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REPORT ON EXPLORATION OF E.L. 2/78
DURING 1978-79
FIELD SEASON

MICROFILMED

79-1349

OPEN FILE

Prepared by
D.C. Speijers

File Report No. 37
April, 1979

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INTRODUCTION

Alcoa of Australia Limited was granted an extension of Exploration Licence EL.2/78 in November 1978. The new expiry date is 12th May 1979. During the past few months the Company has been actively engaged in exploration work on the licence area. This has involved :

- 1) Colour aerial photography
- 2) Rock chip sampling with subsequent geochemical analysis and petrological examination
- 3) Stream sediment sampling followed by heavy mineral separation (currently under way)
- 4) Stream water sampling followed by chemical analysis
- 5) Cursory examination of some aeromagnetic anomalies
- 6) Prospecting and collecting of geological data
- 7) Location of old workings and reclearing old access tracks

These activities are described in more detail in the following pages.

COLOUR AERIAL PHOTOGRAPHY

Tucana Air Systems were contracted to fly the entire licence area with colour photography during January 1979. The nominal scale was 1:20,000 with a datum level of 800m ASL. The new photography provides a better medium for navigation on the ground and should also be more amenable to photointerpretation than the existing coverage. A flight line plot is included in the plans accompanying this report.

ROCK CHIP GEOCHEMISTRY

In order to gain an appreciation of the acid intrusive body occupying a large portion of the area, a series of 35 rock chip samples was collected from widely spread locations over its outcrop area. Each sample consisted of five or six 2" chips collected over an area 5-10m across. The chips were examined in hand specimen and one from each sample was selected for thin section work. The thin sections have been examined by Pontifex and Associates and their report is included as an appendix. Descriptions of several other thin sections made from chip samples taken from country rocks are also included. The remaining sample chips were submitted to Analabs Pty Ltd for trace element analysis. The method used was as follows :

- 1) Chips were crushed, split and pulverised
- 2) Analysis for Sn, W, Bi, Ti, Zr, Ta, Mo, Al and Ga was carried out by pressed powder and XRF
- 3) Analysis for Be was by fusion and AAS
- 4) Analysis for Cu, Pb, Zn, Li, Mg and F was by hydrofluoric acid attack and AAS except for F where a specific ion electrode method was used.

Results of the analyses are presented here as Table 1. The mean values of trace elements for the intrusive as a whole are set out in Table 2 which shows that it is enriched in Sn, W and Li and depleted in Pb, Zr Ti and Mg.

3.

STREAM SEDIMENT GEOCHEMISTRY

During November 1978 orientation stream sediment sampling was carried out downstream from the old Bluff River Tin workings and in other selected localities. The results are shown in Table 3.

In practice the only particle size fraction which is available in sufficient quantity for separation of an adequate amount of heavy minerals is the -16 +44 mesh fraction. This is due to the very low content of heavy minerals in the sediments.

According to the orientation work this fraction gives an adequate if not a maximum anomaly contrast for tin. The statistical limitations of such a coarse size fraction are recognised and allowance will be made for the consequent semi-quantitative nature of the results.

Table 4 shows the distribution of tin in the -16 +44 mesh fraction of stream sediments. Sample No. 13468 is from a stream draining an area of tin mineralisation while the other two samples are from streams draining areas not known to have mineralisation. In the heavy mineral fraction, sample 13468 shows as a clear anomaly and continues to show as anomalous when the tin value is recalculated as a proportion of the whole sample. In the light fraction of the sediment there is no anomaly and indeed when the total tin content of the unseparated sediment is calculated there is still no anomaly.

The futility of analysing an unseparated stream sediment sample from this area is thus demonstrated.

The main stream sediment sampling programme, which was carried out in the period January to March, resulted in the collection of samples from approximately 280 locations. Progress was slower than anticipated and hence the sampling was limited to the area of highest priority, i.e. the acid intrusive and the PreCambrian rocks immediately around it. The locations sampled and the corresponding sample numbers are shown on plan VI.

4.

It is hoped to extend the surveyed area during the next summer field season.

Two sediment fractions were collected at each location; a one or two kilogram sample of -16 +44 mesh material and a smaller sample of -44 mesh size.

The -16 +44 mesh samples are currently undergoing separations using heavy liquid (TBE) methods. The resulting heavy mineral fractions will be examined microscopically before trace element analysis by XRF techniques.

The -44 mesh samples are mainly a back-up in case of problems with the coarser materials. Their further treatment has not yet been determined.

STREAM WATER SAMPLES

Stream water samples were taken at most locations from which sediment samples were collected. Samples of 250ml were stored in PVC bottles which were then submitted for fluorine analysis. A specific ion electrode method was used and this had a detection limit of about 10ppb fluorine. These analysis results are included in the appendix. The reasoning behind the fluorine analyses was that mineralising fluids associated with the formation of tin deposits are often fluorine-rich, resulting in minerals such as fluorite, tourmaline and topaz being deposited.

5.

AIRBORNE MAGNETIC ANOMALIES

In the course of prospecting and stream sampling, several of the magnetic anomalies listed in our report of October 1978 were traversed. These were anomalies A, B, C, E, F, G, H, J, K, M, Q, R and S. Some appeared to be associated with magnetite along fracture planes in quartzite, e.g. anomaly H, but no obvious explanation was found for most of them and they must await detailed relocation on the ground followed by a closer examination.

Anomaly Q appears to be associated with a dark grey sulphide-bearing fine-grained metasediment and is a high priority for further investigation.

PROSPECTING AND GEOLOGY

Prospecting and the collection of geological data have been carried out as part of the stream sampling programme. Rock samples have been collected at many points and some of these have been submitted for geochemical analysis or petrographic examination. The geological data will be used as an aid to photogeological work to be carried out over the winter months.

LOCATION OF OLD WORKINGS

Several old mine workings and diggings exist within the licence area. Some of these have been located and access tracks cleared. These will have a high priority for detailed examination in the next field season. Two or three other prospects remain to be located next season.

6.

EXPLORATION PROPOSALS

Conditional on the granting of a further six month extension to EL.

2/78 the following programme of work is proposed for the winter period :

- 1) Analysis of stream sediment samples, involving -
 - a) separation of heavy mineral fractions
 - b) semi-quantitative mineralogical examination of these fractions
 - c) chemical analysis for trace elements
 - d) Photogeological interpretation of the licence area using the newly-acquired colour aerial photography and aided by geological data collected during the past field season.

Detailed proposals for the next field season could not be made at this stage; however the work would probably involve the following :

- 2) Extension of stream sediment sampling to cover a larger area
- 3) Detailed examination of existing old mine workings and prospects
- 4) Ground location and further examination of magnetic anomalies
- 5) Gridding and soil sampling over the Bluff River Tin Deposits.

Sample Number	Location Number																Σ	
		Cu	Pb	Zn	Mo	F	Sn	W	Bi	Zr	Ta	Ti	Be	Li	Mg	Al	Ga	
13489	G 1	5	x	20	x	2090	30	50	15	50	15	370	x	205	925	13.0	20	
90	G 2	5	5	20	x	2090	25	10	x	55	x	340	5	185	950	13.4	20	
91	G 3	5	5	25	x	1700	25	15	x	45	tr	280	5	155	785	13.2	25	
92	G 4	5	x	20	x	1990	20	25	x	45	tr	340	5	215	735	13.7	25	
93	G 5	5	5	35	x	1140	15	tr	x	65	x	360	10	165	1100	12.6	20	
94	G 6	5	5	20	x	1540	20	10	x	75	x	540	5	170	900	13.4	25	
95	G 7	5	5	30	x	605	15	x	x	100	x	640	5	85	1200	12.6	20	
96	G 8	10	5	75	x	1460	40	10	x	85	x	600	tr	150	1200	13.5	20	
97	G 9	5	10	25	x	910	15	10	x	55	x	340	10	110	695	12.7	20	
98	G10	5	5	45	x	860	10	x	x	130	tr	1150	x	160	1850	12.8	20	
99	G11	5	5	30	x	770	10	tr	x	120	x	740	5	95	1300	12.0	20	
13500	G12	5	5	20	x	1320	30	10	x	55	tr	320	10	120	835	12.1	20	
12201	G13	5	5	60	x	780	25	tr	x	90	x	700	x	50	1550	12.6	20	
02	G14	5	10	35	x	930	8	tr	x	80	15	640	tr	105	1250	13.6	20	
03	G15	5	x	25	x	575	10	tr	x	70	x	490	x	70	1025	12.7	15	
04	G16	5	5	30	x	755	9	tr	x	80	x	560	5	110	1250	12.6	20	
05	G17	5	10	45	x	960	35	tr	x	100	tr	730	tr	130	1375	13.3	25	
06	G18	5	5	30	x	1000	15	tr	x	70	x	470	5	150	1025	13.0	20	
07	G19	5	5	25	x	960	15	10	x	75	tr	470	20	140	975	12.5	20	
08	G20	5	5	20	x	620	15	x	x	55	x	360	10	75	1050	12.3	20	
09	G21	5	5	45	x	1700	35	x	x	90	x	660	10	175	1175	12.8	20	
10	G22A	5	x	10	x	1130	30	x	x	40	tr	260	10	95	680	13.0	25	
11	G22B	5	x	25	x	960	9	10	x	70	x	560	10	115	1050	12.1	20	
12	G23	5	x	30	x	930	6	tr	x	85	tr	680	10	120	1350	12.2	20	
13	G24	5	5	30	x	780	20	10	x	70	x	510	10	125	1050	13.7	20	
14	G25	10	5	45	x	1620	45	15	x	55	x	470	10	120	710	13.0	20	
15	G26	5	5	30	x	1130	15	tr	x	65	x	430	10	140	1050	13.0	15	
16	G27	15	5	45	x	2200	45	15	x	35	tr	150	10	145	615	13.6	30	
17	G28	25	10	75	x	1460	45	x	x	55	tr	240	10	125	990	12.5	25	
18	G29	5	5	25	x	1540	30	25	x	55	x	370	15	140	975	12.5	20	
19	G30	20	5	35	x	1320	45	50	x	50	x	350	10	105	925	12.7	25	
20	G31	5	5	25	85	1260	20	x	50	55	x	410	tr	95	800	12.6	20	
21	G32	15	10	25	x	740	25	20	5	55	tr	400	x	50	785	11.8	20	
22	G33	5	x	40	x	980	10	x	x	85	x	680	5	110	1125	12.2	20	
23	G34	5	5	25	x	825	45	10	x	85	x	580	x	75	750	12.6	20	
Limit of detection		5	5	3	3	5		10	5		15	3	5	5	5			

TABLE 1 : ROCK CHIP SAMPLE ANALYSES

TABLE 2 : AVERAGE TRACE ELEMENT CONTENT OF GRANITE TOR INTRUSIVE

	Granite Tor		Average Granite	
	Mean	Standard Deviation	(Levinson)	(Beus & Grigorian)
Cu	6.9	4.6	10	10
Pb	5	-	20	19
Zn	33	14.4	40	39
Mo	<3	-	2	1.3
F	1190	449	735	830
Sn	23	12.3	3	3
W	11	-	2	2.2
Bi	<5	-	0.1	0.01
Zr	70	21.5	180	180
Ta	<15	-	3.5	2.5
Tl	490	190	2300	1700
Be	7	-	5	3.5
Li	125	39.5	30	38
Mg	1030	260	3300	3300
Ga	21	2.9	18	20

Sample Number	Location	Size Fraction	Heavy Minerals				Normalised for Whole Sample				Drainage Area	
			% H.M	Sn (ppm)	Mo (ppm)	Ti (ppm)	W (ppm)	Sn ppm	Mo ppm	Ti ppm		W ppm
13470	SED 1	-44#	0.25	Insufficient sample								Granitic Intrusive with possibly some influence from Permo-Triassic sediments
13471		-16+44#	0.32	300	<50	1800	80	1.0	<0.16	5.8	0.26	
13472		-8+16#	0.04	350	<50	1400	-	0.1	<0.02	0.6	-	
13464	SED 2	-44#	0.23	1500	100	8000	200	3.4	0.23	18.4	0.46	Quartzite close by intrusive contact
13465		-16+44#	0.12	Insufficient sample								
13466		-8+16#	0.06	Insufficient sample								
13473	SED 3	-44#	0.10	Insufficient sample								Granitic Intrusive
13474		-16+44#	0.08	350	90	12000	150	0.3	0.07	9.6	0.12	
13475		-8+16#	0.01	Insufficient sample								
13467	SED 4	-44#	0.11	8000	>300	12000	-	8.8	>0.33	13.1	-	Area of working on tin veins near intrusive-quartzite contact
13468		-16+44#	0.11	3400	<50	5800	-	3.7	<0.05	6.4	-	
13469		-8+16#	0.18	6100	<50	2100	50	11.0	<0.09	3.8	0.09	

TABLE 3 : ORIENTATION STREAM SEDIMENT DATA FOR GRANITE TOR AREA

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TABLE 4 : DISTRIBUTION OF TIN IN -16 +44 MESH FRACTION OF STREAM SEDIMENTS

Sample No.	Tin (ppm) in H.M. Fraction	H.M. Tin normalised for whole sample	Tin (ppm) in Light Fraction
13471	300	1.0	7
13474	350	0.3	below detection limit ie <3
13468	3400	3.7	5

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STREAM WATER SAMPLE ANALYSES

<u>Sample Number</u>	<u>F(ppm)</u>	<u>Sample Number</u>	<u>F(ppm)</u>	<u>Sample Number</u>	<u>F(ppm)</u>
17002	0.041	17041	0.037	17080	0.053
17004	0.037	17042	0.033	17081	0.053
17005	0.041	17043	0.035	17082	0.046
17006	0.039	17044	0.034	17083	0.043
17007	0.037	17045	0.033	17084	0.051
17008	0.056	17046	0.038	17085	0.052
17009	0.056	17047	0.041	17086	0.051
17010	0.041	17048	0.030	17087	0.052
17011	0.049	17049	0.032	17088	0.055
17012	0.048	17050	0.030	17089	0.055
17013	0.049	17051	0.034	17090	0.054
17014	0.043	17052	0.042	17091	0.048
17015	0.043	17053	0.041	17092	0.051
17016	0.051	17054	0.035	17094	0.053
17017	0.045	17055	0.036	17095	0.055
17018	0.052	17056	0.037	17096	0.050
17019	0.047	17057	0.035	17097	0.078
17020	0.053	17058	0.039	17098	0.060
17021	0.050	17059	0.039	17099	0.046
17022	0.046	17061	0.046	17100	0.051
17023	0.055	17062	0.050	17101	0.040
17024	0.050	17063	0.049	17102	0.041
07125	0.045	17064	0.050	17103	0.043
17026	0.046	17065	0.047	17104	0.050
17027	0.059	17066	0.047	17105	0.043
17028	0.056	17067	0.044	17106	0.043
17029	0.033	17068	0.072	17107	0.050
17030	0.036	17069	0.057	17108	0.050
17031	0.030	17070	0.064	17109	0.049
17032	0.035	17071	0.060	17110	0.046
17033	0.030	17072	0.059	17111	0.047
17034	0.034	17073	0.055	17112	0.062
17035	0.036	17074	0.073	17113	0.050
17036	0.036	17075	0.076	17115	0.054
17037	0.035	17076	0.062	17116	0.054
17038	0.034	17077	0.054	17117	0.039
17039	0.037	17078	0.050	17118	0.040
17040	0.036	17079	0.074	17119	0.045

Sample Number	F(ppm)	Sample Number	F(ppm)	Sample Number	F(ppm)
17120	0.043	17161	0.037	17202	0.057
17121	0.066	17162	0.035	17203	0.055
17122	0.050	17163	0.038	17204	0.050
17123	0.044	17164	0.043	17205	0.062
17124	0.062	17165	0.049	17206	0.057
17125	0.046	17167	0.053	17207	0.052
17126	0.034	17168	0.041	17208	0.054
17127	0.041	17169	0.047	17209	0.066
17128	0.039	17170	0.063	17210	0.061
17129	0.050	17171	0.038	17211	0.051
17130	0.047	17172	0.035	17212	0.052
17131	0.042	17173	0.035	17213	0.053
17132	0.043	17174	0.036	17214	0.063
17133	0.039	17175	0.036	17215	0.057
17134	0.043	17176	0.037	17216	0.066
17136	0.048	17177	0.036	17217	0.086
17137	0.047	17178	0.035	17218	0.075
17138	0.046	17179	0.040	17219	0.098
17139	0.038	17180	0.045	17220	0.065
17140	0.040	17181	0.046	17221	0.065
17141	0.044	17182	0.044	17222	0.059
17142	0.039	17183	0.047	17223	0.063
17143	0.039	17184	0.044	17224	0.064
17144	0.040	17185	0.047	17226	0.070
17145	0.059	17186	0.044	17227	0.066
17146	0.066	17187	0.047	17228	0.064
17147	0.064	17188	0.048	17229	0.064
17148	0.048	17189	0.042	17230	0.071
17149	0.049	17190	0.041	17231	0.058
17150	0.050	17191	0.042	17232	0.063
17151	0.055	17192	0.052	17233	0.062
17152	0.045	17193	0.056	17234	0.059
17153	0.045	17194	0.060	17235	0.056
17154	0.044	17195	0.050	17236	0.054
17155	0.044	17196	0.050	17237	0.073
17156	0.039	17197	0.052	17238	0.080
17157	0.038	17198	0.048	17239	0.080
17158	0.041	17199	0.050	17240	0.065
17159	0.038	17200	0.060	17241	0.052
17160	0.036	17201	0.071	17242	0.052

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<u>Sample Number</u>	<u>F(ppm)</u>	<u>Sample Number</u>	<u>F(ppm)</u>	<u>Sample Number</u>	<u>F(ppm)</u>
17243	0.060	17258	0.055	17272	0.043
17244	0.050	17259	0.055	17273	0.047
17245	0.059	17260	0.053	17274	0.044
17247	0.060	17261	0.051	17275	0.043
17248	0.054	17262	0.050	17276	0.041
17249	0.057	17263	0.052	17277	0.041
17250	0.060	17264	0.049	17278	0.048
17251	0.072	17265	0.051	17279	0.044
17252	0.073	17266	0.055	17280	0.042
17253	0.066	17267	0.055	17283	0.048
17254	0.054	17268	0.051	17284	0.049
17255	0.054	17269	0.049	17285	0.049
17256	0.054	17270	0.039	17286	0.047
17257	0.053	17271	0.045		

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Pontifex & Associates Pty. Ltd. 171016

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A.H. 31 3816

26 KENSINGTON ROAD, ROSE PARK
SOUTH AUSTRALIA

P.O. BOX 91, NORWOOD
SOUTH AUSTRALIA 5067

MINERALOGICAL REPORT NO. 2591

3rd May, 1979

TO:

Mr. D.C. Speijers,
Alcoa of Australia Ltd.,
Murdoch House
5 The Esplanade,
MOUNT PLEASANT, W.A. 6153

YOUR REFERENCE:

Your letter dated 9/4/79

MATERIAL:

Rock samples and thin sections

IDENTIFICATION:

12201 to 12223
13476 to 13500

WORK REQUESTED:

Petrographic descriptions
with detailed comments as
specified

SAMPLES & SECTIONS:

Returned to you with
this report



PONTIFEX & ASSOCIATES PTY. LTD.

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COMMENT1. GENERAL

All section offcuts were stained with sodium cobaltinitrite to highlight the distribution and abundance of potash feldspar, which is shown stained a vivid yellow color on the offcuts returned to you.

With the exception of the five altered sediments, the entire suite consists of 'granitic' rocks, gradational from granite to adamellite in composition, and apart from several distinct porphyritic samples, textural variations are limited.

Thus, it was decided to tabulate the petrographic characteristics of each sample, allowing space for notes specific to each mineral and to the rock as a whole. This appeared to be the most concise, effective and economical means of presenting the results of this investigation, rather than to adopt the usual practice of writing out individual descriptions, which would have involved considerable, somewhat tedious duplication of terminology.

A proforma was thus devised to record rock number and name, texture (allowing for reference to variations and statement of grain size), modal abundance of essential and accessory minerals, comments on alteration, and special notes.

The metasediments are described in the normal way.

2. NOMENCLATURE

As noted, apart from the metasediments, the granitic rocks are within the composition range of granite to adamellite. These terms are used essentially as according to Joplin in 'The Petrography of Australian Igneous Rocks'.

The granites in the suite consist essentially of quartz and microperthitic potash feldspar, with subordinate oligoclase-

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plagioclase, minor to accessory biotite and muscovite. Microcline is absent. The microperthitic potash feldspar forms greater than 60% of total feldspar.

The adamellites in the suite have essentially the same composition, with variation in minor phases as in the granites, but they are distinguished on the basis of feldspar abundances, i.e. where potash feldspar forms between 40 and 60% of the total feldspar. (This term adamellite may be considered synonymous with the term quartz ^{monzonite} ~~tonalite~~)

Locally within the suite, but not exclusively, muscovite tends to increase at the expense of biotite in the adamellitic facies.

Accessory minerals in both rock types are restricted to : minute zircon inclusions in biotite; trace small apatite associated with micas in 12205, 12208, 12212, 12213; accessory garnet in 12207, 13498; and trace rutile in biotite in 12205.

Tourmaline is accessory in 12210, minor in 13480, 13490, and is an essential phase in the boron-metasomatized 'porphyry' 13476.

Predictably, some samples have a composition transitional from granite to adamellite. Chemical analysis may be useful to resolve such facies trends within the suite however, the chemical data provided for some samples, did not include analyses which could really help refine the petrographic rock classifications. Minor empirical relationships could be made, e.g. higher F values in muscovite-rich rocks, however, further analyses for K, Si, Ca, Na, are needed if chemistry is to be employed in rock classification.

3. TEXTURES

Some interest was expressed in your covering notes in textures, and this property is an integral part of the tabulated descriptions. Predictable gradation and combinations of textures which may be

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defined occur throughout the suite. However the effort is made to categorise the major texture in each sample, according to the following definitions.

Hypidiomorphic granular (generally gradational to allotriomorphic granular) refers to a roughly equigranular rock, i.e. without any consistent or ordered difference in size of any single component or domain. Quartz is almost invariably anhedral (allotriomorphic), the feldspars (and micas) tend to be euhedral. The size range and average size is given, and the terms fine, medium and coarse correspond respectively to <1 mm, 1 to 5 mm and >5 mm.

Inequigranular refers to the allotriomorphic or hypidiomorphic mosaic in which there are two (or more) distinctive size populations of one or generally more mineral phases, and in which these different size populations have a widespread and fairly random distribution. The average size of the different populations are given.

Porphyritic, refers to a special class of the inequigranular texture in which a distinct and ordered size differentiation between phenocrysts and groundmass can be identified. This is gradational into the relatively more heterogeneous and random inequigranular mosaic texture defined above. The average size of the phenocrysts and of the groundmass is given. The rock as a whole is size-classified as fine, medium or coarse as defined above according to the size of the phenocrysts.

4. GROUPINGS ACCORDING TO PETROGRAPHIC CHARACTERISTICS

This suite may be subdivided on the basis of composition; essentially granitic v. adamellitic, and to a lesser extent muscovite v. biotite abundance: and/or it may be subdivided on the basis of texture; i.e. fine to coarse, degree of equigranular, inequigranular and porphyritic development.

Primary (or hydrothermal) alteration is absent from about 75% of the samples. In the other 25% it is restricted to very sparse

019

sericitisation of some plagioclase crystals, which is really insignificant. As noted above, three samples are enriched in tourmaline, including one carrying extensive tourmaline. This is a primary-pneumatolytic alteration, but in the suite as a whole, primary-hydrothermal alteration does not provide a basis for subdivision or definition of trends of facies types.

In the absence of significant alteration and since I am unaware of the distribution of the samples, or of the detailed application of the petrographic examination, I am not sure what parameters of subdivision may be the most meaningful.

The following rough petrographic groups, divided on the basis of gross composition and texture, may be worthy of correlation with field representation, (* denotes muscovite dominant over biotite).

Granite

Porphyritic: 12201, 12203, 12205, *14344A, 13498, 13499.

Inequigranular, weakly porphyritic: 12202, 12207, 13493, 13495.

Generally hypidiomorphic/allotriomorphic granular: 12204, *12206, *12208, 12211, *12212, 12213, 12215, *13489, *13491, *13494B, *13497.

Granite transitional to adamellite

Porphyritic: *13480

Weakly porphyritic: *12209, 12223, *13492.

Generally hypidiomorphic/allotriomorphic: *12218, *13491.

Adamellite

Porphyritic: *13480.

Weakly porphyritic: *13496, *13500.

020

Hypidiomorphic/allotriomorphic: *12210, *12214, *12216, *12217, 12219, 12220, *13490.

5. BRIEF GENERAL COMMENTS ON GENESIS

The composition and textures manifest in this suite indicate a granitic intrusion of relatively high-level type. Textural relationships in some of the porphyritic and more inequigranular samples indicate some interruption and two or possibly more, probably continuous spasms during final crystallisation, which reflect late stages of stabilisation of the structural setting. These features include coarse, deformed and rarely corroded quartz phenocrysts, partly invaded along fissures by the groundmass; overgrowths or margins of microperthite carrying fine graphic quartz and/or myrmekite, around euhedral twinned crystals of microperthite, and rare oscillatory zoning in plagioclase, commonly highlighted by selective supergene argillic alteration.

However, there is no conclusive evidence for distinct multiple intrusive phases in any given sample, (which was questioned in your notes) and the general lack of primary alteration tends to confirm this.

In the suite as a whole, the distribution of granite and adamellite composition may however, indicate differentiation, or intrusion and partial assimilation of one phase into a previous phase.

021

12201 : medium to coarse, porphyritic (muscovite-biotite) granite

Texture : Porphyritic. The micaceous quartzo-felspathic, microcrystalline groundmass has an average size of 1 mm, phenocrysts generally measure about 5 mm across

	Estimated total % abundance	If inequigranular		Specific Comments
		finer	coarser (mainly phens.)	
quartz	40	10-15	25-30	phenocrysts are irregularly rounded, stressed and fissured
*K-spar	35	20	15	myrmekite occurs along some zoned margins of phenocrysts
plagioclase	20	12	7-10	oligoclase, incipiently zoned
biotite	3-5	-	-	unaltered variably fine to fairly coarse
muscovite	3-5			unaltered variably fine to fairly coarse
zircon	< 1			almost exclusively as inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Incipient, patchy sericite + clay alteration in some plagioclase crystals (and selectively in some zones in these), probably supergene.

General Comments :

The myrmekite and/or micrographic quartz carrying inclusions of plagioclase, along margins of some euhedral perthite phenocrysts formed in the late or deuteric stage of consolidation, and considered together with porphyritic texture indicates a probable relatively high level plutonic intrusive, possibly with late interruptions in crystallisation.

022

12202 : medium to coarse, weakly porphyritic (biotite) granite, several very coarse euhedral plagioclase phenocrysts.

Texture : Weakly porphyritic to generally inequigranular, 'ground-mass' about 1 mm, but gradational up to average size of 'phenocrysts' (5 mm), several very large plagioclase phenocrysts 15 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)		Specific Comments
quartz	35	size differentiation generally not really distinctive		phenocrysts distorted and fissured.
*K-spar	30-35	"	"	inclusions of minor fine quartz, lesser plag.
plagioclase	15-20			vaguely zoned, rare graphic quartz around margins
biotite	7			in small clusters, but widespread.
muscovite	3-5			assoc. with groups of coarser quartz.
zircon	1			minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid patches of sericite ± clay in some plagioclase cores, probably only supergene; sparse supergene chloritisation of biotite.

General Comments:

Generally less porphyritic than 12201, otherwise similar, including sparse graphic quartz and incipient myrmekite. Quartz phenocrysts in both samples fractured and now occur as a group of 2 or 3 stressed grains, rarely with felspar along fissures.

023
12203 : medium to coarse, moderately porphyritic (biotite) granite; texturally heterogeneous groundmass and quartz phenocrysts restructured.

Texture : Porphyritic, patchy groundmass mosaic of quartz and feldspar, size about 0.8 mm, texturally reconstituted phenocrysts 10 - 12 mm, roundish quartz 0.1 mm scattered as inclusions mainly in feldspar.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	10	25	3 size modes of occurrence finest is incipiently graphic.
*K-spar	35	?20	?15	size difference not distinctive, small quartz inclusions common simple twinning.
plagioclase	15-20			medium grained
biotite	5-7			localised in clusters
muscovite	3-5			common in fissure networks through feldspar
zircon magnetite	tr			inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Networks and stringers of muscovite in feldspar may be regarded as incipient white mica alteration.

General Comments:

Glassy quartz phenocrysts fairly distinctive. Original single crystals have been deformed and apparently fractured into a group of 2 or 3 fairly coarse stressed grains. Network mode of occurrence of muscovite clearly late (?or due to recrystallisation) but not really alteration. Three sizes of quartz, and relationship of groundmass to phenocrysts suggests recrystallisation or deuteric readjustment.

02A

171025

12204 : coarse (biotite) granite.

Texture : predominantly hypidiomorphic granular, average size about 7 mm, but somewhat inequigranular due to inclusions of finer phases in felspar.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)		Specific Comments
quartz	35-40	10	25-30	deformed fairly coarse anhedral, and small inclusions in Kspar
*K-spar	35-40			abundant exsolved albite, small quartz and plag. crystal inclusions
plagioclase	10			smaller than Kspar
biotite	7-10			tends to be in clusters
muscovite	3			associated with biotite
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Clay sericite patches in plagioclase, slightly more intense than in samples above, and + sparse biotite along cleavages may represent incipient hydrothermal alteration.

General Comments:

As in above samples, coarser quartz is texturally deformed. Generalise hypidiomorphic granular texture, compared with porphyritic rocks above, fairly distinctive.

025

12205 : medium to coarse porphyritic (biotite-muscovite) granite.

Texture : Porphyritic, groundmass size average about 0.8 mm, phenocrysts about 5 mm but rarely up to 10 mm.

	Estimated total % abundance	If inequigranular		Specific Comments
		finer	coarser	
quartz	35	20	15-20	phenocrysts stressed as in rocks above
*K-spar	35	10	25	abundant exsolved albite some inclusions
plagioclase	15-20			mainly in groundmass, some incipient phenocryst weakly zoned.
biotite	3-5			scattered as fine flakes
muscovite	5			in moderately coarse plates
apatite	tr			associated with biotite
rutile	tr			
zircon	tr			inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Weak clouding of plagioclase by sericite ± clay, probably only supergene.

General Comments:

Muscovite, albeit a minor phase is proportionately more abundant than biotite, than in samples above. Rare intersertal myrmekite in groundmass.

026

12206 : fairly sparsely coarsely porphyritic, but otherwise medium grained muscovite granite.

Texture : Small number of coarse (15 mm) phenocrysts of quartz and micro-perthitic K-spar, randomly disposed through an otherwise hypidiomorphic granular aggregate, average size about 2.5 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	20	15	stressed and fissured, coarse granular phens.
*K-spar	35	25	10	
plagioclase	15			generally not significant as phenocrysts
biotite	3			scattered as fine flake
muscovite	10			coarse discrete plates locally in clusters
zircon	tr			inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Vague turbid dust and sericite flecks, more or less in core of plagioclase, supergene.

General Comments:

Muscovite more abundant than in rocks above.

027

171028

12207 : medium to coarse inequigranular (muscovite biotite), granite; rather felsic, accessory garnet.

Texture : Inequigranular gradational to porphyritic; fine mosaic, average size about 2 mm gradational into and randomly mixed with coarser aggregate, average size 10 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)		Specific Comments
quartz	20	no really distinctive differentiation of size		coarse quartz is fractured and stressed
*K-spar	40-45	"	"	generally twinned abundant exsolved albite
plagioclase	15-20	"	"	oligoclase
biotite	5-7			very strongly pleochroic
muscovite	5			most intergrown with biotite
zircon	tr			inclusions in biotite
garnet	1			

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Incipient fine sericite + clay dust as turbid patches in plagioclase, probably supergene.

General Comments:

Mode indicates this rock to be anomalously highly felsic, but abundances difficult to accurately assess in relatively small area of section due to tendency for coarser quartz and feldspar to aggregate rather locally.

Accessory garnet is distinctive, but immediate host has been plucked from the section.

028

171029

12208 : medium to coarse rather inequigranular but nonetheless generally allotriomorphic muscovite granite.

Texture : Generally a massive allotriomorphic, but rather inequigranular texture, average size about 4 mm but coarser K-spar up to 5 x 8 mm; felspar slightly more anhedral than above.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)		Specific Comments
quartz	30-35	no marked size differentiation		
*K-spar	35-40	15-20	15-20	inclusions of fine plag. and rounded quartz
plagioclase	20-25	10-15	7-10	stressed and twinning rarely bent
biotite	2-3			assoc. with muscovite
muscovite	7-10			clusters of fairly coars plates reare networks in plagioclase
zircon apatite	rare tr			minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Plagioclase weakly flecked with sericite, conceivable primary but really insignificant.

General Comments:

029

12209

: medium to coarse, rather inequigranular allotriomorphic, (biotite) muscovite granite (gradational to adamellite).

Texture : Essentially inequigranular, but gradational to porphyritic, the irregular finer mosaic has an average size of about 1 mm, the coarser about 5 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35	15	15-20	
*K-spar	30-35	15	15-20	
plagioclase	25-30	no real size differentiation		generally coarser than in most rocks above.
biotite	3-5			
muscovite	7-10			more widely scattered than in above rocks.
zircon	tr			minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Fine sericite-clay alteration more or less in core of larger plagioclase crystals more intense than in samples above, probably primary.

General Comments:

Ratio of K-spar:plagioclase somewhat less than in samples described above- suggesting an adamellitic trend.

030

12210 : fine to medium grained muscovite adamellite; accessory tourmaline.

Texture : generally fine grained allotriomorphic granular, average, but with very minor quartz and K-spar crystals up to 5 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30		some coarse stressed, rounded phenocrysts.
*K-spar	30		
plagioclase	30		oligoclase
biotite	3-5		some quite coarse greenish flakes.
muscovite	5-7		some skeletal intergrown with plag.
zircon	tr		minute inclusions in biotite.
tourmaline	1		pale blue, skeletal grains through plagioclase.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Macroscopically some micas appear green, this is primary pale green biotite and not chlorite alteration. Turbid clay-sericite cores in some plagioclase.

General Comments:

Relatively high proportion of plagioclase, in relation to K-spar indicates an oligoclase composition. Skeletal nature of some muscovite, and the tourmaline indicates minor residual volatiles.

031

12211 : medium to coarse, (muscovite biotite) granite.

Texture : Hypidiomorphic inequigranular, average size about 4 mm, but some coarser quartz up to 8 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	35-40	no ordered size difference	
*K-spar	35-40	"	generally twinned minor small quartz inclusions
plagioclase	10-15		some crystals weakly zoned.
biotite	5		commonly in clusters
muscovite	5		single coarse ragged flakes
zircon	tr		minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Rare turbid clay-sericite cores in plagioclase.

General Comments:

032

12212 : medium grained (biotite-muscovite) granite.

Texture : Hypidiomorphic, inequigranular average size about 3 mm, but some quartz and K-spar crystals up to 5 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	35-40	no ordered size difference	
*K-spar	35-40	"	twinned, small quartz inclusions
plagioclase	10-15		oligoclase
biotite	5		in clusters, fairly commonly assoc, with muscovite.
muscovite	5-7		coarse ragged plates, some skeletal intergrown with felspar
zircon	tr		minute inclusions in biotite
apatite	tr		rare grains assoc. muscovite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid patches of sparse clay-sericite in felspars probably supergene.

General Comments:

Slightly finer grained equivalent of 12211, although with slightly more muscovite.

033

12213 : coarse, (biotite-muscovite) granite.

Texture : Hypidiomorphic granular, average size about 8 mm; minor fine (1 mm) quartz randomly scattered as inclusions in feldspars.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	35-40	no ordered size difference	
*K-spar	40	"	twinned, small inclusion quartz and plag.
plagioclase	10-15		oligoclase, generally coarser than in samples above.
biotite	5		commonly greenish
muscovite	5-7		coarse ragged flakes intergrown with biotite, skeletal intergrowths feldspar.
zircon	tr		minute inclusions in biotite.
apatite	tr +		assoc. with muscovite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid clay-sericite in irregular core zone of some plagioclase probably supergene, but slightly more intense than in most samples above.

General Comments:

Greenish primary biotite fairly distinctive in thin section, to a lesser degree in hand specimen.

034

171035

12214 : fine to medium grained (biotite) muscovite adamellite.

Texture : Hypidiomorphic granular (and fairly equigranular)
average size 1.5 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)			Specific Comments
		finer	coarser		
quartz	30				
*K-spar	30				
plagioclase	30				oligoclase
biotite	2-3				
muscovite	5-7				coarse plates and highl skeletal intergrowths in fels.
zircon	rare tr				inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolve
in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Fine discrete flakes muscovite scattered within plagioclase and minor
highly skeletal intergrown muscovite in plagioclase, incipient hydro-
thermal alteration. Turbid clay + fine sericite supergene.

General Comments:

Relative proportion of feldspars indicates an adamellite composition.

035
12215 : coarse (muscovite biotite) granite

Texture : Hypidiomorphic inequigranular, average size about 7 mm, but coarse K-spar crystals up to 4 x 11 mm, albeit not clearly differentiated as phenocrysts.

	Estimated total % abundance	If inequigranular (mainly phenocrysts.)		Specific Comments
		finer	coarser	
quartz	30-35	7-10	25	
*K-spar	35-40	10	30	commonly twinned, small inclusions quartz & plag
plagioclase	15-20			
biotite	5-7			rarely partly greenish
muscovite	3-5			coarse ragged flakes, rarely intergrown with felspar
zircon	tr			minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Some plagioclase turbid in incipient zones with clay + trace fine sericite.

General Comments:

036

12216 : fine to medium grained muscovite adamellite.

Texture : Allotriomorphic granular, average size about 1 mm, minor quartz and K-spar coarser (1-3 mm) tend to segregate into clumps, but not clearly porphyritic.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30-35		
*K-spar	25-30		
plagioclase	25-30		oligoclase
biotite	3-5		commonly greenish
muscovite	15		highly irregular plates form integral part of aggregate

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Most feldspars flecked with trace to accessory sericite, indicates very incipient hydrothermal alteration, probably consistent with gross muscovite enrichment.

General Comments:

Relative abundance of feldspars indicates an adamellite, and corresponding increase in muscovite seems to be following consistent trend in the suite. Highest muscovite in suite so far.

037

171038

12217 : fine to medium grained muscovite adamellite.

Texture : Hypidiomorphic to allotriomorphic granular, average size about 1.3 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30-35		generally allotriom. evenly distrib. but locally as graphic intergrowths in felspar
*K-spar	25-30		
plagioclase	25-30		oligoclase
biotite	2		fine single flakes, commonly greenish
muscovite	10-12		discrete coarse flakes, also skeletal intergrow with felspar

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolve in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Extremely fine flakes muscovite sparsely scattered through plagioclase apparently very incipient hydrothermal alteration.

General Comments:

Essentially an equivalent of 12216, slightly coarser grained.

038

171039

12218 : medium to coarse, (biotite-)muscovite granite;
(transitional to adamellite).

Texture : Hypidiomorphic to allotriomorphic and fairly equigranular,
average size about 3 mm, minor K-spar approach 5 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	35		
*K-spar	35		minor small inclusions plagioclase crystals.
plagioclase	25		oligoclase
biotite	5-7		slightly greenish and oxidised
muscovite	7-10		ragged plates, some skeletal intergrown with feldspars
zircon	tr		minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved
in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Rare turbid patches of clay ± trace sericite in plagioclase apparently
supergene.

General Comments:

Apparently a slightly coarser, and potassic, i.e. more granitic,
differentiate of 12216, 12217.

039

171040

12219 : medium grained, biotite muscovite adamellite.

Texture : Generally allotriomorphic granular, average size about 2.3 mm, but minor K-spar crystals up to 5 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30		
*K-spar	30		
plagioclase	25-30		oligoclase
biotite	5-7		weakly oxidised
muscovite	7		discrete ragged flakes
zircon	tr		minute inclusions in biotite.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Minor extremely fine muscovite, and skeletal networks of muscovite in feldspar, very incipient hydrothermal alteration.

General Comments:

Although adamellite, muscovite does not completely dominate biotite as in several adamellites above.

040

12220 : medium-grained biotite muscovite adamellite.

Texture : Generally hypidiomorphic and fairly equigranular, average size 2 mm, local allotriomorphic patches up to 10 mm across, average size 1 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35			
*K-spar	30-35			
plagioclase	25-30			oligoclase
biotite	5-7			
muscovite	5-7			ragged discrete flakes.
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Minor turbid patches of clay \pm trace fine sericite more or less in core of plagioclase supergene, but this superimposed on minor primary sericite alteration.

General Comments:

041

12223 : weakly porphyritic, generally medium grained (biotite-muscovite) granite, gradational to adamellite.

Texture : Inequigranular, locally porphyritic; bulk of rock allotriomorphic mosaic, average size 1 mm, poorly defined phenocrysts of rounded quartz (5 mm) and minor coarser K-spar.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35	25	10	
*K-spar	30-35	25	10	
plagioclase	25-30	equigranular		
biotite	3			more in sample (5-7%) than in section
muscovite	3-5			ragged flakes, minor skeletal intergrown with felspar

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Selected plagioclase crystals show moderate to advanced clay + fine sericite alteration, almost certainly supergene.

General Comments:

Not certain if section coincides with slide off cut of this number, certainly clumps of biotite in off cut not represented in the section.

042

171043

- 13476 : medium grained, quartz plagioclase tourmaline rock, weakly porphyritic in quartz (?porphyritic adamellite, pervasively boron metasomatized with substitution of K-spar and micas by tourmaline).
- Texture : Essentially porphyritic, roundish anhedral quartz phenocrysts of 2 to 3 mm randomly disposed through microcrystalline groundmass, average size about 1 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	40-45	20-25	15-20	in groundmass, primary fine mosaic with finer intergran. hydrotherm.
*K-spar	nil			
plagioclase	30			entirely in primary groundmass
biotite	nil			
muscovite	nil			
tourmaline	25-30			ubiquitous with finest hydroth. quartz, intergran. in groundmass.

- *K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Extensive boron metasomatism (tourmaline) + quartz more or less interstitial and ubiquitous through groundmass mosaic.

General Comments:

The complete absence of K-spar and micas, and the essential abundance of tourmaline highly diagnostic, and probably reflects extensive boron metasomatism (?at margin of the intrusive at contact with hornfels 13477).

Tourmaline quantitatively substitutes for K-spar, and micas, i.e. for the normal potassic and volatiles differentiation phases.

043
13477

orthoclase-quartz 'hornfels',
(an original homogeneous fine
grained sediment replaced by pervas-
ive potash-silica metasomatism),
or a contact metamorphosed
sericitic quartz siltstone.

This is a massive, homogeneous, extremely fine grained (0.25 mm) rock. It consists essentially of a microcrystalline, more or less microgranoblastic mosaic of essential quartz (approx. 45%) and orthoclase potash feldspar (approx. 45%). The mosaic pattern is weakly elongated to give rise to a vague layered structure.

Fine (0.01 to 0.1 mm) flakes of sericite (<5%) and chlorite (5%) occur as inclusions in quartz, and intergranular. Chlorite rarely forms short irregular lenses. Trace TiO granules accompany chlorite indicating that it formed from biotite. Trace minute zircon crystals are scattered.

This is a metasediment. The close association with granites suggests that at least the K-spar and possibly the quartz may represent metasomatic enrichment phases, derived from the granites, and completely pervasively replacing an original fine sediment.

Alternatively, the K, Al and Si forming the potash feldspar may be indigenous to the sediment, thus the rock may be a contact metamorphosed, sericitic quartz siltstone.

044
13479

pyrrhotite orthoclase quartz
tremolite hornfels; contact meta-
morphosed (?and metasomatised)
impure dolomite facies.

This is also a homogeneous, very fine grained (0.1 mm) rather massive rock, layered by virtue of similarly oriented fine amphibole and minor very fine pyrrhotite with a fairly even planar distribution, slightly more abundant in some bands than in others.

Basically the rock consists of a hornfelsic, somewhat elongate micromosaic of quartz (30%) and generally finer essentially intergranular potash felspar (30%). (This ubiquitous extremely fine potash felspar is highlighted on the stained offcut.)

Very small clusters of fibrous tremolite (30%), has a layered distribution through this micromosaic as noted above. Rare veins of the same tremolite cut the rock. Fine (0.08 mm) anhedral grains of pyrrhotite (10%) also have a generalised layered distribution.

Accessory minute granules of epidote and sphene are disseminated.

045

13480 : fine grained and microporphyratic (muscovite) adamellite, minor tourmaline through groundmass; (relates to 13476).

Texture : Very fine inequigranular/porphyritic; the bulk of the rock consists of a microcrystalline groundmass 0.5 mm, with abundant scattered phenocrysts of mainly quartz 1.5 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30		generally slightly coarser than ave. groundmass, gradational to phenocryst
*K-spar	30		some Qtz & K-spar vaguel composite
plagioclase	30		entirely within micro groundmass
biotite	nil		
muscovite	5		ubiquitous, fine
tourmaline	5-7		randomly disposed in groundmass, average size 0.3 mm.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Textural relationship of groundmass and coarser quartz-K-spar suggests, groundmass + tourmaline is a late phase introduction replacing and/or incorporating earlier groundmass.

General Comments:

Significantly accessory tourmaline probably relates to 13476.

046

13484

massive, altered scapolite, diopside (skarn) rock, with minor patches of potash feldspar (contact metamorphosed and metasomatised impure dolomitic facies).

This rock consists predominantly of a massive tight aggregate of randomly interlocking, more or less euhedral crystals of diopside (50-60%), average size about 1 mm. Generally single, euhedral (pseudo-rhombic) and more commonly prismatic crystals are scattered in vague bands, and independently through the diopside, to form about 30% of the rock. These are completely pseudomorphed by ultrafine sericite \pm intimately associated carbonate - the original crystals appear to have been scapolite, and almost certainly had a predominantly metasomatic origin.

Rare drusy cavities in the diopside aggregate are partly filled by extremely fine chlorite (5%). Accessory sphene crystals are scattered.

Irregular anhedral fairly coarse grains of potash feldspar, (10%) accompanied by minor, finer quartz are locally intergranular to the calc silicate aggregate may have been metasomatically introduced, to represent an incipient form of the massive pervasive material of 13477. Alternatively, this may be reconstituted indigenous material.

The rock is a contact metamorphosed magnesian-carbonate facies.

047
13485

fine crystalline massive to irregularly layered skarn rock composed of (altered scapolite), potash feldspar (?adularia) and diopside (metasomatized, contact metamorphosed impure dolomite).

Macroscopically this is a tough very fine crystalline, pale greenish grey rock, which has a somewhat contorted layering on a scale of 5 to 25 mm.

Two adjacent relatively broad bands in thin section consist of (1) coarse crystalline mosaic of potash feldspar, carrying abundant small inclusions of diopside; and (2) coarse crystalline diopside with irregular poorly defined layers of altered ?scapolite, as in 13484.

The potash feldspar has an anomalously very low 2V and appears to be the low temperature, (albeit metasomatic) adularia variety.

Thinner bands consist of diffuse microcrystalline mosaic of potash feldspar, diopside, and minor alteration products after scapolite. Minor fine granular sphene is relatively abundant in some layers.

13486

orthoclase quartz hornfels, carrying minor fine actinolite (essentially the same as 13477).

The bulk of this rock is essentially the same as 13477. It consists of a massive, homogeneous, microgranoblastic aggregate of quartz (60-70%), and potash feldspar (25-30%). Average and quite consistent grain size is 0.15 mm.

Minute prisms of actinolite (5-7%) granules of epidote (<1%) and minute oxidised garnet crystals (<1%) are randomly and fairly evenly scattered, (these do not occur in 13477). Accessory extremely fine chlorite is also disseminated as in 13477.

The genesis of this rock is essentially the same as 13477, but in addition the minor calc-silicate phase indicates some original components probably related to the skarn rocks 13484 and 13485.

The degree to which the potash feldspar may be metasomatic v. metamorphic is not certain.

049
 13489 : medium to coarse, (inequigranular) muscovite granite.

Texture : Hypidiomorphic, average size 5 mm but somewhat inequigranular due to variation in size of anhedral quartz, also due to some euhedral microperthite crystals up to 8 mm.

	Estimated total % abundance	If inequigranular (mainly finer coarser phens.)	Specific Comments
quartz	30	no distinct differentiation	rather inequigranular
*K-spar	35	tends to be coarse	several euhedral zoned crystals with margin enclosing graphic quartz + plag.
plagioclase	25		oligoclase
biotite	2-3		
muscovite	10-12		ragged flakes, skeletal intergrowth with felspar

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Incipient fine sericite scattered in some plagioclase crystals.

General Comments:

Mode of occurrence and abundance of muscovite, also graphic quartz + fine plag. inclusions in margins around K-spar crystals indicates fairly prominent and penetrating deuteric phase of crystallisation.

050

13490 : medium grained (biotite) muscovite adamellite, minor
tourmaline.

Texture : Allotriomorphic, inequigranular average size 2 mm but coarse
patchy quartz, and lesser K-spar crystals up to 5 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	10	25	coarse granular quartz stressed.
*K-spar	25-30	5	20	mainly as fairly coarse twinned crystals
plagioclase	30			oligoclase, fairly equigranular
biotite	2-3			
muscovite	5-7			coarse ragged flakes, skeletal intergrowths in felspar
zircon	tr			minute inclusions in biotite
tourmaline	??			not represented in section

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved
in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Trace minute flecks of muscovite through plagioclase.

General Comments:

Section not representative of sample, since fairly coarse, widespread
tourmaline (??%) seen macroscopically not represented in section.

051
13491 : fine to medium grained, muscovite granite, gradational to adamellite.

Texture : Allotrio to hypidiomorphic and fairly equigranular, average size about 1 mm, with minor coarser quartz.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	10	15	
*K-spar	30	tends to be coarser		minor graphic quartz inclusions
plagioclase	20-25	equigranular		oligoclase
biotite	1-2			
muscovite	10			fairly discrete ragged plates forming essential part of aggregate.

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid clay dust in plagioclase supergene, rare flecks of fine muscovite essentially hydrothermal.

General Comments:

052

171053

13492 : medium to coarse muscovite granite, transitional to adamellite.

Texture : Allotriomorphic (to hypidiomorphic), average size about 2 mm, but inequigranular due to 'clumping of quartz' into small aggregates 5 mm, and generally coarser K-spar.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35	10	25	locally coarse, aggregated and deformed
*K-spar	30			twinned crystals coarser than average
plagioclase	25			oligoclase
biotite	3-5			oxidised and leached
muscovite	10			discrete ragged plates, form integral part of aggregate

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid clay dust in feldspars supergene

General Comments:

053

13493 : medium grained and incipiently porphyritic, (biotite muscovite) granite.

Texture : Allotriomorphic (to hypidiomorphic) also inequigranular; bulk of rock has mosaic texture average size 1 mm, carries slightly coarser quartz clumps (5 mm) and lesser K-spar crystals (5 mm).

	Estimated total % abundance	If inequigranular		Specific Comments
		finer	coarser (mainly phens.)	
quartz	30-35	10	25	coarser granular quartz deformed
*K-spar	30-35	15	20	twinned crystals minor inclusions graphic quartz, plag. crystals
plagioclase	20	10	10	oligoclase, some coarse crystals.
biotite	5			
muscovite	5-7			discrete ragged plates forming part of aggregate
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Fairly extensive turbid clays in feldspars, minor oxidation of biotite supergene.

General Comments:

054

13494A : irregularly porphyritic (biotite) muscovite granite
(possibly two phases of primary crystallisation).

Texture : Porphyritic, microcrystalline groundmass, average mosaic
size 0.5 mm, carries coarse quartz and lesser K-spar,
5 to 10 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	10-15	15-20	coarse quartz, poly- crystalline deformed, vaguely composite with K-spar
*K-spar	30-35	25	10	minor graphic quartz intergrowths around margins
plagioclase	10-15	5-10	5-10	some coarse crystals
biotite	2-3			
muscovite	7-10			ragged plates intricate- ly interstitial through groundmass

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved
in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Minor to moderate patchy sericitisation in plagioclase probably hydro-
thermal.

General Comments:

** There are two samples with this same number. One with a gross, roughly
porphyritic texture is arbitrarily labelled 'A'. The other more equi-
granular sample is labelled 'B'.

Gross textural relationships suggest groundmass may be a late pulse,
which has incorporated and modified earlier primary groundmass.

055

**13494B : medium to coarse (biotite) muscovite granite; minor very selective clay-sericite-biotite hydrothermal alteration.

Texture : Generally hypidiomorphic average size about 3 mm, but somewhat inequigranular due to variation mainly in size of quartz (1 to 5 mm) and generally coarser K-spar (3 to 6 mm)

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35	10	25	coarser quartz stressed but not really deformed
*K-spar	30-35	7-10	25	commonly twinned
plagioclase	25	equigranular		
biotite	5-7			somewhat leached (?oxidised), in clumps
muscovite	7-10			ragged plates as integra part of aggregate

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Intense clay sericite \pm secondary biotite, hydrothermal alteration in most (but not all) plagioclase crystals.

General Comments:

** Second sample of this number, see note given in description of 13494A.

056
 13495 : weakly porphyritic, medium to coarse grained, (muscovite biotite) granite.

Texture : Incipiently porphyritic, 'loose' randomly interlocking coarse quartz and K-spar (5 mm) with minor chaotic, interstitial groundmass of fine (0.5 mm) mosaic.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	15	15-20	coarse quartz stressed
*K-spar	35	10	20-25	coarse euhedral crystals with overgrowths of K-spar with graphic quartz myrmekite
plagioclase	20	fairly equigranular		oligoclase mainly in groundmass
biotite	5			some coarse green, intergrown with muscovite
muscovite	3-5			coarse ragged plates
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid clay-dust \pm trace sericite, mainly in vague cores in plagioclase essentially supergene.

General Comments:

Late phase graphic quartz, and fine intersertial quartz, noticeably fairly abundant.

057
13496 : weakly porphyritic, medium to coarse grained (biotite) muscovite adamellite.

Texture : Inequigranular, weakly porphyritic, poorly defined coarse (8 mm) quartz 'phenocrysts', and lesser equally coarse muscovite randomly disposed through patchy microcrystalline mosaic (2 mm).

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	40	15-20	15-20	coarse quartz stressed
*K-spar	30	10-15	10-15	
plagioclase	25-30	equigranular		oligoclase
biotite	5			assoc. with muscovite
muscovite	10			coarse ragged plates as integral part of aggregate
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Irregular patches of turbid patches of clay ± minor sericite occur in most plagioclase, almost certainly supergene.

General Comments:

058

171059

13497 : fine to medium grained, muscovite granite.

Texture : Fairly homogeneous, allotriomorphic granular average size about 1 mm; (minor coarser quartz in hand specimen not represented in section).

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	30-35	20	10	
*K-spar	35	fairly equigranular		
plagioclase	15-30			oligoclase
biotite	<1			
muscovite	10-12			random ragged plates an essential part of aggregate

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Minor turbid clay patches in most plagioclase supergene.

General Comments:

13498 : fine to medium grained, (biotite) felspar quartz (granite) porphyry, accessory garnet.

Texture : Distinctly porphyritic, euhedral crystals, average size 5 mm are scattered through a microcrystalline groundmass average size about 0.8 mm.

	Estimated total % abundance	If inequigranular (mainly phens.)		Specific Comments
		finer	coarser	
quartz	35	15	20	common as euhedral phenocrysts, minor fine graphic quartz in groundmass
*K-spar	35-40	25-30	10	minor phenocrysts, mainly essentially in groundmass
plagioclase	20-25	7-10	15-20	euhedral phenocrysts common
biotite	10	5-7	3-5	some coarse phenocrysts mainly scattered through groundmass
muscovite	3			
garnet	1-2			in cluster within altered plag. in offcut, rare in the section assoc. biotite
zircon	tr			in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Turbid clays + flecks of sericite almost certainly supergene.

General Comments:

This is one of the most distinctly porphyritic rocks in the suite and distinctive in that felspar phenocrysts are euhedral and vaguely zoned plagioclase, also a cluster of fine garnet ?replacing plagioclase, 3 mm across is seen in the offcut (although not retained in these dimensions in the section).

060
 13499 : medium grained, biotite felspar quartz (granite) porphyry.

Texture : Very distinctly porphyritic. Euhedral phenocrysts average size 5 mm within a homogeneous microcrystalline groundmass average and fairly consistent size 0.15 mm.

	Estimated total % abundance	If inequigranular		Specific Comments
		finer	coarser (mainly phens.)	
quartz	30-35	10	25	phenocrysts euhedral stressed and dislocated
*K-spar	30-35	20-25	10	mainly in groundmass, some small phenocrysts
plagioclase	20-25	10	15	fairly common as coarse phens + graphic quartz inclusions
biotite	10-15	3-5	7	prominent as phenocrysts also scattered through groundmass
muscovite	3-5			in groundmass
zircon	tr			minute inclusions in biotite

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Minor clay sericite in some fissures in some plagioclase probably primary; turbid supergene clays more abundant.

General Comments:

This is the most distinctly porphyritic rock in the suite. Minor micrographic quartz, and/or myrmekite occurs around the margins of some coarser crystals of quartz and K-spar.

Groundmass invades some deformed quartz phenocrysts.

061

13500 : weakly porphyritic; fine to medium grained (biotite)
muscovite adamellite.

Texture : Generally allotriomorphic granular, average size about
1 mm, but with minor scattered clumps quartz (2-3 mm) to
produce incipient porphyritic texture.

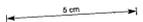
	Estimated total % abundance	If inequigranular (mainly phens.)				Specific Comments
		finer	coarser			
quartz	30	20	10			phenocrysts stressed and some fissured
*K-spar	30	size ranges from groundmass to small phenocrysts				
plagioclase	30	"	"	"	"	" " "
biotite	3-5					scattered but some clusters
muscovite	7-10					

*K-spar invariably micro-perthitic, i.e. minor extremely fine albite exsolved
in orthoclase, which is commonly twinned. Microcline is absent.

Alteration :

Biotite oxidised and turbid clays in felspar, mainly plagioclase,
supergene.

General Comments:



Scale 1:40000

0 0.5 1 1.5 2 kms

LEGEND

Boundary of E.L. 2/78

Photo centre

