN TERRITORY.

by

W. M. B. Roberts.

A collection of angular fragments of a radioactive mineral from Hamilton Downs, Northern Territory, was submitted by the resident geologist Darwin, for identification and assessment of its economic possibilities. The mineral is black, it has a resinous lustre and a conchoidal fracture. It weathers to a rust coloured material, thinly coated with a buff coloured deposit in places.

An X-ray powder spectrograph gave a rather faint pattern which could not be reconciled with any mineral in the A.S.T.M. index, or in U.S.G.S. Bulletin No. 1-36-G or X-ray data of uranium and thorium minerals.

X-Ray spectrochemical analysis showed the minerals to consist of mainly thorium, yttrium, cerium and iron, with minor amounts of rare earths, uranium and nickel. No silica, phosphorus, columbium, tantalum or titanium are present, so it is assumed that the mineral is a thorium, yttrium, cerium oxide.

At this stage the mineral cannot be identified by name, the spectrographic results confirm the radiometric analysis that the activity is due essentially to thorium.

With the information available, no statement can be made on the economic possibilities of the deposit, except that thorium has no economic significance at the present time, and both yttrium and cerium can be obtained in commercial quantities from producing mines both in Australia and overseas.

Report No. 11 — 66/PNG/1 — September 1961.

Examination of Magnetite Sand from Pt. Saucepan Bougainville Island, New Guinea

by

G. J. G. Greaves.

Following is a description of a beach sand (P.431) from Bougainville Island submitted by J. E. Thompson.

The sand was separated into fractions based on specific gravity and magnetic susceptibility using heavy liquids and a hand magnet and will be described under the following fractions.

Specific Gravity (S.G.)		Magnetic Susceptibility	Percentage Weight
(i)	<2.85	non magnetic	0.3%
(ii)	>2.85 <3.26	non magnetic	0.4%
(iii)	>3.26	non magnetic	0.1%
(iv)	>3.26	strongly magnetic	98%
(v)	>3.26	less strongly magnetic	1.2%

MINERALOGY

All the fractions have a grainsize from 0.1 mm. to 0.4 mm. in diameter.

(i) Non magnetic fraction with S.G. <2.85

A sample was treated with boiling 5% oxalic acid to remove iron oxide staining. Examination in thin section showed that feldspar and quartz form the bulk of this fraction and are present in about equal amounts. Most of the feldspar grains show some evidence of abrasion, the composition ranges from minor sericitized orthoclase, mixtures of oligoclase and andesine, and both andesine and oligoclase. The plagioclase in places has altered to kaolin or sericite; some grains are partially altered to epidote and may be termed saussurite; others are strongly zoned. Quartz forms angular grains commonly coated with hydrated iron oxides. Some of these grains have a well-developed undulose extinction and some have equidimensional or acicular colourless inclusions which could not be identified.

A small quantity of hornblende and epidote are present and there is some contamination from other fractions.

Report No. 11 continued:

MINERALOGY -cont'd.

(ii) Non magnetic fraction with S.G. > 2.85 < 3.26

In this fraction the principal constituents are: diopside 70%, hornblende 20%, hypersthene 5%, epidote and zircon less than 5%.

Diopside forms small slightly rounded elongate crystals which are pleochroic from pale green to green and the extinction angle $Z \wedge C$ has a maximum value of 45° to the cleavage. The surface is pitted and small rounded opaque inclusions are present.

Hornblende, which is more rounded than diopside is pleochroic from brownish-green to dark green, showing a maximum extinction angle of 25° to the cleavage.

Hypersthene forms small slightly rounded elongate crystals which are strongly pleochroic from bluish-green to orange red. The extinction is parallel to a well developed cleavage.

Pink zircon forms perfectly developed, doubly terminated crystals, up to 0.3 mm. long, which contain minute inclusions.

Epidote forms very minor elongate grains, pleochroic from yellowish-green to green and show parallel extinction.

(iii) Non magnetic fraction with S.G. > 3.26

This fraction consists predominantly of ilmenite with minor contaminants from fraction (ii) (for a description of the ilmenite see the description of fraction (v)).

(iv) Strongly magnetic fraction with S.G. > 3.26.

In polished section the grains are well rounded, pitted, and have a maximum diameter of 0.4 mm. This fraction consists almost entirely of magnetite with minor haematite hydrated iron oxide and rare ilmenite. Haematite has formed along the (111) directions of the magnetite, some grains of which are entirely altered to haematite. Ilmenite forms composite grains with magnetite, exsolution lamellae along the (111) directions giving a grid-like intergrowth, and very rarely as free grains.

The percentage of titanium determined X-ray spectrochemically, by W.M.B. Roberts, in this fraction is 2.38% which is equal to 3.97% TiO_2.

(v) Less strongly magnetic fraction with S.G. > 3.26

The principal constituents are roughly: ilmenite 60%, magnetite 20%, haematite 10%, haematite-magnetite intergrowths 5%, and non opaques. The ilmenite is much more angular than the magnetite and has a maximum length of 0.3 mm.

/CONCLUSIONS ...

Report No. 11 continued:

CONCLUSIONS: The percentage of ilmenite as free grains in the sand is roughly 1%; the percentage of magnetite is about 95% and the percentage TiO_2 in the magnetite is 3.97%. In addition TiO_2 from free ilmenite grains in the less magnetic fraction would increase the TiO_2 percentage by about 0.4% TiO_2.

The quartz in the light non magnetic fraction appears to be mainly derived from vein quartz and metamorphosed rocks containing quartz. It must be borne in mind that quartz forms only about 0.1% and that the bulk of the non opaque minerals suggests the heavy minerals were derived from basic igneous rocks.

Report No. 12

170ACT/1
September 1961.

NOTES ON SPECIMENS FROM THE WODEN DAM SITE

by Robert Bryan.

Four specimens from the Woden dam site were submitted by G. W. D'Addario for petrological examination. Three of the specimens (R 9214-9216) were collected during the plane tabling of the dam site, and have been described in an attempt to find out whether they form part of the Painter Porphyry or the Deakin Volcanics. The fourth specimen (R 8598) was collected rather earlier during the lakeside survey, and was submitted for examination for the same reason.

R.9214, Field No. 197005, T.S. 7345.

Altered Crystal Tuff, or Dacite.

In the hand specimen, the rock looks like a typical greenstone of tuffaceous origin, with about half the bulk consisting of fragmental material. The remainder forms a fine green groundmass. No bedding is visible.

Seen in thin section, the hand specimen description is confirmed. The fragmental material makes up half the rock and consists of altered feldspar (50%), quartz (30%), biotite flakes (14%), altered mafic mineral (4%) and apatite crystals (2%). The groundmass is very fine-grained; much of it is chlorite, probably resulting from the devitrification of an original glassy matrix.

The feldspar has been completely altered to sericite, epidote, quartz and (?) albite. The original laths were subhedral, and up to 2mm. long. The quartz forms irregular fragments, strongly embayed by corrosion, and up to 4 mm. across. The shale fragments now consist of aggregates of chlorite, epidote and leucoxene and show a strong lineation parallel to the pronounced long axis of the flakes. The fragments vary greatly in size but all appear to have been derived from similar material. The mafic mineral has been completely replaced by chlorite, and there is no indication of its original nature. Small subhedral apatite crystals - showing marked biaxial negative crystal properties - are scattered through the rock.

Report No. 12 continued:

R.9214 cont'd:

The queer appearance of the rock, and the very marked alteration of the fragments, would suggest that the rock has suffered low grade regional metamorphism or else severe deuteric alteration. Tuffs are very readily altered, particularly by late magmatic or hydrothermal solutions. The composition of the rock is probably dacitic; it is also possible that the rock is an altered dacite rather than a tuff.

R.9215 Field No. 197006A T.S. 7346.

Sheared Crystal Tuff, or Dacite.

This rock is very similar to R.9214 above, except that the alteration of the feldspar in particular, is more pronounced, and the rock has been sheared.

Seen in thin section, the shearing has resulted in the break-up of the large quartz and feldspar fragments, and in the attenuation and buckling of the chloritised biotite flakes. Some veining by calcium carbonate is also seen.

The more pronounced alteration of this rock when compared with R.9214, can probably be attributed to shearing.

R.9215, Field No. 197006B T.S. 7347

Altered Crystal Tuff, or Dacite.

This rock is identical to R.9214 except that it contains numbers of calcite veins. The rock is unsheared. The groundmass of the rock is also slightly coarser - though it is still very fine-grained.

R.9216 Field No. 197007. T.S. 7348

Altered Crystal Tuff, or Dacite.

The principal difference between R.9214 and this rock is that the latter contains much calcite, replacing large sections of the chloritised mafic mineral. The other point of interest is that the quartz fragments are commonly euhedral or subhedral crystals - thus putting the volcanic origin of the quartz in these rocks beyond any doubt.

R.8598 Field No. 197003 T.S. 7349

Very Altered Crystal Tuff, or Dacite.

This rock is obviously closely related to R.9214, but has been much more severely altered. In the hand specimen the fresh face is purplish colour, while the weathered surface is heavily stained by iron.

Seen in thin section, the similarity to R.9214, described above, is much stronger. The proportions and types of fragments are the same, and the groundmasses are identical. Some of the quartz fragments show perfect crystal development though the fragments themselves have been badly fractured. The feldspar is almost entirely made over to sericite, (?)albite, and epidote. Virtually all the biotite flakes, and the mafic mineral have been replaced by (?)nontronite - a clay mineral of the montmorillonite group.

Report No. 13

46Q/1
September 1961.

DESCRIPTION OF SAMPLE OF WALL ROCK FROM BRADLOW TIN MINE, HERBERTON, NORTH Q'LD.

by
Robert Bryan

The specimen (R.9392, T.S. 7400) was collected by J.G. Best from the barren walls that enclose the tin lode at the Bradlow Mine. These walls are made up of "black rock" and occur within a large mass of clearly recognizable granite.

In the hand specimen, the "black rock" was seen to consist of patches of clear quartz up to 10 mm. across set in an extremely fine-grained grey chert.

Seen in thin section, the rock consisted predominantly of quartz and the alteration products of feldspar, together with some biotite and fluorite; accessory amounts of zircon and (?) rutile were present.

Between 60% and 70% of the rock is made up of very fine-grained aggregates of quartz epidote and sericite, that have completely replaced original feldspar. The original form of the feldspar is quite clear, and is of two types. About half of the feldspar occurred as large subhedra, up to 10 mm. long and 4 mm. across, while the remainder formed medium-sized interstitial anhedra. Though these two types cannot now be distinguished mineralogically, it is very likely that they represented original plagioclase (the large laths) and potash feldspar (interstitial material).

It seems probable that the sericite and epidote that have replaced the feldspars were derived mainly from the original feldspars. This type of alteration is very common in rocks that have been subjected to late magmatic (deuteric) or low-grade regional metamorphic processes. But it is most unlikely that the extensive replacement by quartz could be explained in this way.

Quartz forms most of the remainder of the rock; some forms large anhedra, as noted earlier, but much of it is fine-grained and obviously once formed micropegmatitic intergrowths with potash feldspar.

Medium-sized books of biotite, containing lenses of muscovite, make up the only mafic material in the rock. The biotite has been recrystallized to aggregates of very fine-grained randomly oriented books of biotite, separated by some chlorite. Optically the effect of this has been to obscure any pleochroism except under high magnification. Zircon crystals with their characteristic haloes occur within the biotite.

Patches of fluorite are found as interstitial filling. Also one colourless grain with a very high refractive index could have been either rutile or cassiterite.

Report No. 13 continued:

On the basis of textures alone, there can be no doubt that the rock was originally a coarse-grained granite (in the broad sense) in which the mafic mineral was biotite. It is quite likely that potash feldspar and plagioclase occurred in about equal amounts and together made up 60 - 70% of the rock. The feldspars have suffered alteration to sericite and epidote, and lastly, fine - to cryptocrystalline quartz has replaced a great deal of the original feldspars.

Silicified saussuritized and sericitized biotite granite.

Report No. 14 139G/1

5th October, 1961.

IDENTIFICATION OF THE "HEMATITIC" PSEUDOMORPH FROM STOKES PASS, NORTHERN TERRITORY.

by

W. M. B. Roberts.

A small twinned crystal composed of hydrated iron oxide was submitted by the resident geologist, Alice Springs for identification of the original mineral.

Although it is difficult to determine accurately the indices of the various forms developed on the crystals, two are immediately apparent in the hand specimen, these are the cube and the dodecahedron (pyritohedron), both common in pyrite.

This type of pseudomorph is fairly common. When the cubic forms are better developed they are known as 'Devil's Dice', and are generally accepted as being pseudomorphs after pyrite, as the crystal development suggests.

In addition the hydrated iron oxides are a common alteration product of pyrite, and the dodecahedral form is not recorded as forming in galena.

Report No. 15 139G/1

9th October, 1961.

IDENTIFICATION OF A MINERAL FROM BORE WRB/U (No. F163) IN THE ALICE SPRINGS FARM AREA.

by

W. M. B. Roberts.

Several chips of a grey silicate mineral were submitted for identification by the resident geologist, Alice Springs. They were taken from Bore WRB/U (No.F.163) in the Bitter Springs Formation in the Alice Springs farm area.

The mineral was identified by X-ray diffraction as orthoclase feldspar.

Report No. 16 130N/1

26th October, 1961.

PETROGRAPHIC EXAMINATION OF FLAGSTONE FROM NARRANDERA, NEW SOUTH WALES

by

L. V. Bastian.

INTRODUCTION

Two specimens of a building stone were submitted by D. E. Gardner for petrographic examination. It was required to determine the nature of the bonding or other features bearing on the suitability of this rock as a building and paving material. The specimens were collected from a shallow quarry one mile north-west of Narrandera.

PETROGRAPHY

Specimen 9406 (T.S. 7652) is a pale maroon, flaggy, fine-grained sandstone. It is micaceous, and the micas are closely aligned parallel to the bedding, producing its strong bedding-plane cleavage. Graded bedding is present, the sets of graded beds ranging from about 0.5 cm. to over 1 cm. in thickness, and thereby producing a rather pleasing colour banding.

Thin section examination shows the rock to be made up of a high maturity quartz-muscovite sand, with a small amount of sericitized clay matrix. The sand is well sorted, with a grain-size ranging from about 0.1 mm. to 0.05 mm. between the coarse-grained and fine-grained laminae. The quartz is mostly clear, but many grains consist of composite, finely sutured quartz intergrowths, probably derived from a metamorphic terrain. The quartz grains, originally moderately well-rounded, have since been enlarged authigenically, producing considerable interlocking. There are numerous detrital grains of sericite, derived presumably from schistose rocks, and accessory amounts of heavy minerals, including leucoxene, iron oxides, tourmaline, and zircon. There appears to have been originally a low percentage of clay matrix, which has been converted to fine sericite-quartz intergrowths, and now interlocks closely with detrital muscovite and with the authigenic quartz outgrowths. Hydrated iron oxides rim the detritals, and are densest in the finest material.

The considerable diagenetic changes give to this rock the features of an orthoquartzite.

Specimen 9407 (T.S. 7653) is a cream, fine-grained, flaggy sandstone, again carrying micas which are closely aligned with the bedding. Like the previous specimen it is a fairly tough rock, but is perhaps slightly less coherent, and has a higher porosity.

In thin section it carries a similar detrital assemblage of quartz and muscovite, and has a grain-size ranging around 0.08 mm. There is a higher percentage of sericitic material intergrown with the muscovite and with the authigenic quartz outgrowths, but it is difficult to say how much of this was originally clayey matrix or detrital grains of sericitic rocks. Heavy minerals are common and of a wide range, including leucoxene, tourmaline, zircon, and other unidentifiable grains. There are also many grains of quartz which carry dense brown inclusions of dirty appearance, and other grains which might be devitrified volcanic glass. Hydrated iron oxides are virtually absent.

Report No. 16 continued:

CONCLUSION

Both rocks are flaggy orthoquartzites, their main cement being authigenic silica. However, even the sericitic material is intergrown with the secondary silica, and, as it would be stable under normal weathering conditions, it does not constitute a weakness in the rock. It can be noted here that the quarry from which the specimens were taken is shallow, and the rocks presumably have been subjected to near-surface conditions. It is therefore concluded that, in their present state, they would be quite suitable for use as a building, facing, or paving stone.

Report No. 17

170ACT/2
November 1961

PETROGRAPHY OF SPECIMENS FROM UPPER COTTER DAM SITE "E"

by

L. V. Bastian

INTRODUCTION

Five specimens from the Upper Cotter Dam Site "E" were submitted by E. J. Best for petrological examination, as representing a range of interbedded shales, siltstones, and sandstones at that locality. Three of these have the common feature of containing pyrite, both disseminated and in concentrations, and an opinion on the origin of the pyrite was sought.

PETROGRAPHY

R9394 (T.S. 7434) is a light grey medium-grained sandstone containing numerous fragments of grey shale and small amounts of disseminated pyrite. Parts of the rock show a patchy colour change to a pale brownish shade. The sample was obtained from D.D.H. P - 1B, at a depth of 92'9".

The thin-section examination shows the sand to be made up of well-rounded quartz grains - a high maturity sand - around 0.3 mm. in size, with scattered grains of shale and silty shale. Feldspars and micas are absent. The quartz is of a wide variety, suggesting a mixed parentage, and the grains have prominent authigenic outgrowths which now occupy all voids and interlock closely. Much of the quartz is heavily strained, and this strain continues into the authigenic material, showing that it took place after lithification, probably as the result of tectonism. The detrital shale fragments have been impacted by the quartz grains, producing contortions in the orientation of their clay particles, and giving a misleading appearance of being patches of matrix; but the impaction, and hence their real nature, is well displayed in the largest fragment: an undoubted pebble of silty shale about 5 mm. by 2.5 mm. in size.

Report No. 17 continued:

Pyrite occurs as isolated cubes and clumps of cubes, concentrated mainly within the shale fragments and also within patches of cherty void filling and cherty quartz grains. The brownish parts of the rock are patches in which the pyrite has been oxidised, and occasional partly dissolved or replaced pyrite grains can be seen.

This rock shows the curious paradox of having a very mature and well-rounded quartz sand, indicative of a lengthy transport, associated with unrounded shale and silty shale fragments, whose weakness is well seen by their considerable impaction. Because the unstable fraction is made up of only a single rock type, it probably was derived from very close by - perhaps from a slightly earlier formation in the same sequence.

R9485 (T.S. 7800) is a massive, light-grey, medium-grained (6.4 mm.) quartzitic sandstone, which contains angular fragments of dark grey shale aligned in the bedding plane. It was collected from the surface, whereas R9394 was a bore core, but in thin-section appears to be essentially the same rock type. It is made up largely of moderately to well-rounded grains of quartz and quartzite (about 75%), numerous detrital shale fragments (about 20%), a few grains of fine microcrystalline quartz, and little, if any, genuine clay matrix. The shale is made up of intergrowths of sericite and finely divided quartz, with a few cubes of hydrated iron oxide pseudomorphing pyrite. This rock thus shows the same two obvious phases, and is not properly a greywacke. It can best be called a lithic quartz sandstone or protoquartzite (Pettijohn 1957, p. 205), and a similar name would also fit specimen R9394.

R9395 (T.S. 7435) is a tough, pale grey protoquartzite with a granular sugary appearance. It contains numerous clots of pyrite crystals ranging from about 1 to 5 mm. in diameter. This sample was obtained from D.D.H. P - 1, at a depth of 113'4".

The main constituent is again a well-rounded mature quartz sand which has developed authigenically so as to interlock closely. A few well-rounded grains of zircon are present, but feldspars and micas are, as before, absent. Many of the interstices are filled with a chlorite (very low birefringence, positive relief, length-fast, non-pleochroic), probably clinochlore. In addition to this void filling, some patches of this mineral take instead the form of detrital grains, and suggest the same conclusions as for the previous specimens, viz: that these were sand-sized particles of shale which have been incorporated into the sediment and have then been squeezed out to fill adjacent voids, giving the erroneous appearance of being a clay matrix. However, whereas in the previous specimens this material was represented by common shale minerals, it is here represented by chlorite. This may indicate that the rock had here been subjected to a low grade of pressure metamorphism, and the presence of occasional grains of epidote within the chlorite patches would support this idea. However, an addition of Mg to the rock must also be envisaged, and so a better explanation may be simply that the chlorite was primary; derived from a different source to the lithic material seen in the other specimens.

Report No. 17 continued:

Pyrite cubes are concentrated into several clumps, and their euhedral form has been exerted at the expense of other minerals. Several well-defined thin sinuous lines of pyrite are also developed, running in between grain contacts among the quartz. These appear to represent channelways for sulphide solutions, and at least one of the clumps is located at the node of a tightly looping seam. This suggests a control for the initiation of the clumps. It seems that clumps started to develop at points along these channels, after which the continued growth of pyrite progressed as a matter of course from those centres, by virtue of its strong power of crystallisation.

R9393 (T.S. 7433) was obtained from D.D.H. P - 1B, at a depth of 28'4". It is a buff-grey massive mudstone, without any distinct cleavage, which contains irregular patches of white material having a bleached appearance. These patches show a marked zonation, from a central zone laden with small pyrite crystals to outer zones of mauve and brick-red colours. There may be one or two secondary red rings, and then the colour drops off rapidly to the background buff colour.

The thin-section examination shows that the major part of the material is a fine mesh of well oriented kaolinite crystals; presumably this was recrystallised from originally finer mud. Minor amounts of silt-sized particles of quartz and sericite are also present. The pyrite is located entirely within the white zone, and takes the form of a scattering of perfect cubes, each rimmed with a diamond-shaped growth of small muscovite flakes, suggesting a "pressure-shadow" effect. The kaolinite here is quite colourless. Then follows a narrow zone just within the red zone, in which the pyrite has been completely dissolved away, leaving mainly cubic cavities; some of these have been subsequently filled by quartz. Enrichment with hydrated ferric oxide begins sharply, and in this zone the pyrite cavities are occupied by pseudomorphing iron oxide, possibly goethite. Outwards from the most heavily oxidised zone, the iron oxide impregnation decreases rapidly and is paralleled by a steady decrease in the numbers of cubical pseudomorphs, indicating that there was here a definite patch of pyrite. The background buff rock is seen as a mildly ferruginised kaolinite intergrowth (slightly pleochroic due to iron impurities) without any pyrite pseudomorphs. It is noted that the muscovite "pressure-shadows" were developed around the pyrite under the pressure of the mild metamorphism seen here, and indicate that pyrite enrichment preceded the metamorphism. The oxidation was a much later weathering process which had begun to advance into the strongly reduced pyrite zone, in the course of which, because of the higher percentage of iron in that zone, increasing amounts of ferric oxide were produced.

R9486 (T.S. 7801) is a light grey, massive, fine siltstone, with a marked banding caused by rapid compositional changes. It is heavily faulted on a small scale, but the fractures are closed and firm, and associated with this is small-scale folding of incompetent type.

In thin-section the rock is seen to be made up of a fine "flour" of detrital grains with a mean grain-size ranging about 0.01 mm. Quartz makes up 65-70% of the sediment, but fine flakes of muscovite and golden brown montmorillonite are abundant, and form a distinctive lattice-like texture. The darker bands are made up of the same sized material, but contain higher proportions of montmorillonite. There are also numerous patches of opaque iron oxides and leucoxene, and some unidentifiable material. The fracturing, folding and mineral assemblage suggests that this rock has, like the others, suffered a mild degree of regional metamorphism.

Report No. 17 cont'd:

General Comments

The rocks examined here are of high maturity, and are not by any means typical of the geosynclinal environment, although they were presumably laid down in some part of a geosyncline. The particular feature to be noted here is the inclusion of incompetent shale fragments in sand which had undergone lengthy transport; this suggests a paralic environment lacking a heavy supply of immature sediment from nearby highlands. This evident paucity of supply is further supported by marked changes of sediment type, and contrasts with the characteristic thickness and homogeneity of formations laid down under conditions of heavy supply.

The pyrite channelways and the occurrence of pyrite as distinct concentrations, show that it entered these rocks from elsewhere. The bright colour banding in specimen R 9393 is the product of oxidation of pyrite under normal weathering conditions.

Report No. 18

84NT/4A
28th November, 1961.

NOTES ON THE "AMPHIBOLITE" from DIAMOND DRILL HOLE 337, RUM JUNGLE CREEK SOUTH PROSPECT, RUM JUNGLE AREA, N.T.,

by

Robert Bryan.

INTRODUCTION

During November 1959 the core from D.D.H. 337 from Rum Jungle Creek South Prospect was examined and sampled, as part of the work on the altered basic igneous rocks of the Katherine-Darwin area. "Amphibolite, spotted and sheared amphibolite and chloritic schist" had been logged by T.E.P. geologists as making up over 900 feet of the total core length of 1,200 feet. Samples were taken at 30-foot intervals, but close to changes of lithology the sampling was much closer. From these samples, 29 thin sections have been cut.

GENERAL PETROLOGY

One piece of the drill core, previously forwarded to Dr. B. P. Walpole, was described as "amphibolite after gabbro". (Oldershaw W., 1960, T.E.P., D.D.H. No. 337, Rum Jungle Creek South, Bur.Min.Resour.Aust. File Note, 120 NT/4A.)

Both igneous and sedimentary "amphibolite" are now known to occur - though little or none of the material deserves the title of amphibolite, for virtually all of the rock would fall within the albite-epidote amphibolite facies of metamorphism, rather than the amphibolite facies.

Much of the core is banded, and it appears that this banding commonly represents the original layering of a sediment; but shearing has been very pronounced, and this can easily be confused with layering. The sedimentary layering makes angles ranging from 0^{o} to 40^{o} with the direction of the drill hole.

Report No. 18 cont'd.:

DETAILED PETROGRAPHY

This can best be treated by drawing up an approximate log of the hole based mainly on thin section petrography:-

145' - 349' * The rock is grey, fine-grained, strongly banded, and contains many prominent lenses - of boudinage origin - of mixtures of quartz and carbonate. Some thin bands of interlocking quartz grains occur. Shearing is pronounced, and is marked by zones rich in mica.

Seen in thin section, the rock consists predominantly of chlorite, phlogopite, and tremolite - actinolite, sodic plagioclase, carbonate, and quartz. Pyrite, pyrrhotite, and some leucoxene are scattered through the core.

Layered variation in the proportion of amphibole, phlogopite, carbonate, and quartz is marked. There is no doubt that the core is of sedimentary origin and was once bedded siltstone, and calcareous siltstone, with some fine sandy bands.

373' - 772' This rock is dark grey, massive, apparently fine-grained, though it contains many larger dark spots. No real variation in colour or in texture is seen. In thin section, the rock is seen to consist of actinolite and possibly alumina-poor hornblende, oligoclase, andesine, chlorite, quartz, magnetite, ilmenite, pyrite, marcasite, carbonate, and biotite. It is the amphibole that forms the dark spots in the rock; these spots are medium - to fine-grained pseudomorphs after pyroxene, and ophitically enclose plagioclase. This places the igneous origin of the rock beyond reasonable doubt. The plagioclase shows corroded outlines, and is commonly twinned. Chlorite is abundant, replacing the pyroxene - or possibly replacing the actinolite which has originally replaced the pyroxene. Interstitial quartz is quite common. The rock is cut by occasional veins of quartz, carbonate, and chlorite.

There can be no doubt that this rock is of igneous origin, and probably formed from medium-grained dolerite.

773' - 1012' The rock is fine - to medium-grained, grey to grey-black, and either massive or banded. Seen in thin section it consists of actinolite, oligoclase, biotite, phlogopite, quartz, chlorite, magnetite, and pyrite. In almost every case the thin section shows a distinct lineation and compositional variation, due to bedding at right angles to it.

The rocks were originally interbedded siltstone, calcareous siltstone, and fine sandstone.

1031' - 1037' In the hand specimen this rock consists of interlocking blades of carbonate up to 2 cm long. In two of the samples the carbonate was white calcite and this also formed an irregular vein pattern through the rock. In the third specimen the blades were of pale grey pearly dolomite.

In thin section, carbonate makes up over 90% of the rock. The only other material is fine interstitial chlorite, quartz, and carbonaceous material.

It appears that the carbonate is not original, but rather the result of very thorough carbonatization; the nature of the original rock is quite uncertain, but the fine quartz suggests a sedimentary origin. In one slide, calcite appears to have replaced dolomite.

* The divisions are based entirely on the samples of core, and so are only approximate.

Report No. 18 continued:

1056' - 1241'

In the hand specimen the rock is medium - to fine - grained, dark grey, and massive, and is cut by bands and patches of white quartz, and carbonate. In thin section this rock consists of actinolite, chlorite and quartz, with lesser amounts of oligoclase, biotite, pyrite, leucoxene, apatite, and epidote. The texture is metamorphic and gives no indication of the origin of the rock. The actinolite and chlorite form medium-sized bundles of fibres which are separated by fine interlocking anhedra of quartz and oligoclase. Pyrite occurs in very variable amounts, and in one slide forms as much as 6% of the rock.

The rock appears to be of sedimentary origin, probably initially a dolomitic siltstone; but this conclusion is based only on the relative abundance of quartz, and on the general similarity to the overlying sediment, and is in no way conclusive.

1286' - 1342' In the hand specimen, this rock is medium-grained, massive, and patchy olive green to grey. In thin section it is seen to consist of actinolite, hornblende, oligoclase, quartz, sphene, iron oxide, and biotite. The hornblende forms pseudomorphs after pyroxene, and is strongly pleochroic from deep blue green to olive green to pale straw brown. Actinolite has commonly formed in the cores of the hornblende crystals, and as scattered fibres through the plagioclase. Oligoclase forms medium-sized irregularly-shaped pools, some of which show twinning and zoning. Quartz is common as isolated anhedra. Sphene occurs surrounding cores of magnetite or ilmenite. In one slide the texture is rather unusual, as much of the feldspar and quartz is fine grained. This texture is somewhat similar to that in "amphibolite" between 113' and 118', from D.D.H. 4 at Waterhouse No. 2 Prospect (Bryan R., 1961, Notes on the amphibolite from D.D.H. No. 4 Waterhouse No. 2 Prospect, Rum Jungle Area, N.T. Bur.Min.Resour. Aust.File Note 84 NT/4A).

Remnants of igneous texture, especially ophitic texture, are common, and leave no doubt of the igneous origin of the rock. The rock is very similar to altered medium-grained dolerite from the 373' - 772' section of D.D.H. 337; it is also very similar to "amphibolite" from Brocks Creek that has previously been described (Bryan R., 1961, Lower Proterozoic basic intrusive rocks of the Katherine-Darwin area N.T. Bur.Min.Resour.Aust.Rec. 1961 (in preparation).

CONCLUSIONS

Within this drill hole, "amphibolite" derived from basic igneous rocks occurs between 373' and 772', and from 1286' to the bottom of the hole at 1342'. The igneous rocks were certainly intrusive and probably dolerite or gabbro in each case. There are no indications whether these igneous masses were concordant or discordant; but the similarity of the rocks at Waterhouse No. 2 Prospect and at Browns Prospect in the same stratigraphic position would favour a concordant form for the dolerite or gabbro.

The igneous rocks intruded siltstones and calcareous siltstones containing lenses of fine sandstone and limestone. These sediments have been altered to the same degree as the igneous rocks, and in the case of the calcareous siltstones, to an "amphibolite" very similar to the altered igneous rock.

Report No. 18 continued:

All the rock in the drill hole has suffered low-grade regional metamorphism and has reached the "albite-epidote amphibolite facies". In the case of the igneous "amphibolite" the changes may have been assisted by earlier deuteric alteration. It is possible that the later intrusion of granite and the very large Giants Reef fault system may have contributed to the alteration of the rock.

Report No. 19

120PNG/6

November 1961.

MINERAGRAPHIC DESCRIPTION OF TWO MINERALIZED SPECIMENS FROM FERGUSSON ISLAND PAPUA.

by

G. J. G. Greaves

Following is a description of two specimens from Fergusson Island, believed to contain copper minerals. They were submitted by H. L. Davies and D. J. Ives.

A.30 Tahana Creek. A breccia which consists of hard black fragments (? silicified serpentinite) in a siliceous matrix containing suspected pyrite and chalcopyrite.

Marcasite is the only sulphide present and forms about 20% of the specimen; most of it is concentrated in veins measuring up to 3 mm. across, where it forms a mosaic of interlocking crystals. Some lath-shaped idiomorphic crystals of marcasite with fine lamellar twinning were observed; these ranged up to 0.3 mm long. In addition, these veins commonly contain zoned crystals of marcasite with colloform texture; the largest of these crystals is 0.2 mm. across. One small hexagonally-shaped, zoned crystal of pyrite measuring 0.036 mm. in diameter was observed in the vein. Although the rock in hand specimen appears to be mineralized only along veins, some marcasite is distributed throughout the apparently unmineralized part.

A.114 Morina Coast near the south of the Ipwapaia Creek. This specimen was submitted as a suspected magnetite gossan containing chalcopyrite.

The hand specimen consists of dark brownish-red mineral containing small grains of a lighter brown mineral and brassy yellow and black sulphides.

Sulphides form roughly 15% of the specimen; these consist of chalcopyrite (7%), covellite (5%), and digenite (3%) and form composite grains in iron oxide. The largest mass of sulphide measures 7 mm. across and consists largely of chalcopyrite which has altered on its margin and along cracks to hydrated iron oxides, covellite, and digenite. Some irregular areas of covellite and digenite close to the chalcopyrite mass are probably alteration products of chalcopyrite.

The remainder of the specimen consists of alternating bands of magnetite and haematite, veins of hydrated iron oxides with minor iron-stained quartz and malachite.

Report No. 20 84W/1

November 1961

DETERMINATION OF THE CAUSE OF RADIOACTIVITY IN A LIMESTONE FROM THE CARNARVON BASIN, NORTHERN AREA W.A.

by W. M. B. Roberts.

A piece of limestone, described as a calcrete, was submitted by the Geophysical Branch for determination of the cause of radioactivity. The rock is from Airborne Anomaly No. 1, Carnarvon Basin, Northern Area W.A., and its radioactivity ranges from five to ten times that of the adjacent rocks.

Examination of the hand specimen revealed abundant patches, ranging up to 1 cm. across, of a bright lemon yellow, powdery mineral lining solution cavities. These proved to be non-fluorescent in ultra-violet light. An X-Ray powder diffraction photograph identified the minerals as the potassium, uranium vanadate, Carnotite.

Conclusion

The radioactivity of the specimen is due to the secondary uranium mineral, carnotite, which is distributed fairly uniformly throughout the rock.

Report No. 21 106Q4/1

21st December, 1961.

IDENTIFICATION OF MINERALS FROM EMERALD, QUEENSLAND

by
W. M. B. Roberts.

Six rock specimens containing large mineral inclusions were submitted by G. Mollan. The specimens are from the Emerald district, Queensland, and the identity of the mineral inclusions was required.

The minerals were identified by a combination of X-Ray diffraction and X-Ray spectrochemical analysis; the following is a list of the field numbers of the specimens and the identities of the mineral inclusions:

EM102/1M	- Corundum
EM102/1M (black mineral)	- Spinel (containing high Fe and is therefore either hercynite or a mixture of hercynite and pleonaste).
EM161/1	- Pyroxene
EM166/2	- Pyroxene
EM166/2 (B)	- Pyroxene
EM107/1	- Pyroxene

RECORDS OF THE GEOLOGICAL BRANCH LABORATORY

JULY-DECEMBER 1961

PART II. CHEMICAL INVESTIGATIONS.

Compiled by
S. BAKER.

INTRODUCTION

The Records consist of reports completed by the Chemists of the Bureau Laboratory. In addition to the work reported here, a large number of trace metal analyses were carried out by E. J. Howard and S. Baker on soil, rock and water samples from the Captain's Flat Area.

The officers responsible for these reports are A. D. Haldane, E. J. Howard and S. Baker.

Report No. 1 94ACT/1

16/8/1961.

IRON ORE FROM GINNINDERRA, A.C.T.

by

S. BAKER.

Following are the results for the determination of iron in three ore samples from Ginninderra, A.C.T. submitted by Mr. N. J. Canham, Braddon, A.C.T.

Sample No.	Iron (as Fe)
1	55.78%
2	59.34%
3	57.72%

Lab. No. 61/1053

Report No. 2 127/G/1

22nd August, 1961.

COARSE SALT FROM N.T. GULF AREA

by

S. Baker.

At the request of the Gulf Trading Co., Borroloola, N.T., a sample of coarse salt, taken from a natural salt pan in the N.T. Gulf Area, has been analyzed with the following results:

Chloride	(expressed as NaCl)	98.93%
Calcium	(expressed as Ca)	0.16%
Magnesium	(expressed as Mg)	0.09%
Sulphate	(expressed as SO_4)	0.38%
Potassium		less than 10 p.p.m.
Strontium		15 p.p.m.
Zinc, Copper		not detected.

All results refer to the sample dried to constant weight at 105°C.

Lab. No. 61/1054.

Report No. 3 46Q/1

15th September, 1961.

SPECTROGRAPHIC EXAMINATION OF WALLROCK (R.9392) FROM BRADLOW TIN MINE, HERBERTON, NTH. QLD.

by
A. D. HALDANE

The following elements were detected spectroscopically.

Major constituents	Minor constituents	Trace elements
Si, Al, Fe, Ca, Mg, K, Na > 1%	Mn, Ti 0.1 - 1%	Ba, Sr, Cu, Sn < 0.1%

Both Ni and Cr were present, but are considered to be derived from the crushing equipment.

Of the commoner elements the following were sought but not detected W, Mo, V, Pb, Zr, Be, B and P. In all the examination includes approximately 40 elements.

Report No. 4 84NT/10A

8th November, 1961.

DETERMINATION OF TRACE ELEMENTS IN AUGER CUTTINGS FROM CASTLEMAINE HILL AREA, RUM JUNGLE, NORTHERN TERRITORY.

by A. D. HALDANE.

The seventeen samples listed below were submitted by D. L. Rowston on behalf of B.P. Ruxton, Rum Jungle Geochemical Party for check analyses of copper, lead and zinc. The samples were selected to cover a wide range of field values and are all from the Castlemaine Hill area, Rum Jungle, Northern Territory. Check analyses for copper and zinc were done by standard geochemical procedures and for copper and lead by spectrographic technique. In addition spectrographic results for cobalt, nickel, tin, vanadium and molybdenum were obtained at the same time. Chemical analyses were carried out by S. Baker. All results are in p.p.m.

Field No.	Depth feet	Copper Spec.	Copper Chem.	Lead Spec.	Zinc Chem.	Cobalt Spec.	Nickel Spec.	Vanadium Spec.
CH.92E/4N	8-10	2000	1700	70	50	70	300	150
CH.94E/4N	14-16	3000	3000	1000	60	150	250	200
CH.94E/8N	13-15	1500	1000	20	150	200	250	70
CH.96E/00	26-28	500	500	1500	1000	60	200	250
CH.96E/4N	14-16	1000	1000	100	30	60	100	200
CH.96E/6N	26-28	1300	1700	10	50	400	300	150
CH.98E/4N	8-10	1500	1000	100	30	150	300	150
CH.98E/6N	26-28	3800	4000	100	40	500	450	200
CH.98E/8N	13-15	700	700	20	40	100	300	150
CH.100E/2N	8-10	150	250	70	20	30	50	70
CH.100E/4N	20-22	2000	2500	450	1300	100	70	200
CH.102E/4N	14-16	1000	1000	700	800	450	400	300
CH.102E/6N	20-22	2000	2500	20	30	30	50	450
CH.104E/2S	14-16	1700	1500	1200	150	250	150	400
CH.104E/00	20-22	2500	3000	1200	1000	200	250	250
CH.104E/12N	8-10	30	30	<10	1000	200	400	70
CH.106E/6N	8-10	2500	2500	50	100	200	250	450

Tin was not detected in any sample. Detection limit <10 p.p.m.

Molybdenum was present at <15 p.p.m. in all samples.

Lab. No. 61/1063

Report No. 5

84NT/10A
25th October, 1961.

DETERMINATION OF ZINC IN SOIL AND ROCK SAMPLES FROM RUM JUNGLE.

by
Stefan Baker

Fifty soil and rock samples taken by the geochemical party at Rum Jungle from Flynn's Anomaly, were forwarded to Canberra from Darwin on 15/9/61. The samples were analysed for zinc by the usual procedure for geochemical analysis: digestion of the dried, ground sample with concentrated sulphuric acid, followed by colorimetric determination of zinc with dithizone. The results reported here are the mean values of two replications carried out by E. J. Howard and the writer.

	Field No.	p.p.m. zinc
1.	F/1gE/18N/18-20	10
2.	F/15.75E/21N/18-20	20
3.	F/9E/20N/16-18	30
4.	F/11E/17N/18-20	10
5.	F24E/175N/93-99	10
6.	F/6W/28N/20-22	10
7.	F/1W/32N/20-24	30
8.	F/3W/26N/6-8	10
9.	F/11E/20N/24-26	10
10.	F11E/20N/44-46	10
11.	F/12E/19N/42-44*	
12.	F/14E/16N/14-18	10
13.	F/6E/32N/12-14	10
14.	F/6E/32N/20-22	10
15.	F/6E/32N/22-24	30
16.	F/6E/32N/20-26	10
17.	F/1E/32N/20-22	10
18.	F/1W/30N/6-8	10
19.	F/1W/30N/18-20	60
20.	F/1W/30N/20-22	40
21.	F/1W/30N/38-40	40
22.	F/4W/29N/2-4	10

...23. ......

* No satisfactory result could be obtained with this sample due to emulsification and bleaching of the organic phase.

Report No. 5 continued: 84NT/10A

.. results - cont'd.

	Field No.	p.p.m. zinc
23.	F/4W/29N/6-8	10
24.	F/4W/29N/10-12	10
25.	F/2W/31N/2-4	10
26.	F/2W/31N/6-8	20
27.	F/2W/31N/12-14	20
28.	F/2W/31N/18-20	20
29.	F/2W/31N/24-26	30
30.	F/2W/31N/32-34	20
31.	F/2W/31N/40-42 b	40
32.	F/2W/31N/50-52	30
33.	F/14E/18N/0	10
34.	F/14W/30N/0	10
35.	F/20E/18N/0	10
36.	F/2W/24N/0	10
37.	F/12W/32N/0	10
38.	F/12E/32N/0	10
39.	F/3W/28.75N/0	70
40.	F/29.4W/29.76N/0	500
41.	F/25E/15N/0	2000
42.	F/10E/24N/0	80
43.	F/24E/18N/0	300
44.	F/6W/338N/0	50
45.	F/103W/336N/0	400
46.	F/115E/1825N/0	10
47.	F/36E/25/N/0	10
48.	F/SSW/33N/0	50
49.	F/40E/27N/0	20
50.	F58E/23N/0	40

Lab. No. 61/1062

Report No. 6.

File 45ACT/1
4/12/61

ANALYSIS OF SIX WATER SAMPLES

by

S. Baker.

Six water samples submitted by G. M. Burton were analysed with the following results:

Sample No.:	L9	L10	L11	L12	L14	L15
Cl(ppm)	615 (17.3)	80(2.25)	20(0.56)	75 (2.11)	35(0.99)	230(6.49)
SO_4 "	79 (1.64)	<5	<5	102 (2.12)	<5	18(0.37)
HCO_3"	220 (3.6)	146(2.40)	15(0.25)	> (0.12)	12(0.20)	6(0.10)
Ca "	23 (1.15)	47 (2.34)	3(0.15)	30 (1.5)	14(0.69)	23(1.15)
Mg "	25 (2.05)	7 (0.57)	<0.5	9 (0.74)	1(0.08)	11(0.90)
Na "	433 (18.83)	35(1.52)	14(0.61)	40(1.74)	9(0.39)	102(4.43)
K "	5 (0.13)	2(0.05)	0.5(0.01)	6(0.15)	0.5(0.01)	15(0.39)
Sr "	6 (0.13)	0.3(0.006)	0.2(0.004)	0.35(0.005)	0.1	3(0.07)
T.D.S"	1350	300	40	260	62	400
pH	8.1	7.8	6.3	6.4	7.5	7.2
Conductivity (micro mho/cm 25°C)	2040	446	111	440	143	790

Note:

(1) L.9 Lake George Gauging Station 25/10/61

L.10 Well in Coastal sand 'Christian Minde' Jervis Bay, 21/10/61

L.11 Lake Windermere Jervis Bay, Pumping Station 21/10/61

L.12 Spear Point Pump at Cash and Carry Stores, Sussex Inlet 22/10/61

L.14 No. 1 Reservoir, Lake Windermere Catchment 21/10/61

L.15 Spear Point Pump 'Seacrest' Sussex Inlet South 22/10/61

(2) Figures in brackets refer to milli equivalent per litre.

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