RB211

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DEPARTMENT OF MINES.

SOUTH AUSTRALIA.

Radium Hill Mineragraphic Investigations

PROGRESS REPORT No. 10

PETROLOGICAL SECTION

29.7.52

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B.10

590'6" - 591'5". Feebly radioactive.

This is a weak lode consisting of quartz and biotite with irregularly shaped rutile rich nodules ½" in size near the centre of the intersection. These nodules show slight radioactivity at the centres due to small amounts of intergrown davidite.

558'10" - 559'4". Non-radioactive.

A weak lode with quartz-felspar gangue mineralized by large anhedral pyrite and minor non-radioactive opaque mineral.

525'8" - 527'5". Weak radioactivity.

This shear is replaced mostly by felspar on the hanging-wall side and by quartz on the foot-wall side. Opaque minerals are abundant throughout the lode but are non-radioactive except for minute isolated spots 1 mm. in size. Mineragraphic examination showed the mineral to be mainly rutile with minor haematite and ilmenite. Dark ultrafine-grained bands cross the rock at intervals parallel to the schistosity. These consist of numerous minute tourmaline crystals with some zircon and biotite.

S.40

298'5" - 298'10". Non-radioactive.

A weak lode with quartz-rutile gangue and a few small rutile nodules.

273'9" - 275'0". Feebly radioactive.

This quartz-biotite lode has a few widely scattered rutile nodules several of which carry a little intergrown davidite.

F.11

91'2" - 92'5½". Weakly radioactive.

This is a fine textured section of sheared rock rich in biotite and carrying occasional nodules of radioactive ore mineral which is essentially haematite containing irregularly shaped, widely spaced areas of davidite.

No well defined structure is obvious. There is disseminated euhedral pyrite averaging 1 mm. in size.

Z.16

25'5" - 27'5". Weakly radioactive.

This is a quartz rich lode containing also some felspar and biotite. Small irregularly shaped ore nodules are disseminated at wide intervals.

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D.D. HOLE Z17.

<u>0 - 3'0".</u> Moderately strong.

This lode is in sheared granitic rock rich in sericite and biotite. There is an abundance of opaque mineral in the first 6 inches associated with biotite and secondary quartz. The mineral is almost entirely rutile exhibiting a distinct breccieted texture in which large original crystals up to 1" in size have been broken down and separated into smaller angular fragments. One small daviditic crystal is present. Down to 15" the lode may be considered as "horse rock" composed mainly of country rock replaced by felspar. At about 15" shears commence again and continue to 3'0" and it is in this section of the lode that the radioactive ore is concentrated especially between 15" - 28". Between 15" - 28" the ore is very rich and associated with biotite and abundant coarse grained quartz. Towards the foot wall non radioactive opaque mineral (mainly rutile) and pyrite dominate.

Macro photo of portion of core showing brecciated structure in opaque minerals indicating post depositional movement in the ore body. X 2.

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RADIOACTIVE MINERAL FROM BOOLCOOMATTA.

Prospector Johnson who is working in this district submitted specimens obtained near Old Boolcoomatta Homestead from local pegmatites.

The specimens are massive and consist of several minerals in irregular aggregation. Weak radioactivity is displayed by the rocks.

The minerals making up the aggregate are either phosphates or silicates. The principal mineral and that which accounts for the radioactivity, is florencite an anhydrous cerium aluminium phosphate, $AlCeP_2O_8.2Al(OH)_3$. This mineral is abundant in the specimens as a resinous brown lustrous glassy material displaying a basal cleavage. Its refractive indices were determined as

No 1.680
Ne 1.685

soluble in hydrochloric acid and it is uniaxial positive and presumably a content of thorium associated with cerium accounts for the radioactivity. The mineral is extremely rare and not, as far as is known, described from Australia hitherto.

Another phosphate mineral present in the specimens is dufrenite $Fe_2(OH)_3PO_4$. It forms very fine grained dark green brown aggregates intimately associated with florencite. This mineral has very high refractive indices and is strongly pleochroic in olive green and brown. It too, is a very rare mineral.

The third important constituent is the silicate mineral fuggerite, an iron calcium silicate showing green-brown on the specimen. It is uniaxial negative with N_o and N_e 1.690.

Several other materials of lesser importance include an ultra-fine indeterminable blue encrustation of high refractive index, brown limonite and occasional quartz.

The occurrence is interesting in view of the fact that this prospector recently found large crystals of xenotime in this locality.

Apparently the area is characterised by rare earth pegmatites containing yttrium and cerium minerals.

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THE MINERALOGY OF GEIGER LODE, 100 FT. LEVEL.

This study was carried out at the stage where the 100ft. Level on Geiger Lode extended from 5600N to 6580N, i.e. approx. 1000 ft. A series of equally spaced samples were taken at 30' - 40' intervals across the lode to determine gangue and ore minerals and their associations.

The salient features revealed by the examinations are as follow:-

1. The greater part of the lode is Main Lode Type pinching or becoming poor in ore minerals at intervals. e.g. at 6390N, 6280N, 6180N, 5960N-5700N. Even at these positions the lode preserves some features of the Main Lode Type ore body.

2. The lode is a Nodular Type at 6560N, and may indicate the extremity of the Main Geiger lens. At the other (southern) end of the drive after 2-300' feet of poor lode a rich Main Lode Type appears to be making at the face at 5600N. Microscopically, the texture of the radioactive ore mineral is similar to that from the Old Mine Workings. It is to be expected that the lode will become a rich Main Lode Type southward.

3. Rutile is the major non-radioactive opaque mineral associated with davidite. There is much less haematite and minor ilmenite. Pyrite appears in places with traces of chalcopyrite.

Descriptive Mineralogical Detail.

The northern extremity of the drive 6550N-6580N is largely Nodular Type consisting of sheared highly sericitized country rock with oriented biotite lenticles up to 2" in length. These contain kernels of ore. There are occasional larger masses of ilmenite or rutile-haematite with thin selvages of biotite against the sericitized country rock. Elsewhere there is clear white quartz with "cleavage" associated with fine black and coarse bronze biotite and a little ore. The ore is largely coarse rutile intergrown with fine granular haematite and rutile with small irregular ½" areas of davidite at intervals.

Near peg 173 there is a medium-coarse grained leucocratic trondhjemite in the footwall consisting largely of twinned oligoclase. Ore associated with this primary igneous rock consists of large (1") crystals of ilmenite containing oriented minute haematite lamellae and occasional minute rutile granules.

Southward along the lode from this point a Coarse Main Lode Type ore develops consisting at first, largely of fine grained black biotite enclosing richly daviditic lustrous coarse grained ore. Associated residual minerals are minor rutile and haematite displaying "ring texture".

The lode rapidly develops into a typical coarse grained highly quartzitic Main Lode Type with subordinate mica and an abundance of strongly radioactive ore consisting largely of davitite but with abundant rutile taking the form of large corroded euhedra or fine granular rutile-haematite mosaics. Very occasionally there are ilmenite crystals in these mosaics and pyrite and minor chalcopyrite sometimes form locally rich patches mostly in red quartz.

Between the transcurrent fault (near peg 164) and peg 152 the ore is more strongly biotitic than quartzitic and the ore mineral is richly rutilic with variable, but usually subordinate amounts of davidite. There are large corroded rutile euhedra and fine granular mosaics of rutile with subordinate haematite and ilmenite. Davidite replaces such mosaics at intervals.

For the next 2-300' the lode, although retaining the characteristic texture of Main Lode Type is very variable in davidite content as well as in width. Mostly it is rich in rutile and davidite, but either may be predominant. Haematite and ilmenite are occasionally prominent. There are places where the lode is highly quartzitic and almost barren with respect to opaque minerals.

The lode is very poor and inclined to grade into Nodular Type between pegs 176 and 177. It consists of quartz and fine grained black biotite with secondary pink felspars. Small biotite nodules with no ore kernels are present in highly quartzitic rock. There is a little ore which consists of intergrown rutile and haematite in either fine or coarse grained aggregates.

Beyond this low grade area to the end of the drive at 5600N the lode improves and davidite becomes a prominent constituent. It contains residual strings of haematite or rutile granules of minute size, a texture shown by the high grade ore of the Old Workings. There is disseminated pyrite and minor chalcopyrite.

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THE MINERALOGY OF THE WHIP LODE, 200 FT. LEVEL.

A series of ten equally spaced samples were taken between 6500N and 6700N on No. 2 Level for minergraphic examination.

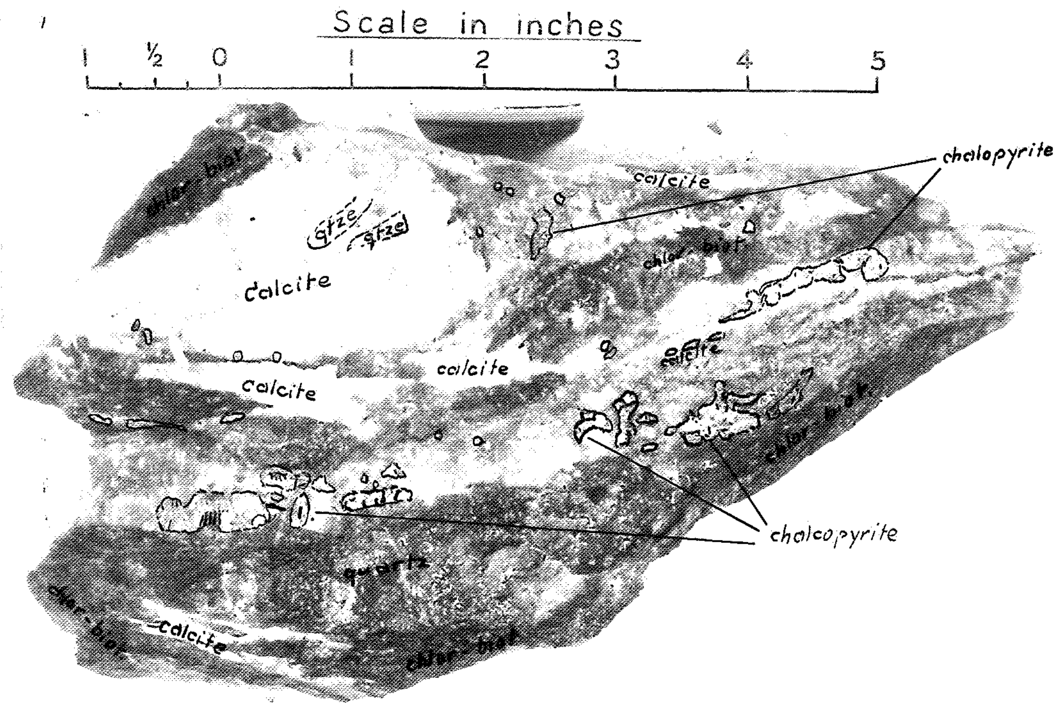
It was found that this part of the lode is principally main lode type rich in davidite with rutile as the major associated opaque mineral. Pyrite occurs in most samples and is abundant in a few of them.

Details of the examinations are as follow beginning at 6500N. The lode is main lode type with coarse grained red quartz intergrown with coarse lustrous ore and minor pyrite. The ore mineral consists mostly of davidite enclosing factured partly replaced rutile crystals several mm. in size as well as numerous minute inclusions of the same mineral. There follows for the next 50 feet barren lode containing little or no ore. It is talcose sheared country rock at first with secondary felspars, biotite and chalcopyrite verying to quartz-pyrite rock in which pyrite is disseminated as small euhedra.

At about 6560N there is some poor grade main lode type consisting of coarse quartz and bronze biotite associated with a fine granular rutile-haematite-minor davidite aggregate. The next sample point (about 6570) yielded no ore but a biotite rich rock enclosing 1-2" euhedra of orthoclase and pyrite crystals.

The remainder of the drive is in good main lode type ore very rich in davidite. Corroded residual rutile crystals 1c.m. in size as well as a host of minute rutiles and haematite are present in the davidite. There is a little pyrite. Towards the face at 6700N the grade weakens, davidite becomes subordinate to rutile and haematite and locally chalcopyrite is abundant. This is indicated macroscopically by loss of lustre in the ore mineral.

A feature of interest is the presence of abundant coarsely crystalline white calcite in places in veins following the schistosity of the lode or wall rock. Chalcopyrite is plentiful in calcite as host. (Fig.).



Rock from Hanging Wall Shear. Whip Lode, No. 2 Level.

X $\frac{3}{4}$.

The rock consists sheared highly chloritized country rock partly replaced by quartz and penetrated by veinlets of white or pink calcite containing abundant chalcopyrite.

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WHIP LODE 6940N - 7000N No. 1 Level.
'DAVID LODE' 7020N - 7233N No. 1 Level.

The Whip lode is poor and inclined to nodular type at 6940N. It is rich in black biotite and quartz with disseminated rutile. At 6960N, without much macroscopic change in the appearance of the lode the opaque ore mineral becomes highly daviditic with intergrown rutile and minor haematite. Green vanadic ochre is present also. The remainder of the lode to 7000N is poor and narrow and nodular type with oriented biotite lenticles or large opaque mineral nodules up to 3" in size enclosed in white highly sericitized rock. The opaque mineral is mostly rutile varying to a rutile-haematite intergrowth with occasional ilmenite.

In the continuation of this drive on No. 1 Level "David Lode" is encountered at about 7010N. For about 140 feet the lode is either typical nodular type or barren quartz-biotite with little or no opaque mineral. Where it is present the opaque mineral is largely haematite in coarse crystals with some intergrown rutile granules. At 7140N there is a coarse grained pink albite pegmatite. The remainder of the lode to 7233N is essentially a coarse quartz-biotite aggregate with opaque mineral directly associated with the quartz and becoming in places of large size and massive. Secondary red felspar is dispersed through the quartzitic gangue. Except at 7175N where the opaque mineral is locally rich in davidite and rutile, it is generally a fine grained granular aggregate of ilmenite with minor haematite and rutile varying to a rutile-haematite aggregate with minor ilmenite.

SMITH LODE 6900N - 7030N No. 1 Level.

There is a series of transcurrent faults at 6900N and the lode is very poor with little or no opaque mineral. The lode is either sericitic country rock with biotite lenticles containing no ore kernels or it may be quartz with biotite shears and occasional ¼" nodules of ilmenite. Red pegmatite is present in the walls.

For the next 60ft. approximately there is a tendency to the formation of a Main Lode type ore body and locally the ore is largely davidite (with minor intergrown rutile and haematite) in coarse-grained association with bronze biotite and pyrite. The lode then trails out to nodular type with rutile and a little pyrite towards

6980N. The northern extension of the Smith lode drive from 7000N is in typical nodular type ore containing rutile dispersed through sericitic rock.

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THE PETROLOGY OF CROCKER'S WELL URANIUM FIELD

Introduction

Since the initial report on this area was submitted more extensive sampling and field mapping has been completed and a detailed plan prepared by Mr. King. This report therefore is intended to bring up to date a description of petrological studies made in connexion with field mapping problems.

Geology and Petrology

The report by the geologist covers the geological features adequately, hence the information presented herein deals only with the results of the examination of thin sections of numerous rocks collected in company with the geologist and bearing upon special field problems.

The regional rocks.

An extensive area of granite is developed on a regional scale in the district forming low rounded hills of porphyritic felspar biotite granite. This rock has a platy exfoliation surface producing a distinctive type of outcrop quite different from that of the granitic rocks of the uranium field. This regional type granite is one developed by granitization. It is a coarse grained massive rock with phenocrysts of orthoclase microcline perthite and occasional plagioclase twinned usually on the Carlsbad law, the latter also on the Albite law. There is abundant biotite showing weak parallel lineation which is insufficient to alter the massive character of the rock, and the interstitial quartz exhibits evidence of considerable strain.

The ratio of potash felspars to oligoclase varies from sample to sample but never exceeds a value such as to re legate the rock to other than the granitic group.

In irregular distribution throughout these granitic coarse grained quartz-microcline, microcline-perthite rocks are found in cross cutting veinlets indicating a late pegmatitic phase. Larger and smaller migmatized xenoliths occur in sporadic distribution through these granites.

The rocks immediately surrounding the uraniferous field.

A distinctive group of granitoid rocks surrounds the known occurrences of Uranium mineral and lies between the latter and the regional porphyritic felspar granites. These rocks are rather variable amongst themselves but are grouped together under the term leuco-adamellites because on the whole they approximate to this composition.

Typically the leucoadamellite is an hypidiomorphic granular rock containing less than 5% of mafic minerals in which the contents of albite or oligoclase is equal or nearly so to that of orthoclase, microcline and perthite. Variations were noted in which potash felspars exceeded plagioclase in amount and vice versa but such minor compositional differences are of no paragenetic significance.

These rocks exhibit sufficient evidence of a regional granitization origin. For instance xenoliths of original sediment in various stages of migmatization are found amongst them and in most thin sections of the rocks rounded corroded inclusions of quartz are to be seen in the felspar. Examination of granitoid rocks in the vicinity of xenoliths showed a variation from leucoadamellite to leucogranodiorite. In extreme cases, where perhaps, the original sediments were argillaceous, the content of biotite and oligoclase is greater and the rocks enclosing the xenoliths are granodioritic. With deficient quartz locally there are leucosyenites.

There is no doubt that these rocks have received very significant strain as evidenced by severe strain shadows in interstitial quartz and its frequent reduction to granoblastic aggregates as well as frequent bending exhibited by the twin lamellae in felspar crystals. The geological map indicates large areas wherein these adamellites are fractured, broken or brecciated.

Mineralogical features of interest include the fact that the blue opalescent interstitial quartz is mostly sagenitic and the presence of abundant rutile and apatite as accessory minerals.

A further feature of the rock group, a possibly contentious point, is that the alaskites, occurring in places amongst these leuco-adamellites, may result from the pre-granitization condition of the metasediments. Thus it may be that in the granitization the argillaceous sedimentary types gave rise to the adamellite ranging to granodioritic group whereas the quartzitic or quartz felspathic sediments were transformed to alaskites. The field geologists claim to have evidence to dispute this reasoning.

The alaskites.

This is a group of white, coarse grained typically hypidiomorphic granular rocks considered by the geologists to be intrusive into the brecciated leucoadamellite zone and occurring near its contact with the surrounding non-brecciated leucoadamellites. These rocks have the appearance of aplites but should strictly be classed as alaskites on the basis of the subhedral development of the felspars and the resultant granitic texture. Sodic plagioclase and potash felspar are in about equal proportion and there is an abundance of sagenitic quartz. Accessory minerals include occasional muscovite, abundant intergrown rutile and ilmenite, a little euhedral zircon and absite which may occur alone or intergrown with rutile.

Assuming that the alaskites are intrusive rocks then the associated quartz-albite pegmatites may be considered as a later pegmatitic phase of these rocks. Occurrences of these pegmatites carrying absite have been noted in the shafts. A final late magmatic stage following upon the formation of these pegmatites is no doubt the blue opalescent quartz veinlets penetrating rocks in the breccia and pseudo breccia zones. These quartz veins carry abundant absite. (Figs. 1, 2).

The fine grained grey granodiorites.

Several outcrops of this rock are shown on the geological plan including an occurrence in the bottom of Shaft C the macroscopic differences being due to different degrees of weathering on the ground and in the shaft. Oligoclase is dominant but there is a little orthoclase. The rock contains considerable biotite as well as minor muscovite and sagenitic interstitial quartz. The accessories are distinctive and similar in the rock outcropping above the ground and in the shaft, and include, in addition to apatite, rutile, zircon and ilmenite, the rare earth minerals monazite and xenotime. Linear bodies of this grey granodiorite are in sporadic distribution amongst the brecciated leuco-adamellites but should be distinguished from granodioritic variations of the adamellites by virtue of a distinctly different texture. This latter fine grained texture is suggestive of an independent minor intrusive phase introducing rare earth minerals in addition to the usual accessories present also in the surrounding rocks.

Modes of various leucocratic igneous rocks.

	Leucosyenite No. 855	Alaskite No. 861.
Quartz	4.8	26.1
Orthoclase	54.5	37.1
Microcline	-	1.1
Perthite	-	0.4
Oligoclase	39.1	34.0
Apatite	0.9	0.8
Mica	0.7	0.3
	100.0	99.8

	Leucogranite No. 713F	Leucosyenite No. 862
Quartz	25.9	3.3
Orthoclase	34.4	52.0
Microcline	2.4	14.6
Perthite	1.5	7.3
Oligoclase	29.0	23.2
Apatite	0.7	trace
Mica	4.8	trace
Absite	1.3	ignored
	100.0	100.4

	Leucoadamellite No. 916	Leucoadamellite No. 927
Quartz	33.6	26.6
Orthoclase	28.7	37.5
Microcline) Perthite)	2.8	4.4
Oligoclase	33.6	31.1
Apatite + rutile	0.4	0.3
Muscovite	0.8	0.3
	99.9	100.2

Basic Intrusives

This final group of rocks is quite distinct from all those already described. Two major occurrences were noted at Crockers Well and in each case the association is with sheared granitoid rocks and epigenetic silica in the zone of large shears.

In a north easterly shear near the wireless station outcrops of a strongly weathered slightly porphyritic microdiorite were observed. This rock is of peculiar composition significantly in keeping with the highly sodic nature of most of the granitoid rocks. The major components are sodic andesine $Ab_{70}An_{30}$ and deep blue hornblende with lesser orthoclase, quartz, ilmenite, zircon and titanite. Epidote is disseminated throughout and is secondary.

A much larger shear, regional in character occurs a mile or so away and trends north westerly. The massive porphyritic felspar granites are locally sheared and pass into a highly silicified zone penetrated by irregular intrusive masses of a fine grained, dark coloured, holocrystalline, sub-ophitic microdiorite. This rock too is uncommonly sodic in that its plagioclase ranges from basic oligoclas to sodic andesine. Hornblende is the major constituent and although there is plenty of quartz, much of this is considered exigenous.

An interpretation of the Petrological data.

The results of thin section investigations indicate a wider variation in rock types than is obvious from macroscopic observation. Some of these differences are graditional only and need not be taken into account, whereas others, often not indicating any greater compositional variation appear quite significant because of field-scale structural and microscopic textural distinction. The salient facts concerned are set out in the notes on the rock groups set out above.

The uranium deposits at Crocker's Well are in an environment of normal potassic granitic rocks resulting from regional granitisation of pre-existent sediments. Locally, at Crockers Well there is an area of granitoid rocks distinct in that they are:-

(a) leucocratic i.e. contains less than 5% mafic minerals

(b) distinctly sodic but to a varying degree.

(c) carry unusual accessory minerals.

The whole problem of genesis is therefore concerned with very localized phenomena within this restricted zone of leucocratic sodic rocks consisting of a roughly circular area of several acres bounded on the outskirts by leucoadamellites which become progressively more fractured, broken, brecciated and mineralized towards the centre.

Two of the rock groups described above suggest themselves as possible mineralizers. These are the alaskites and the fine grained grey granodiorites, both of which on field evidence have an intrusive relation to the leuco-adamellites and which have the compositional peculiarity that they are soda rich. It is further noteworthy that these rocks both occur in the central zone of brecciation and pseudo-brecciation where there is an abundant development of biotite, blue quartz veins and quartz-albite pegmatites and the maximum concentration of absite.

An examination of the breccia; pseudo breccia and richly biotitic rocks produced evidence of apparent genetic significance. Amongst the breccias there are zones consisting almost entirely of biotite, biotite-quartz or biotite-quartz-apatite rock which give the impression of shears. The enclosing rocks are the various breccias, the alaskites, quartz and quartz-albite veinlets and apparently unbroken zones of schistose biotite granite. The texture of the latter, as seen in section is not granitic but distinctly poikilitic. Felspars are the major constituent, mostly orthoclase with lesser oligoclase, minor perthite and microcline and these carry numerous rounded, corroded inclusions of quartz. Quartz also occurs interstitially as a mossaic and the post-quartz origin of the felspars is best seen by the crenulated interpenetrating contact of the felspar crystals against the interstitial quartz (figs. 8-11). This feature, as well as the presence of poikiloblastic quartz in the felspars indicates the growth of felspar in place by replacement of quartz since it is not normal for quartz to crystallize in an igneous rock prior to the felspar. The rock contains abundant biotite and apatite and it is traversed at intervals by aplitic veins up to 2" wide.

The rock from the biotite rich zones (thought to be localised shears) is of peculiar composition and texture. The orientation of the biotite, which constitutes 75-90% of these rocks, is not in strict parallelism as might be thought from a macroscopic examination. In sections cut perpendicularly to what is apparently the schistosity or shear direction it is found that although most flakes lie along this orientation there are many which cross it at angles up to 90° (Figs. 6, 7). A further textural feature of importance is that the apatite subhedra and anhedra constituting up to 25% of the bulk of these rocks, truncate the mica flakes often along straight lines of contact suggestive of simultaneous crystallization of both minerals (see Fig. 7). Quartz in varying amounts is present amongst the biotite flakes.

These features of composition and texture strongly suggest that these rocks are of the nature of greisen produced by late magmatic deuteric action along contraction fissures or joint fractures. The presence of abundant fluor apatite and small amounts of xenotime rutile and ubsite support this conception. Surrounding the zones of biotite enrichment there are areas of irregular extent consisting of brecciated adamellite and schlieren of alaskite (known as pseudobreccia) enclosed in highly biotitic rock (Fig. 4). There exists a gradation from the biotite-apatite-quartz greisens to granitoid rocks through a variety of breccia-like rocks which contain varying amounts of quartz-apatite-felspar and biotite in both the phenoblasts and in the matrix. In some, the schlieren are exclusively sodic plagioclase encased in biotite or biotite-quartz rock, in others the schlieren are alaskitic and encased in biotite-quartz-felspar rock. Apatite and rutile and other accessories are frequent components. It is apparent that these transition specimens with a pseudo breccia structure indicate various stages in the development of a series of auto-metasomatised rocks by the action of magmatic soda rich salic liquors operating along a complex intersecting set of joint or shear fissures in an original fractured mass of leucoadamellite.

The most highly altered centres are represented by the greisenised rock composed of biotite, apatite and quartz, while the other extreme has its representation in the associated gneissic biotite granites containing poikiloblastic quartz and evidence of sodic felspar growth in situ.

There appears from these observations to be abundant evidence of local sodic metasomatism with an intense centre in the vicinity of the shafts.

Summary and Conclusions.

The general nature of the country rock on a regional scale is that of normal potassic granites evolved by granitization of original sediments. Localized round Crocker's Well is a roughly circular area of leucocratic adamellites differing from the enclosing rocks by a low content of mafic minerals and a richness in highly sodic plagioclase, $Ab_{90}An_{10}$. Although massive and unbroken in periphery the degree of brecciation increases towards the centre of the adamellite zone as also does the overall richness in sodic plagioclase, i.e. taking into account all rock types in the complex. Doubtless the brecciated condition of the adamellites whether the result of shearing, intersecting joint systems or diatreme phenomena guided the metasomatising salic liquors which in turn introduced the uranium mineral as well as the other accessories such as apatite, zircon, rutile and the rare earth minerals monazite and xenotime. These rare minerals were principally introduced by medium of blue quartz and quartz-albit veins at a late stage of the metasomatic period (Fig. 1, 2, 12-15).

Further evidence of the post shear introduction of the soda rich and associated rare minerals is indicated by the presence of intrusive basic dyke rocks of peculiarly sodic composition into two well defined shears in the vicinity of Crocker's Well.

A.W.G. Whittle

PETROLOGIST.

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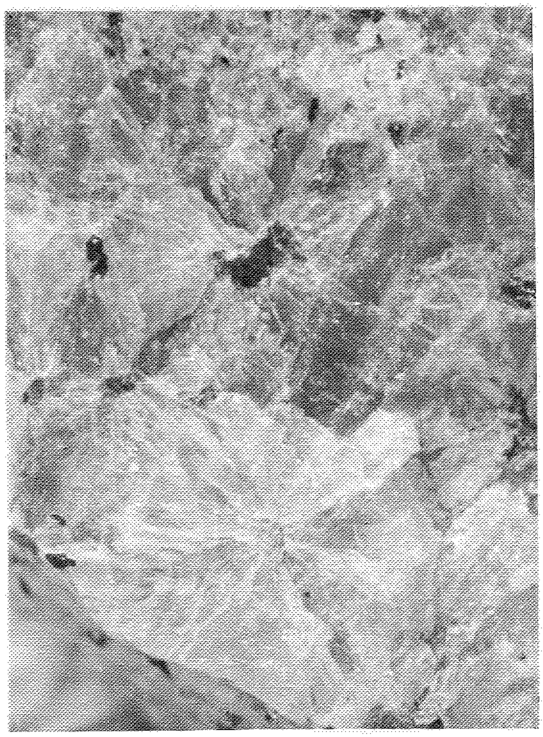

Fig. 1 Natural Size. Fig. 2

Anhedra of Absite enclosed in late magmatic quartz veins. Radial cracks in enclosing quartz indicate expansion of absite due to decomposition or weathering.

Fig. 3 Half Natural Size. Fig. 4

Brecciated granite fragments enclosed in richly biotitic granitic matrix.

Schlieren of alaskite enclosed in richly biotitic granitic rock.

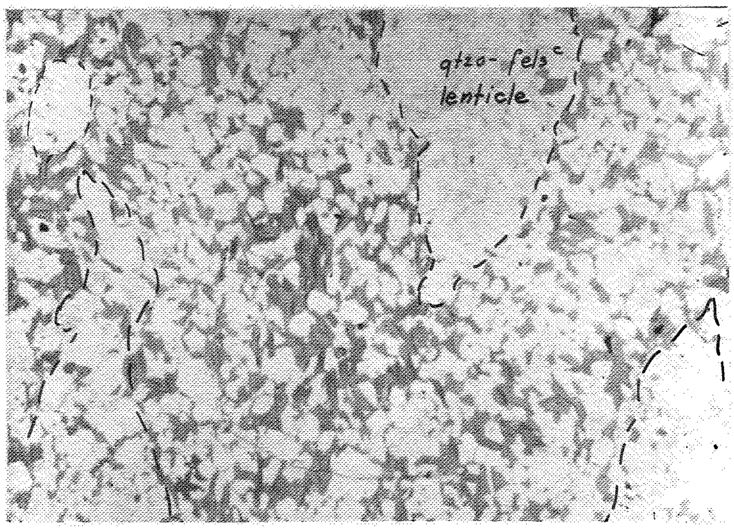

Fig. 5

Schlieren rock X 10 ordinary light showing quartzo-felspathic lenticles (white areas) enclosed in a matrix of quartz-felspar-biotite rock. Note the absence of strict parallelism of micas.

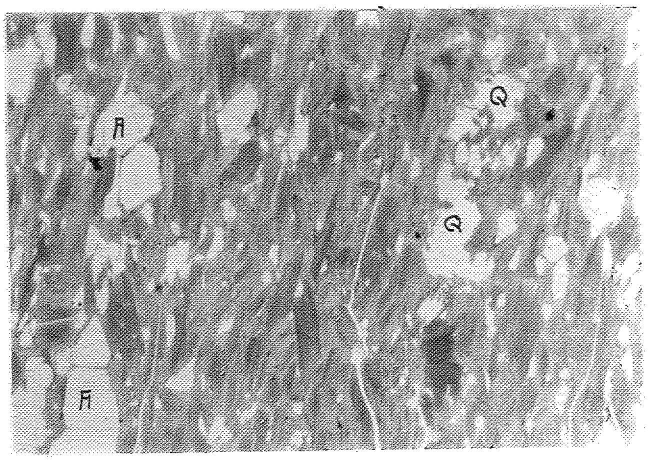

Fig. 6

Greisen X 10 ordinary light showing quartzp Q, apatite, A, and biotite.
Note orientation irregularities in biotite, irregular form of quartz, and subhedral form of apatite.

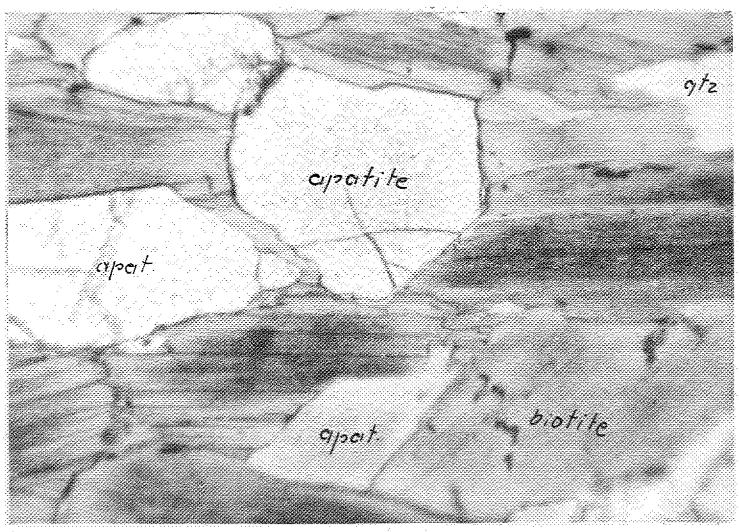

Fig. 7

Greisen X 320 ordinary light.
Note subhedral hexagonal form of apatite and straight line contacts against biotite suggestive of simultaneous crystallization. Biotite is crowded with opaque mineral inclusions (rutile?).

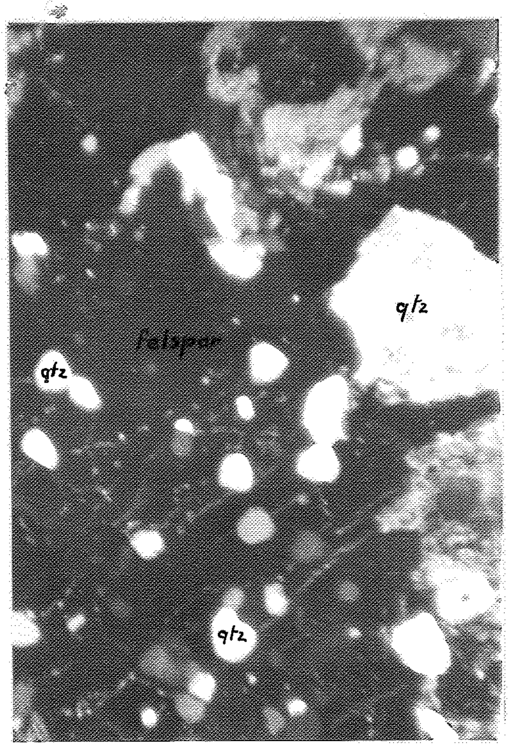

Fig. 8

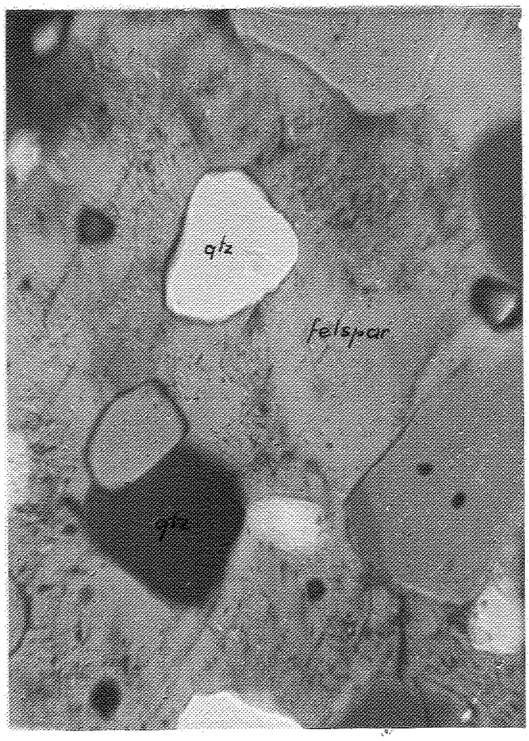

Fig. 9

Gneissic biotite granites X nicols.

Rounded poikiloblastic quartz in felspar indicating growth of felspar in place.

X 32

Rounded poikiloblastic quartz in felspar indicating growth of felspar in place.

X 100

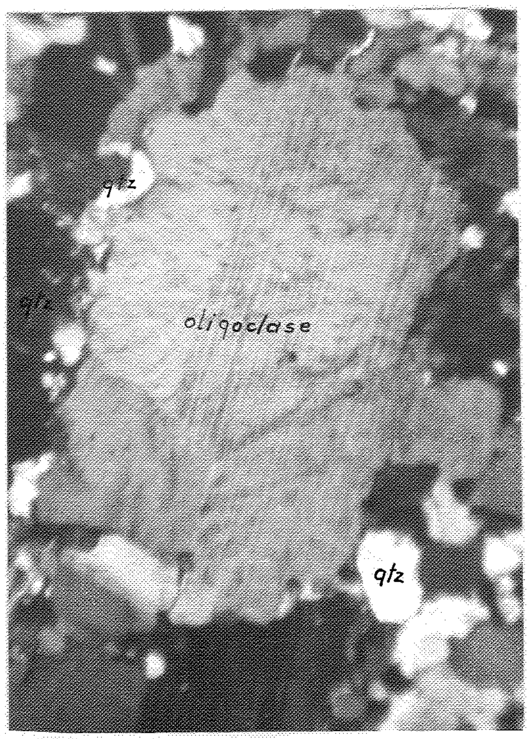

Fig. 10

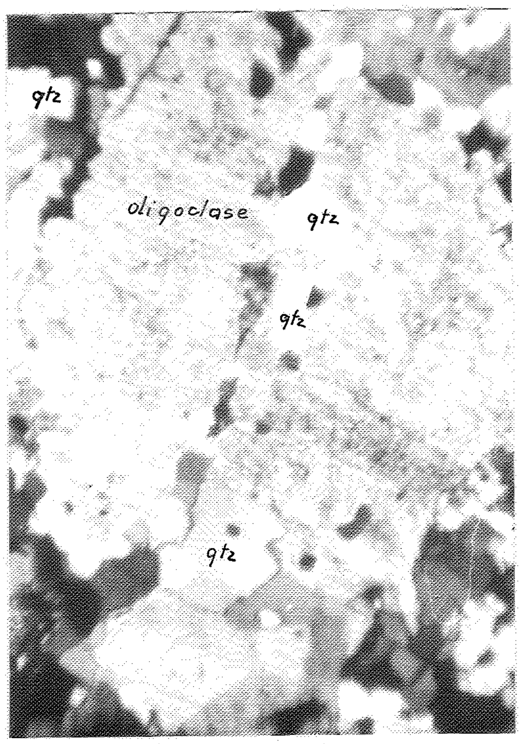

Fig. 11

Gneissic biotite granites X nicols.

A complete oligoclase crystal showing its euhedral habit modified by interpenetrant borders against granular quartz. Indicative of growth in place.

X 32

Detail along edge of an oligoclase crystal showing crenulated contact and enclosure of unreplaced quartz as poikiloblasts.

X 100

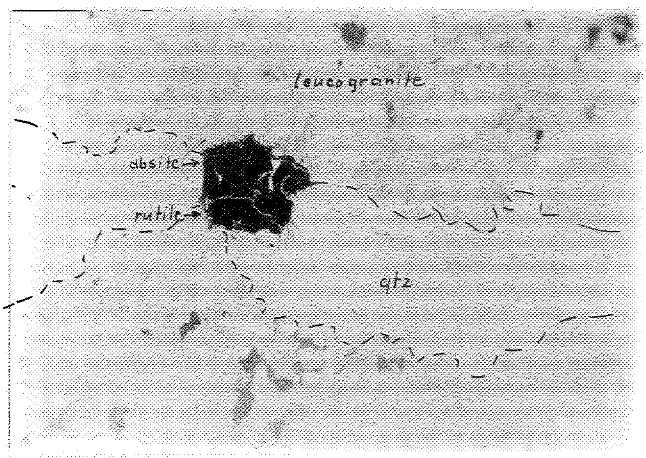

Fig. 12
Ordinary light X 10.

Absite with intergrown rutile (black) tending to hexagonal habit.
Absite enclosed in blue quartz vein in leucogranite.

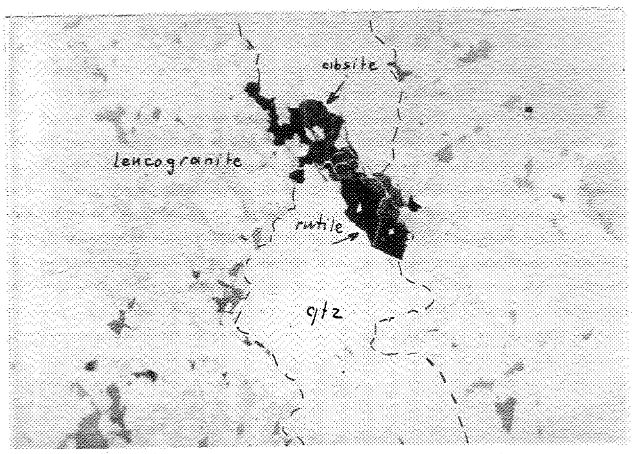

Fig. 13 X 10

Absite (dark grey) and rutile (black) intergrown and associated with deuteric quartz vein in leucogranite.

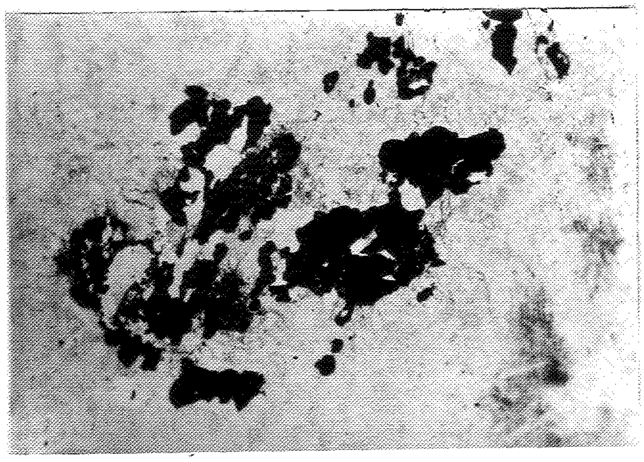

Fig. 14 X 10

Absite-rutile intergrowth in leucogranite with no quartz vein relationship.

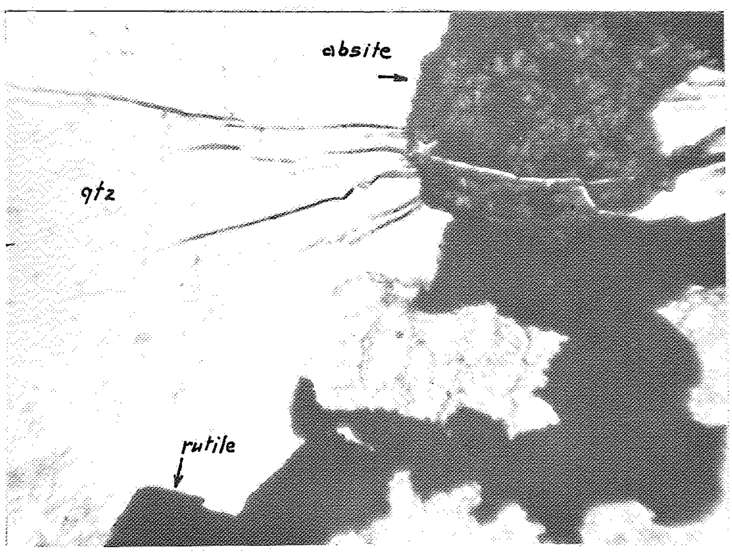

Fig. 15
X 100

Absite (dark grey)-rutile (black) intergrowth showing radial cracks in enclosing quartz emanating only from absite due to decomposition. Rtile unaltered.