COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.
BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

1956/97

URANIUM OCCURRENCES IN TASMANIA.

by

D. Ostle

URANIUM OCCURRENCES IN TASMANIA

by

D. Ostle
Senior Geologist
United Kingdom Atomic Energy Authority

RECORDS 1956/97

Contents | Page

SUMMARY.

Only one of six uranium occurrences inspected in the Devonian granites of north-east and western Tasmania warrants further investigation. At Chwalczyk's prospect, on Storey's Creek in the Avoca District, high-grade pitchblende mineralization occurs in a thin, flat-lying seam in a fracture zone of the granite.

At the other prospects, all of which are in granite, the uranium is present in a supergene phase of mineralization, or in iron minerals of possible hydrothermal origin, except at Hughes prospect, also on Storey's Creek. At the latter, traces of a discrete primary uranium mineral have been recognized in a greisen zone containing sulphides.

A relationship between the uranium-rich mineralization, such as that at Chwalczyk's prospect, and the higher temperature tin/wolfram phase is suggested, which may assist in the search for further high-grade deposits.

Discovery of the type of primary mineralization now exposed on Storey's Creek should stimulate further prospecting in and around the granites.

INTRODUCTION.

During the latter half of February, 1956, brief inspections were carried out at uranium prospects in the Avoca, Blue Tier, and Heemskirk areas of north-east and western Tasmania. Concurrently a number of samples of stream water were collected from each district for the purpose of determining their content of uranyl ion by a field analytical technique described previously by the writer (Ostle, 1954). Apart from the possibility of detecting anomalous uranyl values which might indicate the presence of uranium deposits upstream from them, it was expected that these water samples would provide background values for streams draining areas underlain by radioactive granites. The analytical technique was demonstrated to the Director and officers of the Mines Department.

All the deposits had been examined previously by Mr. T. D. Hughes, Senior Geologist of the Tasmanian Mines Department, and those in the Avoca and Blue Tier districts had been inspected and reported on by Messrs. L. C. Noakes and B.P. Walpole, of the Bureau of Mineral Resources, during 1955 (Noakes 1955 and Walpole 1955). Since the latter's visits only a small amount of exploratory work had been completed which revealed significant information only at one prospect on Storey's Creek. Some of the information which herein relates to prospects in the north-eastern districts therefore duplicates that which is embodied in the reports referred to. The investigations under review took the form of brief and localised radiometric inspections and the collection of samples and specimens which were subsequently assayed and examined in the laboratory in Canberra.

The writer is indebted to the Director and geological staff of the Department of Mines in Hobart for facilitating the enquiries, and in particular to Mr. T. D. Hughes, who conducted the party in the field. Mr. J. Taylor, United Kingdom Geological Survey, assisted in the investigations and some petrographic examinations of specimens were carried out by Mr. W. B. Dallwitz of the Bureau of Mineral Resources. A mineragraphic study of uraniferous vein-rock from one of the Storey's Creek prospects forms the subject of an appendix to this report by W. M. B. Roberts.

THE RADIOACTIVE OCCURRENCES

AVOCA DISTRICT

Three occurrences were examined in the Avoca district; one at the derelict Royal George Tin Mine and two on Storey's Creek some twelve miles to the north-west. During his visit to the area Mr. Walpole inspected three other prospects but slight secondary uranium mineralization was recorded at only one of them and they were regarded as being of no possible economic value.

The north-eastern corner of Tasmania, with the Avoca area at its southern extremity, is underlain by slates and quartzites of supposed Silurian age. These are intruded by Devonian granites and locally both granite and Lower Palaeozoic formations are overlain unconformably by Permian sediments. The area is flanked to the south and west by overlying diabase of Mesozoic age.

Tin mineralization, which has contributed the bulk of the mining output of the area, occurs both in granite and Lower Palaeozoic rocks. The largest orebodies have been located in sediments but substantial production has been obtained from greisen and pegmatite zones in the granites. To date, all the radioactive occurrences have been located in granitic rocks.

Royal George Mine.

The old workings on the Royal George Tin Mine, abandoned since 1922, are situated about 10 miles slightly south of east from Avoca. It is reported that about 900 tons of concentrate were produced by open-cut and underground mining, over a length of 800 feet and a width of 35 feet. The tin mineralization occurred mainly in greisenised zones in granite, formation of which was apparently controlled by a closely spaced system of joints or fractures trending approximately north-west and dipping steeply to the south-west. The altered granite contains modules consisting of concretions of tourmaline crystals.

Visible uranium mineralization, which is exposed in the open-cut, is entirely secondary. Flakes and small tablets of metatorbernite occupy partings and exposed surfaces of the greisen and of unaltered granite, and, to a lesser extent, vugs in the tourmalite nodules. Greatest concentration of secondary mineral is generally found on strongly ferruginized surfaces.

Distribution of the uranium mineral is sporadic throughout the open-cut. The floor is blanketed by rubble, but, as Mr. Walpole has pointed out, lode material or granite outcropping through the rubble is not mineralized and it may be assumed that any mineralization in the floor of the cut will also be pockety. The largest and richest zone of secondaries occurs in the hanging wall of the open-cut, where the slight underlay of the greisen zones has led to the development of open joints, after support was removed from the footwall during mining. At this locality, metatorbernite in varying degrees of concentration occurs over a length of 80 to 100 feet and over a maximum width of about 5 feet. At one point along this zone, ratemeter readings suggest an equivalent urania content of approximately 0.1 percent, over a three foot width; but the average value is undoubtedly less than 0.05 percent. As is the case at other loci of secondary minerals in the open-cut, there is no apparent genetic relationship between the uranium minerals and the greisen zones and it is suggested that the bulk of the uranium has been precipitated from ground water which obtained its uranium content by leaching over a wide area. Uranium in this supergene phase would be most readily deposited along open joints and possibly influenced by the presence of ferruginous matter on the surfaces of these openings. The significance of the nature of the hanging wall of the greisenised zone (as described above), in localising supergene mineraliation, therefore becomes apparent.

Uranium ion is probably contributed to circulating ground water from two sources. Firstly, the granite country rock in the area is radioactive and probably contains leachable uranium. Secondly, a qualitative fluorimetric examination of slightly radioactive sand residues at the mine shows that traces of uranium are present in small grains of a mineral which has been tentatively identified as haematite. The consistent slight anomalous radioactivity of the sands and dunes suggests that, at least to the depth to which the greisen zone has been mined, small amounts of this uraniferous haematite(?) were dispersed through the ore and some leaching of the uranium could therefore have taken place.

Besides the zone of secondary mineralization described above, another small pocket occurs in the granite of the footwall opposite its western end and yet another small concentration is located in hanging wall granite about 250 feet to the north-west. The latter is apparently developed in the vicinity of a highly ferruginised transverse structure, a fault or crush zone.

The secondary deposits do not constitute bodies of workable dimensions or grade and in view of the absence of any indications of high-grade primary mineralization, expenditure on further exploration for uranium alone, in depth, could not be justified. One diamond drill hole was put down in 1955 to test the extension of the greisen zone below the main concentration of uranium secondaries. Although the results were apparently inconclusive, due to the loss of a critical section of core and to failure of bore hole logging equipment to "bottom" the hole, no evidence of high grade mineralization was obtained. Some meta-torbernite was recorded from the hole below 300 feet inclined depth, and this was outside the greisen zone. As suggested already, there is a possibility that the tin-bearing zone contains a trace dissemination of a uraniferous iron mineral. Assays of grab samples of slimes and sands showed that they contained 0.04 and 0.01 percent eU_3O_8 respectively. Considering their respective bulks, these suggest that the overall grade of material mined in the past did not exceed 0.025% eU_3O_8, allowing for the removal of a small percentage of urania in concentrates. If the mine is reopened for recovery of tin ore, a course which it is understood is being contemplated, it is unlikely that more than a few hundredweights of uranium could be recovered annually in concentrates as a by-product. On available evidence, therefore, it is concluded that the Royal George occurrence has no economic potential as a source of uranium.

STOREY'S CREEK AREA.

Two more prospects were inspected in the Avoca district. They are located along the banks of Storey's Creek, the more northerly prospect being about a mile and a half south-west of the village of Rossarden. Access is gained by following a disused water race which follows the course of the stream along the eastern slope of the valley. In the event of a road being required for access to the prospect by vehicles, this route could probably be made passable.

Both prospects are in granite, which in this area is generally a coarse-grained rock containing local areas of finer-grained material of similar composition. Pegmatitic and aplitic phases are reported from the area, while further late-stage magmatic activity is represented by greisen zones and quartz veins. The main outcrop of intruded Lower Palaeozoic sediments is several miles to the north but Mr. Noakes records that roof pendants occur on some of the ridges.

Compared with the sedimentary rocks the granitic rocks are radioactive, the intensity of gamma radiation being up to three times that recorded over sediments and diabase.

Chwalczyk's Prospect.

At the time of the visit this prospect comprised a shallow excavation about 12 feet square at the foot of the eastern slope of the valley and about 20 feet from the stream. The opening had been sited on the basis of high ratemeter readings which were subsequently attributed to the presence of uranium secondary minerals (chiefly metatorbernite) in a flat-lying band of fine-grained granitic rock affected by sub-horizontal shearing. At that time it was not possible to determine whether the uranium was entirely supergene, or related to some primary deposit in the sheared zone.

The latest inspection showed that a narrow but well-defined mineralized band was being exposed, containing a black, sooty, highly radioactive mineral which was tentatively identified in the field as pitchblende. This identification was later confirmed by X-ray powder photograph, at the Bureau of Mineral Resources laboratory in Canberra.

Pitchblende is restricted to the narrow vein-like structure in the zone of sheared, fine to medium-grained granitic rock. Adjacent to the vein the granite is altered, probably by hematization of felspars, to a red colour, over a height of two or three feet on the hanging wall and to an unknown depth below the footwall. The vein, in common with the parallel shears above it, dips at about 8° in a south-easterly direction, i.e. at a small angle to the downstream direction. Over that part of it which has so far been exposed, it appears to be thickening slightly down the dip, the maximum width exposed at the time of the inspection being 12 in. A few feet upstream from the prospect part of the sheared zone outcrops in the stream bank but here and on the west side of the stream, the outcrop of the mineralized band is obscured by coarse detritus.

Studies of thin sections of host rock in the sheared zone show that the fine-grained rock is of the same mineralogical composition as the coarse granite which lies above and below it. There is no definite field evidence to show that the finer-grained rock is intrusive into the coarser, and Mr. Hughes records that similar fine-grained phases which occur throughout the granite mass appear to grade into the coarser variety. In any case, the metallic mineralization is not regarded as being genetically associated with the finer-grained rock. The petrographic examinations show that the mineralization is largely restricted to a band of finely brecciated rock which contains angular fragments of the slightly sheared, fine-grained granite adjacent to it. The contact between the two rock types is sharply defined by a plane of movement. Small amounts of fluorite (the first mineral to the deposited) have transgressed the contact but the bulk of the mineralization has apparently been controlled by the more favourable texture of the strongly brecciated horizon.

The assemblage of hydrothermal minerals is described by Mr. Roberts in the appendix. It includes fluorite, pyrite, galena, chalcopyrite, sphalerite and pitchblende, with a gangue of fine-grained quartz and iron-stained chalcedony. The laboratory studies confirmed the conclusion, suggested by field evidence, that the deposit is of high- to medium-temperature hydrothermal origin.

Mr. Roberts observes, in the appendix, that there is no evidence in the polished sections of secondary enrichment or weathering of the chalcopyrite. This is in keeping with the fact that, in spite of its friable consistency, the pitchblende appears to be quite fresh within two or three feet of the surface. Thus, considering the quantity of pitchblende in the deposit, there is relatively little secondary mineral associated with it below outcrop. A vertical channel sample cut from the altered granite over 20 in. above the vein assayed only 0.035% eU3O8, the radioactivity being due to sparsely disseminated metatorbernite. This relative absence of oxidation close to the surface may be due partly to protection afforded by the overlying granite and partly to the proximity of the vein outcrop to stream level, since the mineralized zone will be almost permanently below the water table. It is of value in preliminary exploration and appraisal of the deposit, in that uranium should be practically in equilibrium and radiometric assays should therefore provide a reasonably accurate indication of the true urania content.

This deposit at Chwalczyk's prospect is definitely the most significant so far discovered in Tasmania. Not only is the uranium mineralization of high grade, but it also demonstrates the existence of a uraniferous hydrothermal phase of igneous activity, distinct from the tin/wolfram phase, which has not, hitherto, been recorded in association with the Devonian granites. Prediction of the possible extent of the mineralization cannot, therefore, be based on local experience of this type of deposit and it would be premature to attempt it at this stage. The urania content of the exposed vein near the surface is sufficiently high, however, to justify further exploration. A channel sample over the full thickness of the vein (10 in.) assayed 1.4% eU3O8, which represents ore grade over a stoping width, assuming adequate reserves.

Experience of similar occurrences in other parts of the world emphasises the need for exploration to be undertaken gradually, with small initial expenditure. Preliminary work should be directed to testing the full vertical extent of the sheared and altered zone by extending the existing excavation downwards. By this means any parallel mineralized fractures will be exposed, while the profile of the zone of alteration thus obtained will be of value in controlling subsequent diamond-drilling operations. Exploration of the vein down the dip presents considerable difficulties on account of the topography. Underground mining would provide most useful information on the grade and habit of the mineralization, particularly in view of the friable nature of much of the pitchblende and the fracturing of altered granite in the vein zone, which will adversely affect core recovery if drilling is employed. Without undertaking unwarranted sinking in barren granite, however, mining may well prove impracticable, because of the difficulty of water control, and diamond drilling from the valley slope will have to be used, in spite of the difficulty of access.

A short distance upstream from the prospect a radioactive anomaly is again associated with sub-horizontal layering or fracturing in the granite. Concurrently with testing of the main deposit, this occurrence should be tested by pitting while detailed radiometric traversing should be carried out over the area.

<u>Hughes Prospect</u>.

Radioactivity at Hughes Prospect is located in the environs of an old prospecting trench about one mile downstream from Chwalcyk's prospect but on the west bank of and fifty feet above Storeys Creek. Country rock is of coarse-grained leucocratic granite.

The anomalous radioactivity is associated with a heavily mineralized band of dark, greenish-grey, altered granite which has been termed greisen. It is a siliceous rock in which felspars have been largely converted to sericitic material, and quartz recrystallised. It is impregnated by abundant sulphide minerals, chiefly sphalerite, but with subordinate pyrite, chalcopyrite, galena and pyrrhotite.

Trenching has exposed the greisen zone over a length of 35 feet and Mr. Hughes inspection of the surrounding area suggests that it cannot persist over a much greater distance than 110 feet. Dip is steep to the east and the maximum width is of the order of 4 feet.

Ratemeter readings show variable radioactivity over the greisen zone with a marked radiometric boundary at the junction between greisen and less altered granite. The highest readings appear to be produced by rock containing the highest proportion of sulphides and over a length of a few feet in the main exposure, they suggest an equivalent uranium content of about 0.1%, across a width of 1-2 feet. A chip sample taken over a width of 4 ft. 6 in. by Mr. Noakes, had assayed 0.08% eU_3O_8 and a specimen had contained 0.19% eU_3O_8. The ratio of beta to gamma radiation (determined by the Bureau of Mineral Resources), the lack of evidence of leaching, the absence or uranium secondary minerals and the present of uranium as shown by fluorimeter tests, indicate that the uranium is present in the proportions in which it was originally deposited. Consequently, there is nothing to suggest that the content of uranium will increase downwards. Together with its small size and low grade at outcrop, this leads to the conclusion that the deposit is of no value as a possible source of uranium ore.

Identification of the source of radioactivity in the greisen is of interest in attempting to demonstrate a relationship between this occurrence and that at Chwalczyk's prospect. Autoradiographs of cut surfaces show that the bulk of the alpha-ray activity emanates from scattered, minute centres, mainly in the fine-grained sericitic material but occasionally associated with the sulphide grains. Mr. A. W. Whittle, of the South Australian Department of Mines, made similar observations and was able to relate the radioactive centres to aggregates of minute gummite particles, some of which contained opaque nuclei which may have been pitchblende.

Discovery of this discrete, primary phase of uranium mineralization may suggest a genetic association between the greisen type of deposit and that at Chwalczyk's prospect. The two types may represent high and lower temperature phases of the same hydrothermal episode, the main concentration of uranium being into the later, lower temperature phase which would require more readily accessible, and possibly later, structural breaks for its deposition.

If such a postulate is valid, then the search for high-grade concentrations of uranium should be directed away from the centres of greisenization and tin/wolfram mineralization.

2. <u>BLUE TIER DISTRICT</u>

Mr. Noakes describes the Blue Tier as a partly dissected plateau almost entirely composed of granitic rocks of Devonian age. The area has produced large quantities of tin, which occurs in greisen, pegmatite and altered phases of a younger granite which intrudes coarse-grained harder granite similar to that at Storey's Creek. The younger granite is medium-grained and occurs as flat topped cupolas. Cassiterite is generally restricted to a zone within 100 feet of the flat-lying contact between the two granites. In places the contact is defined by a narrow band of pegmatite.

The Anchor Mine

The Anchor Mine worked the largest tin deposit in the Blue Tier, with a record of a production of 3,000 tons of tin oxide up to 1950, when the property was abandoned. It is located on the southern margin of the Blue Tier and is readily accessible by road.

The extensive open-cut workings have been examined in detail for uranium occurrences, but the only radioactive anomaly occurs across the roof of a compartment in the wall of the open-cut on the eastern side of the workings. The roof is in coarse-grained older granite which is underlain by altered younger granite. The contact, which has a general low southerly dip, is marked by a thin band of pegmatitic material which is characterised by a predominance of coarse biotite. It is with this micaceous band that the bulk of the radioactivity is associated, although localised anomalies were recorded along small, vertical gouge-filled faults which cut the older granite in the highest corner of the chamber. Samples taken during previous inspections had assayed 0.09, 0.25, 0.22 and 0.35 percent. equivalent U_3O_8 and a chip sample taken by the writer over a few square feet of the roof assayed 0.25 percent. Radiometric disequilibrium determinations carried out by the Bureau of Mineral Resources suggested that the radioactive material was slightly uranium-rich, a fact which agrees with the observed phase relationships of the uranium as outlined below.

The level of gamma radiation which was recorded along the contact zone between the granites suggested either that uranium had been leached, leaving a preponderance of daughter elements, or that it was present in a mineral phase other than the uranium secondary minerals. The latter (chiefly metatorbernite) occur as flakes and points on fracture surfaces, mainly along the upper margin of a silicified band which locally underlies the pegmatite horizon. The proportion and extent of visible secondaries, however, could not fully account for the level of radiation, and further tests were carried out on specimens in the laboratory. Strongly positive results were obtained by fluorimetric tests for uranium, carried out on limonitic matter and on flakes of biotite which were shown under the microscope to contain no uranium secondary minerals. A section of an aggregate of biotite crystals was then autoradiographed for fine clays. The resulting pattern of alpha-tracks could be related to traces of a brown iron mineral occupying partings between mica flakes and along crystal boundaries. Similarly, positive results were obtained by fluorimetric tests on ferruginous clay gouge from minor faults, in the absence of secondary minerals.

From the foregoing, it is concluded that the uranium at the Anchor Mine is of supergene origin, having been concentrated from circulating ground water by precipitation of secondary minerals along a favourable structure and adsorbed by iron minerals in the ferruginous biotite zone. The source of the uranium may have been the overlying granite of a dispersed phase of sulphide/uranium mineralization in the metalliferous formation. The only evidence for the possible existence of the latter is the presence of points of secondary copper mineral on exposed samples and along partings which are also occupied by uranium secondaries.

As a workable source of uranium ore the Anchor Mine is believed to have no potential. The supergene mineralization, where it is exposed, is of moderate grade over a thickness of a few inches and a small areal extent. And the pegmatite band, which apparently constitutes the most favourable host, is reported as being only 6-12 inches wide in the Blue Tier. In view of this, and the absence of any indication of a high-grade primary deposit, further exploration of the occurrence is not warranted.

3. HEEMSKIRK DISTRICT

Two small radioactive occurrences were inspected on the west coast of Tasmania approximately 10 miles west of Zeehan. The geology of the area is similar to that in the Blue Tier and Storey's Creek districts in that Lower Palaeozoic sediments are intruded by Devonian granites. The Heemskirk granite crops out along the coast over a distance of about 10 miles north-west of Trial Harbour, with a maximum width of about 5 miles. Mt. Heemskirk is the highest point in the range of hills which rises north-east of the elevated coastal plain.

Deposits of tin and wolfram are associated with the granite and it is in surface tin workings south-west of the old Federation Mine that the two radioactive anomalies are located.

North-West Anomaly.

The north-westerly of the two anomalies occurs in a small quarry near the foot of the western slopes of the hills flanking the coastal plain. Anomalous radioactivity occurs in zones of purplish granite, to which the colour is imparted by abundant small crystals of hematite, set in a matrix of kaolinitic material. On weathering, this hematitic rock forms masses of limonite, containing hard concretions of iron mineral, which is rather more radioactive than the unweathered hematite rock.

In the absence of any uranium secondary minerals, it was concluded in the field that radioactivity must be closely associated with the iron minerals. Qualitative tests carried out later in the laboratory demonstrated that both the hematite crystals and the limonitic matter contain uranium. It is suggested therefore that uranium has been introduced into the rock with the hematite, and that it is combined with the iron mineral in a sufficiently stable form to resist leaching. Enrichment during weathering is presumably achieved by selective removal of the non-ferruginous, and therefore non-uraniferous, constituents of the rock.

The radioactive material is patchily distributed in the altered granite and ratemeter monitoring indicates that it nowhere exceeds a urania content of 0.05%. A chip sample taken over an outcrop of limonitic rock, showing the highest recorded activity, assayed 0.04% eU_3O_8. As a potential source of uranium ore the prospect may be confidently abandoned.

South-East Anomaly.

The remaining anomaly is located in the mouth of an old shaft-like mine opening near the crest of the ridge which parallels the coast south-east of the other prospect. The prospect is laboriously accessible by foot-track but a gouger has installed a small plant there for recovery of tin concentrate.

Radioactivity is again restricted to a limonitic body, about 3 feet wide, which lies along the western flank of a steeply-dipping, tin-bearing greisen zone in granite. The nature of this formation is open to doubt. It has been suggested that it is a filling of extraneous material in a widened fracture between the greisen and the unaltered granite, but there is no evidence that it pinches out in depth. Its continuation along the strike is masked by platy soil cover.

Radioactivity over the exposed section of the limonite body is of a low order and a chip sample taken over about six square feet assayed 0.03% eU_3O_8. The only possibility of the formation being of economic significance, therefore, would require that substantial quantities of uranium had been leached from the oxidised zone, leaving a small proportion of daughter elements to account for the present level of gamma radiation. That such is not the case is shown by the strong positive result of a fluorimetric test which was carried out on the limonitic matter. Consequently, it is concluded that the uranium has been concentrated either by adsorption of the element from meteoric water or by weathering of a rock containing uraniferous iron oxide, such as that which occurs at the other prospect in the same area. Whichever is the explanation it is reasonable to assume that there will be no increase in uranium content of the deposit in depth, so that exploratory work cannot be recommended.

CONCLUSIONS.

1. Of the uranium occurrences which have been discovered to date in Tasmania, only that exposed at Chwalczyk's Storey's Creek prospect warrants further exploratory investigation.

2. In occurrences other than those on Storey's Creek, uranium has been concentrated largely by supergene processes but there is evidence to suggest that the element may also accompany iron minerals (probably hematite) in the epigenetic mineralization to which the tin deposits are attributed.

3. The latter mode of occurrence and, more particularly, the presence of traces of primary uranium mineral in the greisen zone at Hughes prospect on Storey's Creek, may suggest that the uranium-rich type of deposit (viz. Chwalczyk's) is a lower temperature differentiate of the widespread hydrothermal phase of igneous activity associated with the Devonian granites. Lacking fluxes and being of lower temperature and probably slightly later mobilization than the greisenizing phase, the uranium-rich solutions would require readily accessible structures to favour deposition of their metallic constituents. Such is the brecciated band in the shear zone at Chwalczyk's prospect.

4. Considering the above, the search for high-grade uranium deposits should be directed away from centres of greisenization, both in the granites and surrounding them.

5. Whatever should prove to be the extent of the deposit at Chwalczyk's prospect, the recognition of this discrete phase of uranium mineralization should be regarded as an encouragement to further prospecting, preferably under geological direction.

REFERENCES.

Hughes, T.D., 1955 - A. G. Hughes Uranium Prospect, Storey's Creek. Radioactive Material at the Anchor Mine. Notes on A. Chwalcyzk's Uranium Prospect - Storeys Creek. Dep.Min.Tas. Unpub. Reports.

Noakes, L.C., 1955 - Notes on Radioactive Deposits in Tasmania, Storeys Creek and Blue Tier Districts. Bur.Min.Resour.Aust. Rep. 1955/72 (unpub.)

Walpole, B.P., 1955 - Uranium Occurrences Avoca Area Tasmania. Bur.Min.Resour.Aust. Rep. 1955/30 (unpub.)

Ostle, D., 1954 - Geochemical Prospecting for Uranium. The Mining Magazine, 91, 201-208.

APPENDIX.

EXAMINATION OF RADIOACTIVE SPECIMENS FROM CHWALCZYK'S PROSPECT.

by

W. M. B. Roberts.

The specimens examined were submitted by D. Ostle of the British Atomic Energy Authority and were collected from Chwalczyk's prospect, north-east Tasmania.

A representative specimen registered 16,000+ counts on the Austronic B.G.R.I. counter.

An examination of the polished section disclosed the presence of pyrite, galena, chalcopyrite, sphalerite, and a grey-white isotropic mineral which could not be identified because it was so sparsely present. The principal gangue minerals are quartz and chalcedony with minor amounts of fluorite and sericite.

Pyrite is quantitatively the most important sulphide in the ore, and is the earliest deposited. It forms euhedral crystals ranging up to 1.8 mm. across, and irregular masses which mould the quartz fragments of the rock, and is being replaced by galena and uraninite.

Sphalerite, galena, and chalcopyrite occur in that order of abundance, and appear to have been deposited contemporaneously; wherever they are associated in the ore they form "mutual boundaries".

Sphalerite forms irregular areas ranging up to 10 mm. across, and the irregular masses of galena and chalcopyrite are nowhere larger than 0.17 mm. The unidentified mineral occurs as small irregular areas up to 0.1 mm. in size; it is of medium hardness, medium to high reflectivity, blackens slowly with HNO_3, and is negative to other standard etch reagents.

The total quantity of sulphides does not exceed 5 percent.

The thin sections show that the mineralization has occurred in a crushed and silicified granitic rock, probably a granite, in which the felspar has been completely silicified. The rock consists principally of angular quartz fragments ranging up to 10.0 mm. across; these are strongly fractured, and many show strain shadows.

These fragments are cemented by fine-grained quartz and iron-stained chalcedony which contain the ore minerals.

Fluorite occurs as small veins ranging up to 0.3 mm. in width, and as irregular areas, measuring 0.2 mm. across, which contain zoned growths of the purple and colourless varieties. One section showed an angular quartz grain moulded by fluorite, and both minerals were partly replaced by fine grained quartz, chalcedony and sericite.

A minor amount of bleached biotite is present, the largest piece measured 0.6 mm. It commonly occurs closely associated with much fractured quartz, and exhibits marked bending of the lamellae; and is probably an original constituent of the granite.

Small areas of sericite occur in the chalcedonic material cementing the quartz fragments.

The black friable sections of the rock, thought to contain the radioactive material, were impossible to polish owing to their plucking out on the lap. Part of this material was pulverized. Assuming that, because of the high counts, the dark material may have been in part uraninite, a heavy liquid separation was carried out, and a residue to black powdery material obtained. This was more finely gro nd, and an X-ray powder photograph obtained from it showed it to be uraninite. The lines of the pattern were diffuse, and this, coupled with the powdery appearance of the mineral, suggestes that it is a more oxidised variety than the ideal UO_2.

Conclusions.

The foregoing facts show that the ore minerals, siliceous gangue and fluorite have been emplaced in a crush zone of a granitic type rock, probably a granite, though pneumatolytic and hydrothermal activity.

The fact that fluorite moulds angular and fractured quartz, and is replaced by quartz, chalcedony and sericite shows that it is the earliest deposited mineral in the sequence; its relationship to the pyrite is not clear from textural evidence. However, in this environment the fluorite belongs to the pneumatolytic stage, and the pyrite to the hydrothermal stage which would follow pneumatolysis, so it is reasonable to assume that pyrite follows fluorite. Also associated with the hydrothermal stage are the sulphides of zinc, lead, and copper-iron, as well as the uranium oxide. There was no evidence in the sections of secondary enrichment or weathering of the chalcopyrite.