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1955/72

NOTES ON RADIOACTIVE DEPOSITS IN TASMANIA

STOREY'S CREEK AND BLUE TIER DISTRICTS.

by

L.C. Noakes.

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SUMMARY

Two radio-active prospects in the Storey's Creek area, and one on the Blue Tier in north-eastern Tasmania, occur in Devonian granite. They show little promise at present, but insufficient work has been done on radioactivity in these areas to direct prospecting with confidence.

Radioactivity is due to uranium in at least two of the prospects but no primary source mineral has yet been identified.

In one prospect, a probable primary uranium mineral is associated with sulphide mineralization, and similar small sulphide bodies reported from the area should be examined.

Prospectors on the claims inspected, should be advised against costly development at this stage and surveys to examine radioactivity in both areas, possibly followed by some drilling, seem essential to seek criteria by which prospecting can be guided.

INTRODUCTION

Radioactivity has been detected in some of the Devonian granites in Tasmania, particularly in the North eastern portion of the State, where prospectors have found some localised concentrations in granitic rocks in the Avoca and Blue Tier Districts.

On the 13th and 14th July, 1955, the writer accompanied the Director of Mines, Tasmania, Mr. J. Symons and Mr. T. Hughes, geologist of Mines Department, on a brief inspection of some of the recently found radioactive prospects in these districts. One deposit in the Avoca District, the Royal George Mine where drilling for possible uranium ore is in progress, could not be visited because the access roads were flooded. However, this deposit has been recently inspected by T.D. Hughes, Mines Department, Tasmania, and by B.P. Walpole (1955) of the Bureau of Mineral Resources and the small amount of drilling done by mid July (about 47 ft) was not likely to provide any significant information.

The time available was sufficient only for a brief inspection of the three prospects visited but T.D. Hughes had already inspected the localities and written preliminary reports on two of them. Copies of these reports will be sent to the Atomic Energy Commission and copies have also been kindly provided for Bureau files. These present notes need, therefore, to be regarded as complementary to the work already done and deal largely with the most recent developments, the field assays carried out to establish probable grade and the overall prospects in the light of present evidence.

Equipment used by the writer was a field ratemeter type 1292A, produced by Ericsson Telephones Ltd., of England, with which is supplied a beta-probe and field assay attachments. One beta plus gamma field assay was made at one prospect but samples from all three prospects were assayed by the writer at Canberra using a new method of field assay with this equipment. This method provides both gamma and gamma plus beta assays and hence a determination, at least in some cases, of the radioactive element involved. It is emphasised that these are only field assays although they should indicate the approximate grade of ore. Samples from these three prospects have been forwarded to the Geophysical laboratory, Bureau of Mineral Resources, Melbourne, for more accurate determinations.

RADIOACTIVE PROSPECTS.

Storey's Creek Area.

The two prospects inspected in this area occur in the Storey's Creek Granite which outcrops in a dissected tableland a few miles north of Avoca. The granite intrudes slate and quartzite of the Mathinna Group (Lower Palaeozoic?) and, in places, remnants of this sedimentary cover still remains. In some areas, granite or intruded sediments are overlain unconformably by Permian sediments.

The Storey's Creek Granite normally shows noticeably increased radioactivity compared to that of sediments and dolerite in the Avoca area and counts ranged from two to five times this normal background. The granite mass contains a number of related but distinct phases,- pegmatite, aplite, greisen and quartz veins, - but the most common type is a porphyritic granite with large phenocrysts of soda orthoclase and with subordinate mica. The geology and tin deposits of the area have been described in detail by Reid and Henderson (1929).

Both prospects visited are close to Storey's Creek in fairly rugged country along the dissected edge of the tableland and are about two miles south of Rossarden, a village on the road from Avoca to Aberfoyle. Access from Rossarden is by foot.

The area in which the prospects lie consists mainly of granitic rocks, dissected to about 300 ft by Storey Creek and its tributaries but remnants of root pendants occur on some of the ridges. Old tin workings indicate that some of the granite contains tin.

Chwalczyk's Prospect

This prospect is situated two miles south of Rossarden on the left bank of Storey's Creek which flows roughly south in this locality. Chwalczyk detected abnormally high counts close to water level and has now removed part of the soil and granite scree from the precipice creek bank to expose rock in site. This shallow cut is the main exposure at the prospect although abnormal counts and some torbernite were observed at a shallow hole about 100 ft. upstream on the same bank. In the vicinity of both exposures the ratemeter gave a general count of about 2,700 counts per minute,- * $2\frac{1}{2}$ times the background normal for the granite in the immediate vicinity and about 9 times the background normal for sediments and dolerites of the Avoca Area.

The face of the cut consists mainly of medium to coarse-grained granite, porphyritic in feldspar, but a finer grained aplitic rock was exposed towards the bottom of the cut. Examination with the beta probe clearly indicated that significant radioactivity was confined to this finer-grained material which also yielded torbernite. The area of aplitic rock exposed in the face measured 5 ft long with a maximum height of 2 feet at the southern end. The rock, which is severely weathered, contained phenocrysts of quartz and some large weathered feldspars in an aplitic groundmass. Some of the rock, particularly at the southern end of the cut, contained flakes and patches

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* With ratemeter type 1292A activity is read in microamperes on one of four ranges with no direct conversion to counts per minute. For convenience in these notes readings have been converted to approximate counts per minute.

of torbernite and, in places, soft black material - probably manganese. The aplitic rock was sheared in places and showed closely spaced sub-horizontal lineations like joint plains which tended to dip gently south at the southern end. The contact between the two rock types in the face was made indistinct by weathering but fresher granite close by showed an intrusive (?) tongue of finer-grained rock with feldspar phenocrysts not unlike the aplitic material in the face.

Samples were taken from the finer-grained material at the southern end of the cut where the probe indicated maximum activity over an area of about 2-3 square feet which apparently extended downwards below the floor of the cut. Activity elsewhere in the finer-grained material averaged less than half the maximum activity.

A field assay (beta plus gamma only) of a small sample of about 120 grams was made near the prospect by comparing the sample with a standard sample of uranium. This indicated a grade of about .5%e U_3O_8. A more representative sample, assayed by field method at Canberra, gave .13%eU_3O_8 with a ratio of beta to gamma of .81. A smaller sample collected for petrological work assayed .16%eU_3O_8 with ratio .84. A sample from this prospect previously forwarded by the Mines Department, Tasmania, to the Bureau of Mineral Resources, Melbourne, assayed .17%eU_3O_8 with ratio .81.

Except for the first field assay, mentioned above, the grade indicated by these several samples is low and fairly consistent. The first field result probably indicates a small richer sample.

The ratio from these assays (about .8) is not conclusive for either uranium or thorium and indicates that the radioactivity could be due to either uranium out of equilibrium (uranium poor) or due to the presence of both uranium and thorium. This will be checked by laboratory tests but in any case the amount of uranium present is likely to be less than that indicated by the assays.

The source of the torbernite is not known. It could have migrated into the somewhat sheared aplite by the agency of meteoric waters but there seems insufficient reason for the aplite to be so favoured and present evidence suggests rather that the torbernite derives from uranium or uranium and thorium minerals introduced with the aplite or by genetically related late magnetic fluids.

It seems probable therefore that radioactivity is linked with an intrusive aplitic body whose size and shape is not yet apparent. The existing exposure contains patchy values and even the area of maximum activity is apparently below commercial grade. It is also possible that activity has been concentrated at the upper margin of the aplite against the granite roof and that grade may decrease in depth even if the aplitic material be found to persist.

Present evidence is only sufficient therefore to warrant some cautious development; drilling, extensive underground development and work on access roads should not be considered at this stage. It is suggested that the cut should be deepened at the southern end and the material showing maximum activity followed downwards. Possible lateral extensions upstream and downstream from the cut might also be further investigated.

Hughes Prospect.

This is situated on the right bank of the Storey's Creek about one mile downstream from Chwalczyk Prospect in the

same geological environment except that in this prospect radioactivity accompanies sulphide mineralisation in a silicified greisen body which has been described by T.D. Hughes and G. Everard of the Mines Department. The outcrop occurs about 40 feet above creek level where an apparent vein-like body of greisen strikes southward along the contour of the valley sides. Greisen has been exposed at 3 points over a total distance of 35 feet. It is exposed for about 8 feet along the strike in the main exposure where a granite footwall indicates steep easterly dip. The maximum horizontal width of greisen observed was 4 ft 6 ins but no defined hanging wall had been reached. The hard mineralised rock has been described by Everard as a greisen showing "alteration, silicification, and recrystallisation". The rock is grey in colour with prominent galena and sphalerite crystals with some chalcopyrite and pyrite and rare specks of gold. Much of the rock resembles siliceous lead-zinc ore rather than greisen.

Maximum radioactivity was found on the main exposure and was clearly restricted to the greisen rock. Examination by the probe indicated patchy and rather low concentrations except for one large specimen showing prominent sulphides which gave a beta plus gamma count of about 5000 per minute. However, this was little more than half of the maximum activity obtained at Chwalczyk's Prospect. Some activity seemed concentrated along a prominent joint running with the strike of the deposit but no secondary uranium minerals were found. The tough greisen is very little effected by weathering and this activity is more likely related to adjacent rock rather than to the fracture itself.

A sample of this rock assayed radiometrically by the Department of Mines, South Australia indicated a grade of 0.03%eU_3O_8 and a chip sample taken across 4ft 6 ins by the writer gave .08%eU_3O_8 and a ratio of 1.14 by field assay at Canberra. A specimen containing much sulphide mineralisation and a portion of the rock which showed maximum radioactivity gave .19%eU_3O_8 and a ratio of 1.2. These ratios indicate that activity is due to uranium approximately in equilibrium and it was hoped that the source minerals would be identified from the richer specimen by micro-slide and autoradiograph.

However, petrological and mineragraphic work carried out by W.M.B. Roberts and R.S. Stevens (see Appendix I) shows that the uranium present in the rock is not associated with sulphide minerals but accompanies sericite and is in such small quantities as to defy indentification.

The investigation, therefore, does not indicate any possible source of radioactive ore in the greisen and this, together with the sporadic character of radioactivity and the environment of the deposit suggests that no further development is warranted.

The Blue Tier Area

The Blue Tier is a partly dissected plateau, almost entirely composed of granitic rocks, in north-eastern Tasmania and has been an important producer of tin.

The granitic rocks are of Devonian age and on the Blue Tier Plateau the overlying Lower Palaeozoic sediments have been entirely removed. The geology of the area and of the tin deposits has been described in detail by Reid and Henderson (1928) and reviewed by Thomas (1953).

Two main types of granite have been mapped - a porphyritic granite, essentially similar to the most common type of granite in the Storey's Creek area, and a younger differentiate

the 'tin' granite, a medium and even-grained, more acid granite which intrudes the porphyritic type in flat-topped, steep-sided cupolas. These younger granites have been greisenised and altered in many places and tin is associated with the greisen, pegmatite and altered granite. The most important tin deposits are of the flat-lying 'floor' type where tin is disseminated in greisen and greisenised younger granite for some 70-100 feet below the gently-dipping contact with the overlying, barren, porphyritic granite. A narrow pegmatite band 6-12" wide is found in places along this contact.

Both types of granite show noticable radioactivity in places but it is more noticable in the younger 'tin' granite than in the older porphyritic granites. Little work has again been done on radioactivity here, but samples from the Australia and Anchor Mines, forwarded by the Mines Department, have been assayed by the Bureau of Mineral Resources, Melbourne, and T.D. Hughes has inspected and reported on radioactivity in the Anchor Mine. The sample assayed from the Australia Mine showed .05%eU_3O_8 and ratio of 1.2 which is not encouraging, but this mine was not visited.

The Anchor Mine.

This is the largest tin deposit on the Blue Tier and has produced 3,000 tons of tin oxide at an average grade of .2%. It was worked in a series of open-cuts but has not been mined since 1950. The mine is on the dissected southern slopes of the plateau and is easily accessible by road.

T.D. Hughes has examined all old workings at the Anchor Mine and has found significant radioactivity restricted to one small area of the thin pegmatite band which occurs along the contact between the two granites and which dips gently southwards at most places in the workings. The area of significant activity is in a short gallery in the wall of the open-cut on the eastern side of the mine workings where the band, 4-6" wide, is exposed around the top of the wall and in portion of the roof.

The total length of band exposed around the wall of that portion of the gallery which was accessible, was about 50 feet. Examination by beta probe indicated that maximum activity was restricted to 2 feet of pegmatite, 4-6" wide, on the western wall and elsewhere in the band activity was, on an average, reduced to a third of this maximum and at no point exceeded half.

Samples taken from the point of maximum activity, and assayed by field methods at Canberra, gave .09%eU_3O_8 with ratio 1.0 for a large sample and .25%eU_3O_8 ratio 1.25 for a specimen. Samples or specimens previously sent to the Bureau of Mineral Resources, Melbourne, presumably all from this gallery, assayed radiometrically .22% and .35%eU_3O_8 with ratios of 1.5 and 1.4 respectively. The second sample was also assayed by fluorimeter which gave .29%eU_3O_8. The ratios indicate that activity is due to uranium which, in places, is not in complete equilibrium (uranium rich) although theoretically the assay by fluorimeter should have been higher, not lower, than the radiometric assay. T.D. Hughes took a composite sample of the granites from below and above the pegmatite band and the result was .02%eU_3O_8 with ratio of 2.0.

It is clear that the band as exposed in the gallery is too low grade and too narrow to be of more than mineralogical interest. There is no evidence of significant concentration in the tin granite in the Anchor Mine and, as Hughes has pointed out the only possibility remaining is that of the pegmatite band widening. However, Thomas (1950) describes the band on the Blue Tier and gives its width as 6-12" which does not provide much encouragement.

Judging by present records, there is certainly scope for further radioactive prospecting on the Blue Tier but the Anchor Mine can be eliminated.

DISCUSSION.

Radioactive deposits so far investigated in Tasmania all occur in granite and none of them yet shows much promise. Abnormal radioactive background in granites is an encouraging sign in any area but, so far, granite in Australia has proved a poor environment for commercial deposits of uranium and one in which the prospector is particularly likely to spend time and money for no profitable return.

The Storey's Creek and Blue Tier areas in Tasmania have apparently many features in common with uranium provinces in the New England district of New South Wales. In both areas uranium mineralisation accompanies late magmatic activity in the granite; it is associated with pegmatite minerals, tin and wolfram and more rarely with galena and other sulphides, and concentrations found to date are all in granite - not in the intruded sedimentary cover.

Although this environment is not encouraging, it would be rash at this stage to discount completely the possibility of finding commercial ore but the natural optimism of most of the prospectors who have found anomalies needs to be curbed to prevent loss of time and money on drilling and development which is premature if not completely unwarranted.

More facts about uranium occurrences and mineralisation are needed in Tasmania before geologists can confidently direct prospecting. To collect these facts, radioactive surveys, even of a reconnaissance nature, are needed not only in the areas where claims have been pegged but also in other districts where Devonian granites occur, particularly where these are accompanid by tin deposits.

The facts so far observed in Tasmania are that definite uranium mineralisation accompanies late magmatic phases of the granite, genetically related to tin and sulphide mineralisation but not necessarily accompanying either in emplacement. Concentrations of uranium are not closely linked with major concentrations of tin and unfortunately the most persistent deposits of tin and wolfram, which occur in the metamorphic aureole and not in the granite, apparently carry no uranium. No thorium has yet been detected in radioactive prospects although monazite occurs in the granites at least in some places. Monazite, and radioactive zircon and feldspar are likely to be the main sources of activity within the granite bodies themselves.

Uranium mineralization in sulphide ore at Hughes Prospect held some promise until investigation showed no identifiable ore mineral. Similar sulphide bodies in the Storey's Creek Granite, are described by Reid and Henderson (1928), and if any of these prove to be notably radioactive they might provide useful confirmation of the laboratory work done on Hughes Prospect.

~~obtain information.~~ The drilling programme at the Royal George Mine, premature as it seems, is at least likely to provide information useful to the Mines Department in the investigation of radioactive deposits.

RECOMMENDATION

1. Until more encouraging evidence is found, prospectors on Chwalczyk's and Hughe's claims should be advised against drilling or major development.

2. Surveys to collect information on radioactivity should be carried out, particularly in districts where prospects have been found, in an attempt to establish criteria by which prospecting can be more confidently directed.

3. All possible information bearing on radioactivity should be collected from the present drilling programme at the Royal George Mine.

ACKNOWLEDGEMENTS

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APPENDIX I.

SULPHIDE ORE - HUGHES PROSPECT

STOREY'S CREEK.

TASMANIA.

PETROLOGY.

by

R. S. Stevens.

HOST ROCK

A very strongly altered granite in which the feldspar has been completely replaced by sericite and the original mafic minerals entirely removed. The coarsely crystalline quartz of the original rock has a striking micropegmatitic texture with small blebs and stringers of quartz in optical continuity included in poiklitic fashion and in great abundance in the large quartz anhedra. The texture is, in fact, almost micrographic. The quartz is also crowded with flaky green sericite inclusions and abundant opaque dust of indeterminate nature.

The micropegmatitic quartz has been coarsely recrystallised after alteration of the rock to form large clear subhedral and euhedral crystals free from pegmatitic texture and inclusions apart from occasional relict stringers of fine sericite. That these euhedral quartz crystals are secondary is shown not only by their prismatic form, but also by included lines of powdery opaque dust marking the outline of an earlier but still euhedral stage of their growth.

At the time of formation of the secondary quartz crystals the rock contained numerous rather large cavities into which the growing crystals extended and developed perfect terminations. The remaining space left in the cavities after the growth of quartz ceased was filled by a deep red, semi-opaque (?) hematite.

Large irregular areas of fine, green sericite probably represent original feldspar and often contain inclusions of an opaque amorphous, granular, or fine columnar euhedral prismatic, deep red-brown (?) hematite. The identification of this opaque mineral in thin-section is not definitive and W. M. B. Roberts indicates that it may well be sphalerite.

Small secondary quartz veins cut through the quartz, sericite and (?)hematite, and carry grains of a semitransparent, isotropic (?)sphene with very high refractive index.

THE VEIN.

The specimen is transected by a large vein-like body of composite structure. In thin-section the structure of the vein presents a perplexing problem in that it consists of an outer zone of fine cryptocrystalline silica passing abruptly into a zone of coarsely crystalline bladed euhedral quartz crystals standing out at right angles to the vein walls with their free, perfectly terminated ends projecting towards the centre of the vein giving rise to a distinct comb-structure. The central part of the vein is filled by distinctly fragmental material consisting of small angular chips of the host rock, pieces of quartz and sericite aggregate, and grains, crystals and amorphous masses of several species of opaque minerals, all

set in a dominant matrix of very fine sericitic clay minerals and carbonate (? siderite) with abundant dusty opaque grains.

One narrow quartz vein cuts across this in-filling material and carries a highly lustrous, silvery opaque mineral with "ladder" structure. This small vein cannot be traced through the quartz walls of the main vein nor the host rock.

There is a distinct concentration of opaque minerals at the interface between the sideritic vein-filling material and the euhedral quartz terminations. There are also patches of a greenish brown, slightly pleochroic very fine flaky sericitic mineral in the same region and the same mineral fills fine cracks at the base of the bladed quartz of the main vein.

MINERAGRAPHY.

by

W. M. B. Roberts

MINERAGRAPHY.

In polished section the principal opaque mineral is shown to be sphalerite, which constitutes 90% of the total opaque mineralization. It occurs as irregular areas which range up to 1.00 mm. across which are composed of grains measuring 1.2 mm. across, all of which show a distinct lamellar twinning.

Enclosed within these sphalerite areas are the subordinate opaque minerals which are: pyrite, chalcopyrite, galena and pyrrhotite.

Pyrite and galena form irregular areas ranging up to 0.33 mm. across, galena also fills small fissures which cut the sphalerite bodies.

Chalcopyrite has unmixed from solid solution with sphalerite to form small rounded "blebs" in the mineral, the largest of which measures 0.1 mm. across. In places these are strung out into fine spindles which have a roughly parallel arrangement.

Marcasite occurred in only one of the polished sections examined, occurring in a vein of indurated sedimentary material, where it forms subhedral crystals and is intergrown with pyrite as irregular areas, the largest of which is 0.35 mm. across.

Lamellar twinning is well developed in most of the grains.

Pyrrhotite is replacing chalcopyrite throughout the ore, and forms rounded areas which measure up to 0.15 mm. across.

RADIOACTIVITY.

Autoradiographs prepared from sawn sections of the ore showed the major areas of alpha-particle emission to be located parallel to the vein of sedimentary material which cuts one of the sections. Tests with the sodium fluoride bead showed conclusively that there was no radioactivity associated with the opaque minerals. Tests on a thin vein of sericite-like

material gave weak positive results for uranium. No separate radioactive mineral could be determined, and it seems probable that the uranium mineral has been deposited either with this sericitic material or in the interstices between the grains at a later date, possibly derived from the host rock and concentrated by the metamorphic processes which have been operative in the genesis of this rock.

APPENDIX II.

by

L.C. Noakes

The results of radiometric assays carried out by the Geophysical Section of the Bureau on samples from the three prospects inspected came to hand after the report was written. The samples assayed were those on which field assays were previously carried out at Canberra and quoted in the report and the results of both field and laboratory assay are shown below for comparison.

Chwalczyk's Prospect.

Field Assay eU3O8			Laboratory Assay (Geophysical Section)			
Ub	Ug	Ratio	No.	Ub	Ug	Ratio
.13	.16	.81	TR55/136	.096	.094	1.0
Previous sample sent by Mines Department, Tasmania.			TR55/93	.17	Fluorimetric Assay .14 U3O8	

Hughes Deposit.

.08	.07	1.14	TR55/135	.059	.053	1.0

Anchor Mine.

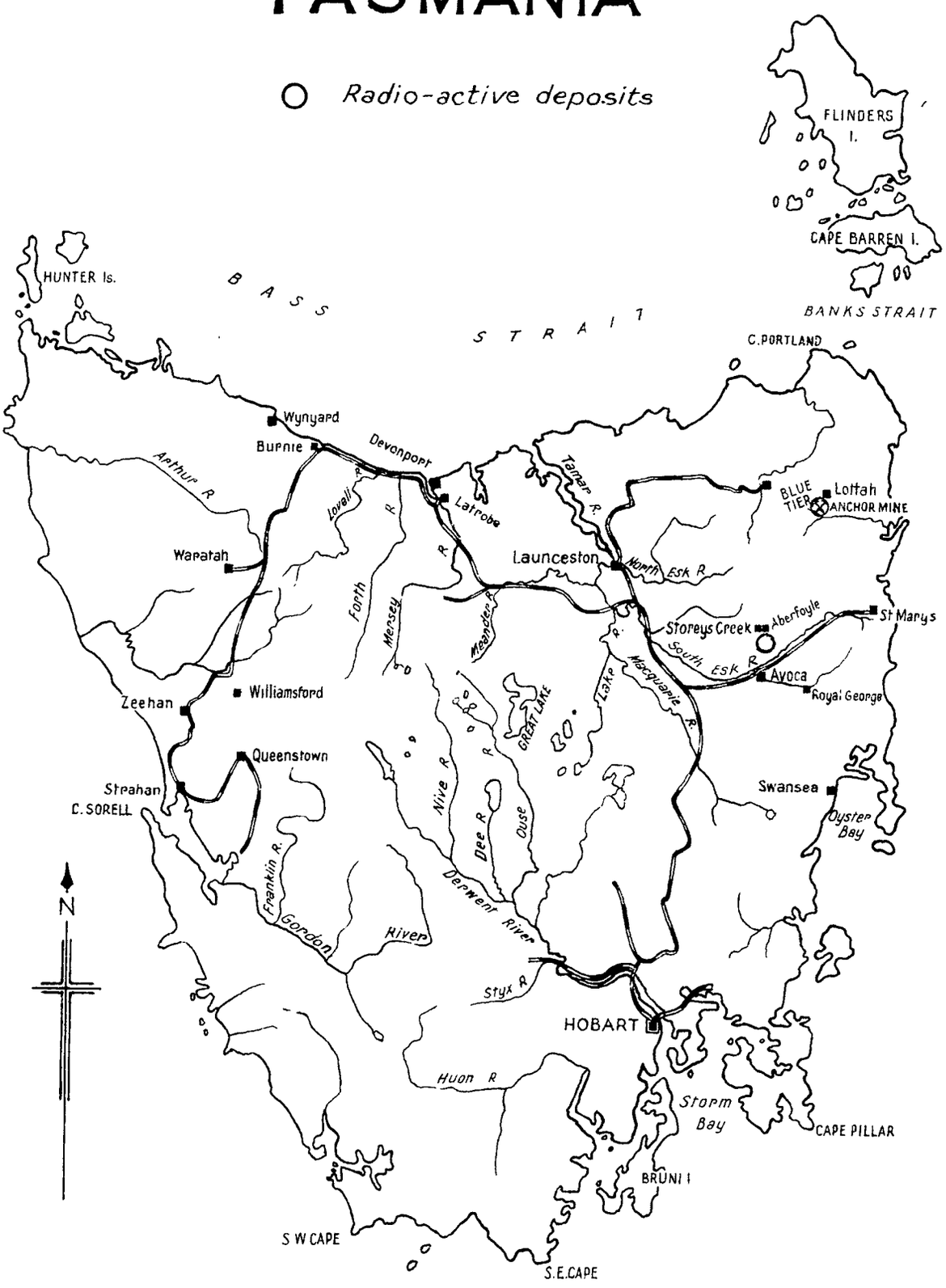
.09	.09	1.0	TR55/134	.078	.055	1.4

REMARKS

Field assays were all slightly higher than the controlled laboratory assays but these more correct results confirm rather than alter opinions based on the field assays.

The laboratory radiometric assay of the sample from Chwalczyk's Prospect is the first from that prospect to give a ratio of 1.0-uranium in equilibrium. This, in conjunction with previous ratios of about .8 and the fluorimetric assay, which is lower than the radiometric assay on the same sample, suggests that activity in previous samples is due to uranium out of equilibrium - uranium poor.

LOCALITY MAP
showing
RADIO-ACTIVE DEPOSITS STOREYS CREEK AND BLUE TIER DISTRICTS
TASMANIA



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