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APPENDICES

Ap. 1 List of Rock and Ore Samples

No.	SAMPLE No.	ROCK NAME	LOCAL-ITY	TEST & ANALYSIS				
				T	P	X	RA	OA
1	301	Dolerite	TW	○			○	
2	302	Rhyolite	TW					
3	303	Rhyolite	TW					
4	304	Basalt	TW					
5	305	Basaltic bracciated rock	TW					
6	306	Rhyolite	TW	○			○	
7	307	Plagioclase-phyric basalt	TW	○				
8	308	Hornblende gneiss	TW					
9	309	Gneissose granite	TW					
10	310	Gneissose granite	TW					
11	311	Amphibolite	SM	○			○	
12	312	Pegmatite	SM					
13	313	Gossan	SM			○		○
14	314	Amphibolite	SM					
15	315	Quartzofeldspathic gneiss	SM	○			○	
16	316	Anorthosite	SM	○			○	
17	317	Serpentinite	SM			○		
18	318	Aphyric basalt	TW					
19	319	Microgranite	TW	○				
20	320	Quartzofeldspathic gneiss	TW					
21	321	Rhyolite	TW					
22	322	Quartzofeldspathic gneiss	TW					
23	323	Basalt	TW					
24	324	Basalt	TW				○	
25	325	Basaltic bracciated rock	TW	○		○		
26	326	Dolerite	TW					
27	327	Rhyolite	TW	○			○	
28	328	Rhyolite	TW	○			○	
29	329	Basalt	TW	○				
30	330	Basalt	TW	○			○	
31	331	Rhyolite	TW					
32	332	Basalt	TW					
33	333	Calc-silicate gneiss	TW	○			○	
34	334	Anorthosite	TW	○			○	
35	335	Orthogneiss	TW					
36	336	Rhyolite	TW				○	
37	337	Charnockite	TW	○			○	
38	338	Granulitic gneiss	TW					
39	339	Clay mineral(kaolinite)	TW			○		
40	351	Uranothorianite ore	TW		○	○		
41	352	Uranothorianite ore	TW			○		
42	353	Mica	TW					
43	354	Basalt	TW	○			○	
44	355	Coal	SM					
45	356	Orthogneiss	SM	○			○	
46	357	Orthogneiss	SM				○	
47	358	Gossan	SM					○
48	359	Gossan	SM			○		○
49	360	Aphyric basalt	TW					
50	361	Rhyolite	TW					

No.	SAMPLE No.	ROCK NAME	LOCAL-ITY	TEST & ANALYSIS				
				T	P	X	RA	OA
51	362	Brecciated and silicified rock in rhyolite	TW	○			○	
52	370	Microgranite	TW	○			○	
53	371	Pyroxene gneiss	TW					
54	372	Orthogneiss	TW	○			○	
55	374	Aphyric basalt	TW	○			○	
56	375	Quartz	TW					
57	511	Copper ore	SM			○		○
58	512	Copper ore	SM					○
59	514	Copper ore	SM		○			○
60	515	Copper ore	SM	○	○	○		○
61	516	Copper ore	SM					○
62	518	Copper ore	SM			○		○
63	519	Copper ore	SM					○

ABBREVIATIONS; TW:TORANOMARO WESTERN AREA, SM:SOAMANONGA AREA, T:THIN SECTION, P:POLISHED SECTION, X:X-RAY DIFFRACTION, RA:WHOLE ROCK ANALYSIS, OA:ORE ANALYSIS

Ap. 2 Assay Results of Ore Samples

No.	SAMPLE No.	ROCK NAME	LOCAL-ITY	Au g/t	Ag g/t	Cu %	Pb %	Zn %	Fe %
1	313	Gossan	SM	<0.016	0.3	0.01	<0.01	0.01	31.60
2	358	Gossan	SM	<0.016	<0.3	0.01	<0.01	<0.01	1.94
3	359	Gossan	SM	0.031	0.6	0.01	<0.01	<0.01	19.80
4	511	Copper ore	SM	3.375	125.3	15.60	0.01	0.01	2.88
5	512	Copper ore	SM	<0.016	<0.3	0.14	<0.01	0.01	5.90
6	514	Copper ore	SM	0.296	110.4	21.60	<0.01	0.01	3.20
7	515	Copper ore	SM	2.566	183.5	31.70	<0.01	<0.01	5.60
8	516	Copper ore	SM	0.031	1.6	0.49	<0.01	<0.01	1.38
9	518	Copper ore	SM	3.266	198.1	14.80	<0.01	<0.01	1.06
10	519	Copper ore	SM	3.561	8.4	9.70	<0.01	<0.01	2.04

ABBREVIATIONS; SM:Soamanonga Area

Ap. 3 Analysis Results of Whole Rock Samples

No.	SAMPLE No.	ROCK NAME	LOCAL-ITY	SiO2	TiO2	Al2O3	Fe2O3	FeO	MnO	MgO	CaO	Na2O	K2O	P2O5	LOI	TOTAL
1	301	Dolerite	TW	49.72	2.47	13.31	5.37	7.13	0.20	4.26	8.02	2.67	1.35	0.34	2.27	97.11
2	306	Rhyolite	TW	76.95	0.27	12.15	1.10	0.13	0.01	0.19	0.65	2.72	5.12	0.14	1.60	101.03
3	311	Hbl-Bi gneiss	SM	55.36	0.73	15.14	2.14	2.81	0.10	4.98	6.41	3.99	3.55	0.55	2.20	97.96
4	315	Qtzfld gneiss	SM	73.10	0.04	15.37	0.57	0.26	0.04	0.11	1.75	4.37	4.46	0.07	0.31	100.45
5	316	Anorthosite	SM	54.49	0.13	27.41	0.62	0.59	0.02	0.68	10.53	5.11	0.64	0.07	0.32	100.61
6	324	Basalt	TW	51.67	2.72	12.19	5.07	6.11	0.14	2.75	5.51	3.00	2.76	0.37	5.95	98.24
7	327	Rhyolite	TW	73.33	0.21	11.42	1.82	0.71	0.04	0.12	1.99	2.71	5.73	0.09	2.23	100.40
8	328	Rhyolite	TW	68.69	0.27	10.47	1.30	1.20	0.06	0.38	5.57	2.74	5.02	0.09	4.75	100.54
9	330	Basalt	TW	48.51	2.99	12.99	8.17	5.31	0.21	4.04	7.93	2.81	1.74	0.36	3.06	98.12
10	333	Calc-sil gneiss	TW	46.57	0.27	16.12	4.45	4.74	0.17	2.32	18.24	2.16	0.59	0.06	1.39	97.08
11	334	Anorthosite	TW	55.60	0.06	24.60	0.74	0.35	0.02	0.31	9.86	5.38	1.65	1.22	1.20	100.99
12	336	Rhyolite	TW	74.22	0.09	13.83	0.62	0.80	0.06	0.31	0.66	2.28	6.90	0.22	0.47	100.46
13	337	Charnockite	TW	69.76	0.61	12.73	3.35	2.08	0.13	0.41	2.23	3.78	3.83	0.19	0.88	99.98
14	354	Basalt	TW	44.33	3.55	12.54	8.29	7.43	0.27	5.20	10.32	2.50	0.14	0.41	2.94	97.92
15	356	Qtzfld gneiss	SM	68.40	0.38	16.00	1.67	1.22	0.05	1.23	3.54	5.26	2.30	0.22	0.52	100.79
16	357	Qtzfld gneiss	SM	72.70	0.23	14.19	1.35	0.65	0.02	0.49	1.25	4.73	3.39	0.16	0.79	99.95
17	362	Quartz rock	TW	88.40	1.57	0.89	3.93	0.13	0.01	0.15	0.91	0.39	0.07	0.91	2.12	99.48
18	370	Chn microgranite	TW	72.80	0.58	12.28	2.43	0.64	0.09	0.46	1.46	3.21	4.96	0.20	0.67	99.78
19	372	Grt-bg granite	TW	74.30	0.10	13.66	1.04	0.23	0.01	0.38	1.58	2.52	5.45	0.25	0.54	100.06
20	374	Aphyric basalt	TW	51.00	1.56	13.99	10.71	3.02	0.22	3.49	6.13	2.94	2.44	0.27	3.10	98.87

ABBREVIATIONS; Hbl:Hornblende, Bi:Biotite, Qtzfld:Quartzofeldspathic, Calc-sil:Calc-silicate, Chn:Charnockitic, Grt:Garnet, bg:bearing

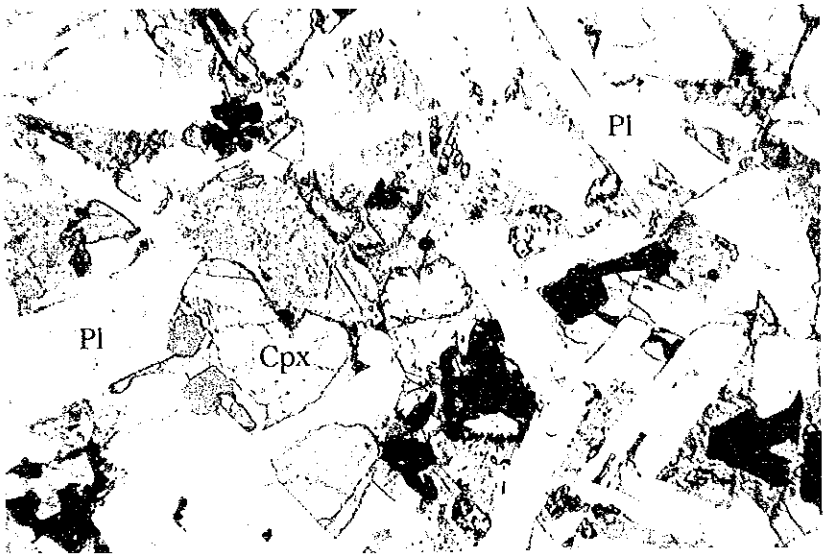
Ap. 4 Microphotographs and Microscopic Observations of Thin Sections

No.	Sample No.	Locality	Rock name	Primary minerals																		Secondary minerals									Remarks
				Qtz	Pl	Kfs	Bt	Hbl	Opx	Cpx	Ol	Grt	Cum	Spn	Ap	Ep	Cal	Tur	Mnz	Zrn	Rt	Hem	Opq	Chl	Sap	Csm	Bt	Ep	Zo	Ser	Cal	Cri	Tri	
1	301	TW	Dolerite		○					○													△	△	△								
2	306	TW	Rhyolite	○	○		*														*		*								*	*	
3	307	TW	Pl-phyric basalt		○					△													△	*				*	*				
4	311	SM	Hbl-Bt gneiss	○	○	△	△	△							*	*	*	*	*	*													
5	315	SM	Grt-bg. quartzofeld. gneiss	○	○	○	△					△								*			*	*						*			
6	316	SM	Anorthosite		○		*	*		*					*								*				*						
7	319	TW	Microgranite	○	○	○	△								*			*		*			*								*		
8	325	TW	Basaltic brecciated rock	○	○				△															*	*	*		*	*		*			
9	327	TW	Rhyolite	○	○	△																	*	*							*		*	
10	328	TW	Rhyolite	○	○																													(Kao)
11	329	TW	Basalt		○					○													*	*	*	*	*						*	
12	330	TW	Basalt		○					○													*	*	*	*					*			(Qtz)
13	333	TW	Calc-silicate gneiss	△	○					○		○		○																				(Ms)
14	334	TW	Anorthosite	△	○	△	△							*	△					*				*				*	*					
15	337	TW	Charnockite	○	○	○	△	△	△			△			*					*			*	*		*								(Mnt)
16	354	TW	Basalt		○					○	△												△		*	*								
17	356	SM	Quarztfeld. Hbl-Bt gneiss	○	○	○	○	○							*	△			*	*			*	*			*	*		*				Zo
18	362	TW	Quartz rock	○																*			*											Hem
19	370	TW	Charnockitic microgranite	○	○	○	△		△				△						*	*			*											
20	372	TW	Grt-bearing granite	○	○	○						△											*				*			*				(Kao)
21	374	TW	Aphyric basalt		○					△													△	*				*						(Act)
22	515	SM	Quartz vein with Cu-mineral.	○	*												*			*			*								*			(Qtz, Az, Mal)

Mineral abbreviations

Qtz: quartz, Pl: plagioclase, Kfs: K-feldspar, Bt: biotite, Hbl: hornblende, Opx: orthopyroxene, Cpx: clinopyroxene, Ol: olivine, Grt: garnet, Cum: cummingtonite, Spn: sphene, Ap: apatite
Ep: epidote, Cal: calcite, Tur: tourmaline, Mnz: monazite, Zrn: zircon, Rt: rutile, Hem: hematite, Opq: opaque mineral
Chl: chlorite, Sap: saponite, Csm: chlorite-saponite mixed layer, Zo: zoicite, Ser:sericite, Cri: cristobalite, Tri: tridymite, Kao: kaolinite, Ms: muscovite, Mnt: montmorillonite, Act: actinolite
Az: azurite, Mal: malachite

Circle: abundant, Triangle: medium, Star: minor, Parethesis: secondary



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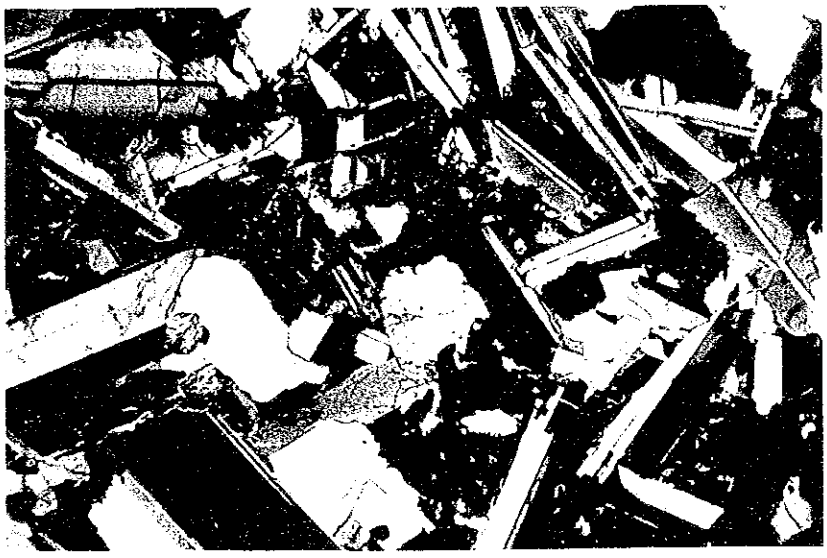


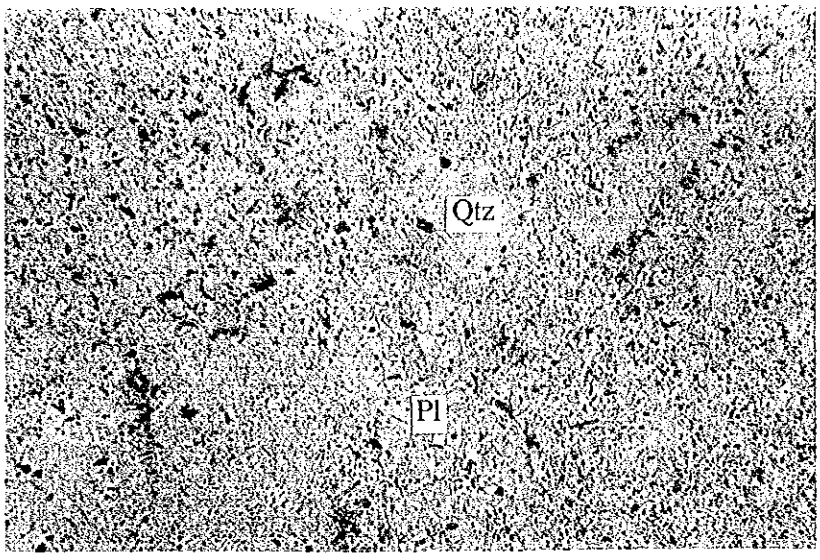
Cross polarized

0.5 mm

Sample No.: 301
Rock name: Dolerite(Clinopyroxene gabbro)
Formation (Locality):
Descriptions:

The rock contains coarse grains of plagioclase, clinopyroxene and opaque minerals (magnetite?) with intergranular texture.

Euhedral to subhedral plagioclase is 0.3 - 4.5 mm in garin size, which shows remarkable zonal structure with albite-carlsbad twin. Rarely it includes poikilitic clinopyroxene. Clinopyroxene is 0.2 - 1.0 mm in grain size. Note that the interstitial clinopyroxenes are subhedral to anhedral against the euhedral plagioclase. Partly glomeroporphyritic clinopyroxenes also present. Both plagioclase and clinopyroxene alter to chlorite and/or saponite.



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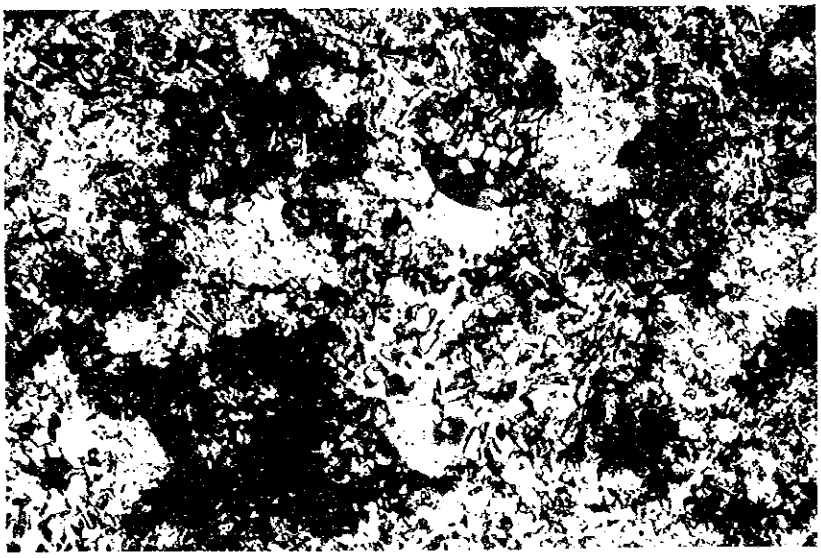


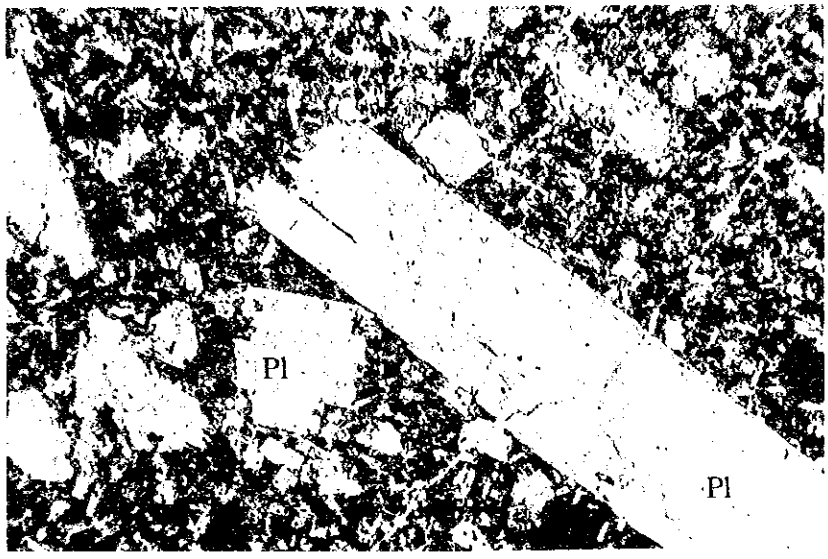
Cross polarized

0.5 mm

Sample No.: 306
Rock name: Rhyolite
Formation (Locality):
Description:

The specimen shows cryptocrystalline texture containing fine grains of quartz and plagioclase. Minor constituents are biotite, rutile and opaque mineral. Amygdaloidal gas cavities (0.3-1.0 mm in diameter) are filled with cristobalite and cristobalite+tridymite.

Groundmass is composed mainly of quartz and plagioclase with subordinate amounts of biotite, rutile and opaque mineral. Their grain sizes are usually less than 0.02 mm. Some valioles in the groundmass are composed of plagioclase and quartz.



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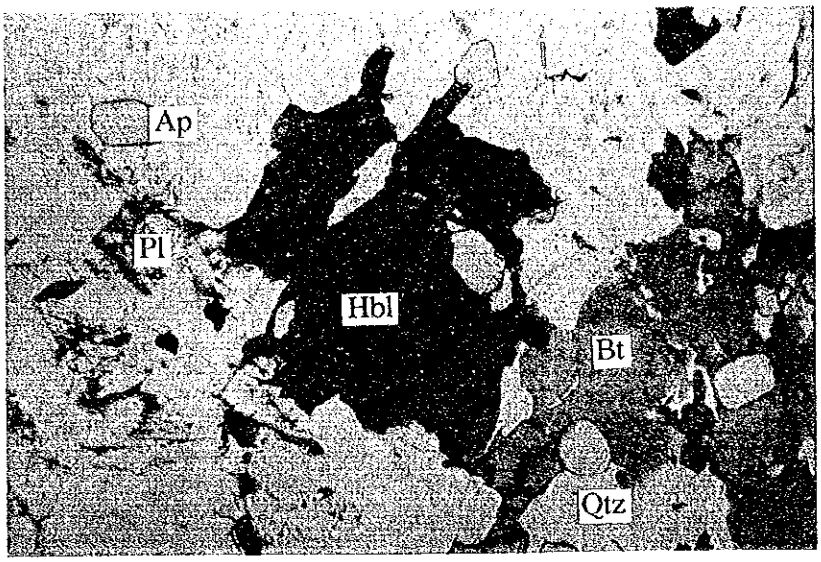
Cross polarized

0.5 mm

Sample No.: 307
Rock name: Plagioclase-phyric basalt
Formation (Locality):
Description:

The rock is somewhat coarser in grain size than is usual. It is composed mainly of phenocrysts of plagioclase and opaque mineral with groundmass containing plagioclase, clinopyroxene and opaque mineral.

Euhedral plagioclase phenocryst is 0.5 to 18.0 mm in grain size and shows zonal structure and albite twin. A part of plagioclase phenocryst alters to zoisite, epidote and chlorite. Phenocrysts of opaque mineral are euhedral to subhedral which grain sizes are 0.2 to 1.0 mm. Groundmass is composed of fine euhedral to subhedral grains (0.02-0.15 mm) of plagioclase, clinopyroxene and opaque mineral. They are usually altered by chlorite and epidote, except opaque phase.



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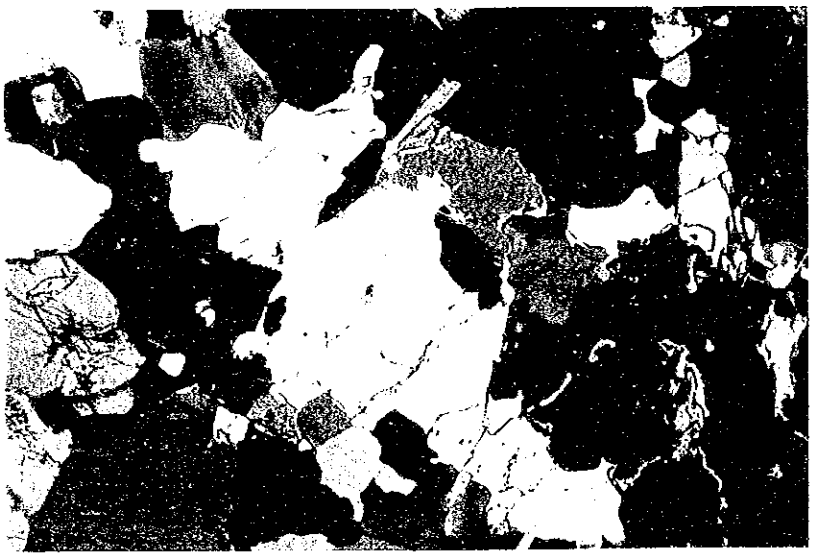


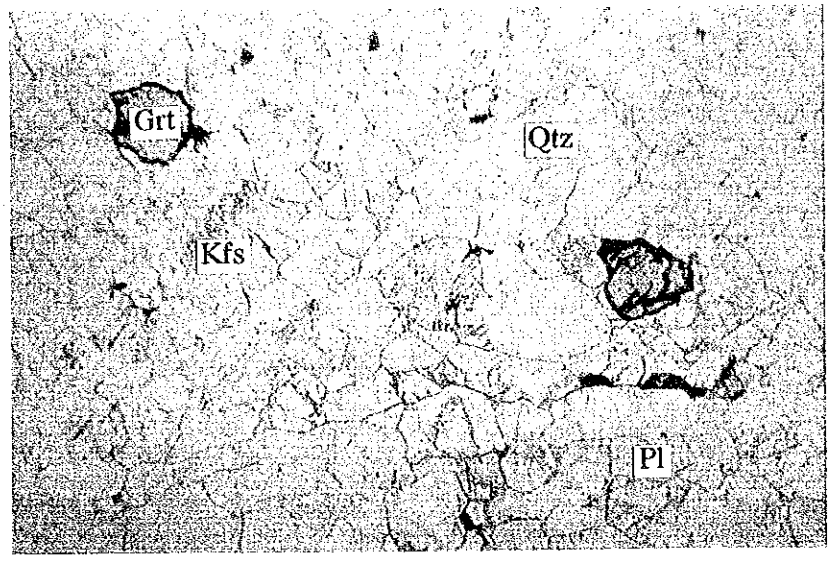
Cross polarized

0.5 mm

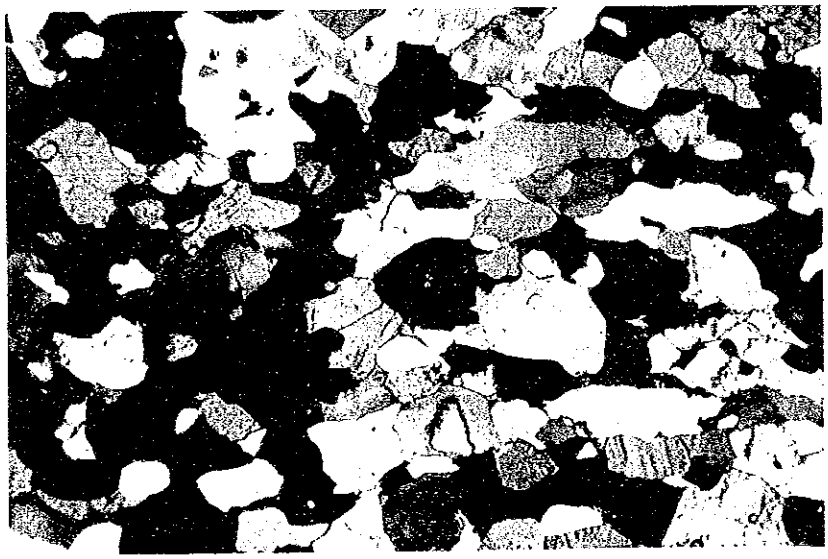
Sample No.: 311
Rock name: Hornblende-biotite gneiss
Formation (Locality):
Descriptions:

The rock shows granoblastic texture and is composed mainly of hornblende, biotite, plagioclase, quartz and K-feldspar with accessories of calcite, tourmaline, zircon, epidote, monazite and apatite.

Hornblende (subhedral to anhedral, 0.3-2.5 mm in grain size) shows pleochroism from pale brownish green to pale bluish green, which includes quartz, plagioclase, biotite and apatite poikiloblastically. Poikiloblastic biotite (subhedral to anhedral, 0.3-2.0 mm) includes quartz, hornblende, zircon, monazite and apatite. Subhedral to anhedral plagioclase (0.2-1.5 mm) includes fine grains (<0.1 mm) of biotite and quartz. It has no zonal structure while alters to sericite. K-feldspar occurs as subordinate constituent and shows hair-perthite to micro-perthite texture. Calcite proceeds along the grain boundary.



Plane polarized



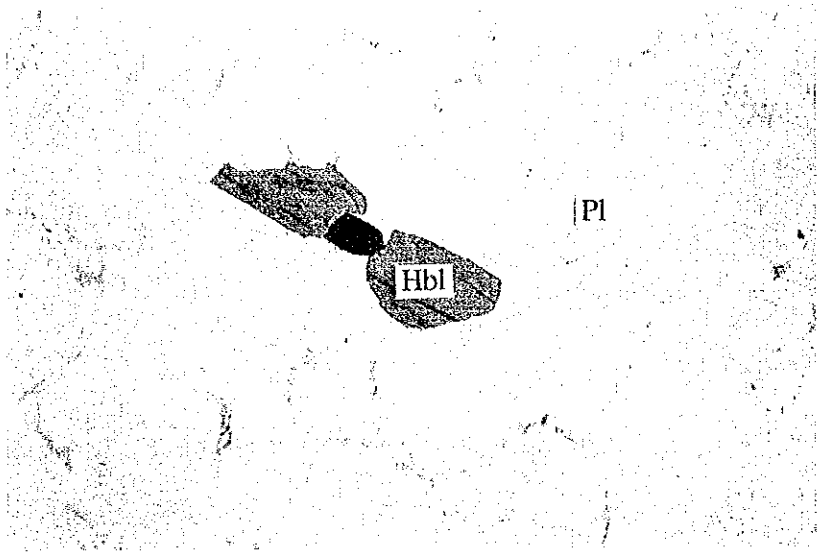
Cross polarized

0.5 mm

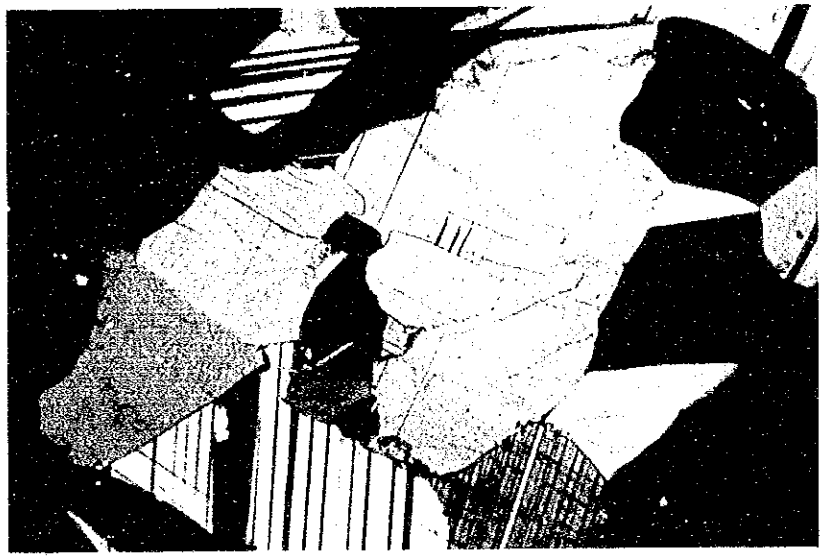
Sample No.: 315
Rock name: Garnet-bearing quartzofeldspathic gneiss
Formation (Locality):
Description:

The rock shows xenoblastic to subidioblastic texture with gneissose structure formed by quartz preferred orientation. It is composed mainly of quartz, plagioclase and K-feldspar with subordinate garnet and biotite. Accessories are opaque mineral and zircon. Secondary muscovite and chlorite are also observed.

Grains of the main constituents show subhedral to anhedral shapes and is 0.2 to 0.7 mm (max. 2.0 mm) in grain size. Plagioclase partly alters to sericite. K-feldspar shows hair-perthite texture. Garnet is subhedral to anhedral, 0.1-0.4 mm (max. 0.8 mm). Euhedral to subhedral biotite (0.1-0.4 mm) alters to chlorite.



Plane polarized



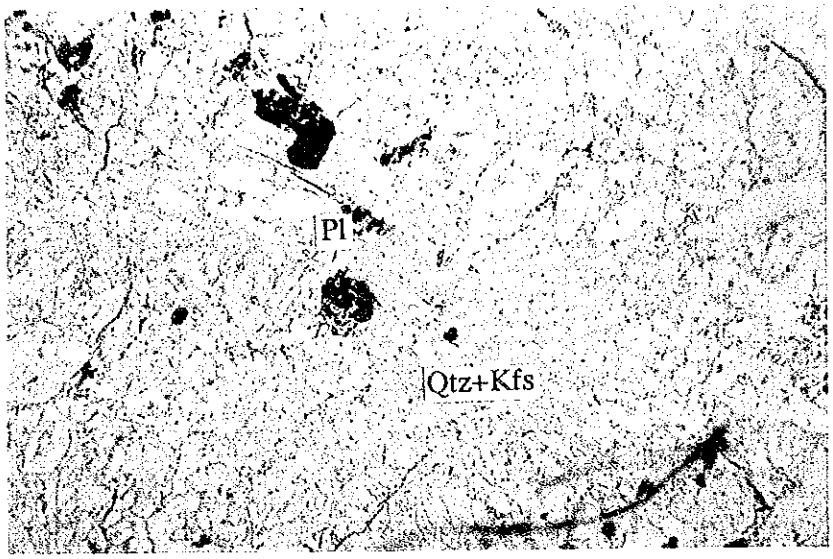
Cross polarized

0.5 mm

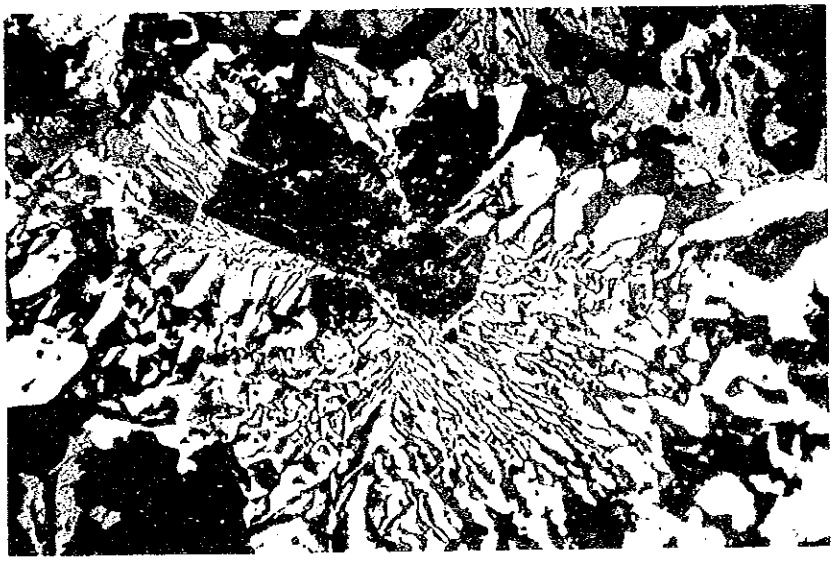
Sample No.: 316
Rock name: Anorthosite
Formation (Locality):
Description:

This sample shows hypidiomorphic granular texture and is composed mainly of plagioclase. Accessory minerals are biotite, clinopyroxene, hornblende, apatite and opaque mineral.

Subhedral to anhedral plagioclase shows albite and carlsbad twins and is 0.5 to 3.0 mm (max. 15.0 mm) in grain size. Clinopyroxene (subhedral, 0.4-0.7 mm), hornblende (subhedral, 0.25-0.5 mm) and biotite (subhedral, 0.3-0.5 mm) are minor constituents. Some hornblende and biotite, which are probably secondary minerals, replace clinopyroxene and hornblende, respectively.



plane polarized



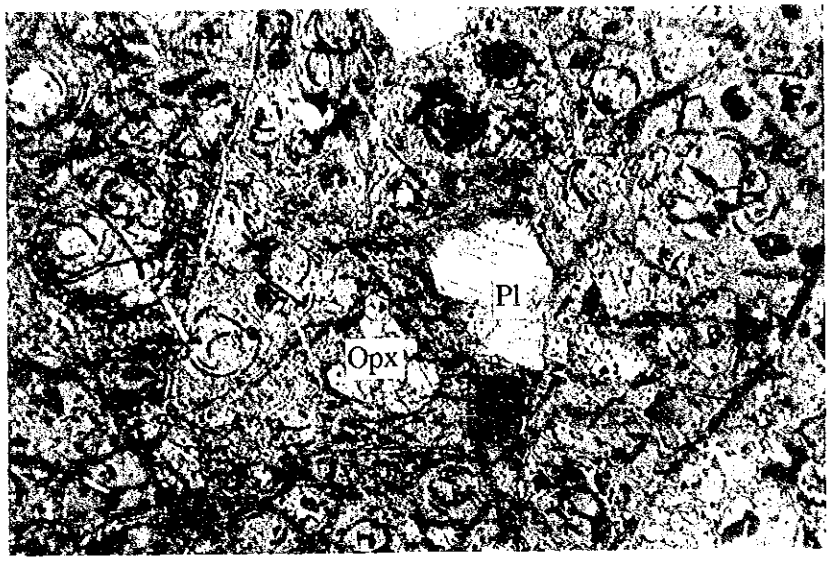
Cross polarized

0.5 mm

Sample No.: 319
Rock name: Microgranite
Formation (Locality):
Description:

The specimen is composed of quartz, plagioclase, K-feldspar with subordinate biotite. Accessories are apatite, zircon, tourmaline and opaque mineral. In this rock granophyric texture is predominant. Euhedral plagioclase is surrounded by radiate intergrowth composed of quartz and K-feldspar. Rarely there are graphic textures composed of quartz and K-feldspar.

Plagioclase is euhedral to subhedral (0.2-1.0 mm in grain size) and shows zonal structure with albite twin. K-feldspar (0.2-1.0 mm) is also euhedral to subhedral crystal and shows remarkable perthite texture. Biotite (0.1-0.5 mm) has rare occurrence. Secondary calcite occurs along the cleavages of plagioclase and K-feldspar or grain boundaries.



Plane polarized

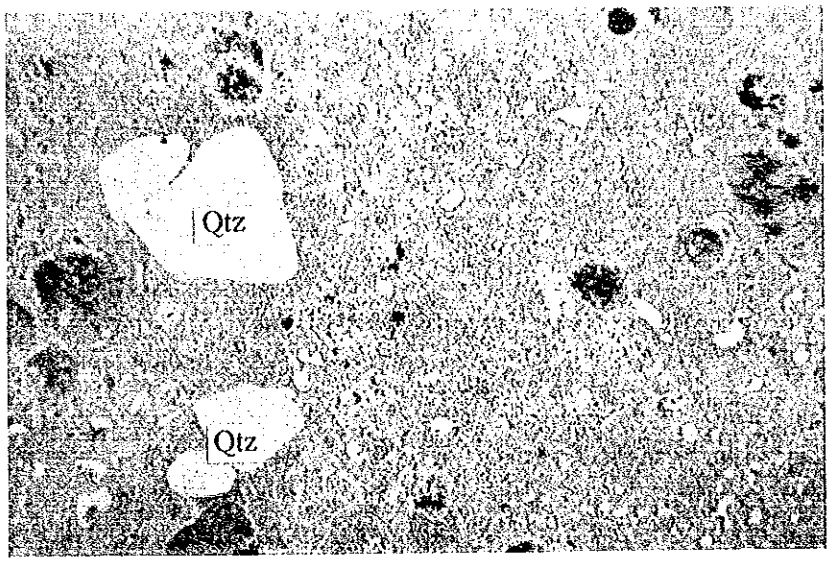
Cross polarized

0.5 mm

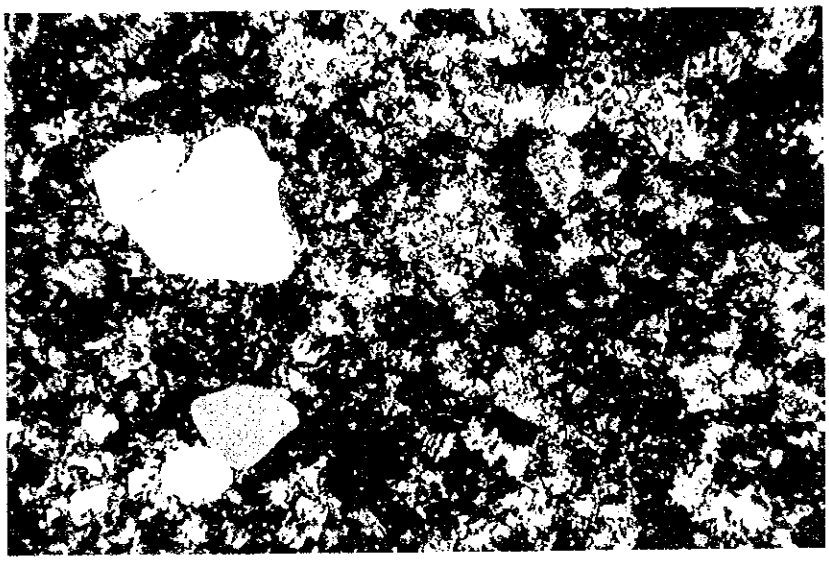
Sample No.: 325
Rock name: Basaltic brecciated rock
Formation (Locality):
Description:

The rock is composed of perlitic rhyolite and rhyolite breccias with matrix. Sizes of breccias are from 0.5 to 10.0 mm in diameter. Phenocrysts in perlitic rhyolite breccia are plagioclase (euhedral to subhedral, 0.2-0.7 mm in grain size) and orthopyroxene (subhedral, 0.07-0.3 mm). Groundmass contains plagioclase lath (euhedral, < 0.2 mm) and perlitic textured glass. Pale greenish glassy part is altered by chlorite, spherulitic saponite (< 0.03 mm in diameter) and minor epidote. Rhyolite breccia has euhedral to subhedral plagioclase phenocryst (0.2-4.0 mm) and groundmass containing plagioclase lath and altered glass. Plagioclase phenocryst alters to chlorite, epidote and zoisite. Glass in groundmass is replaced by saponite and chlorite-saponite mixed layer.

Matrix of this rock is composed of quartz and calcite. There are epidote and amygdaloidal chlorite-saponite mixture between breccia and matrix calcite.



plane polarized



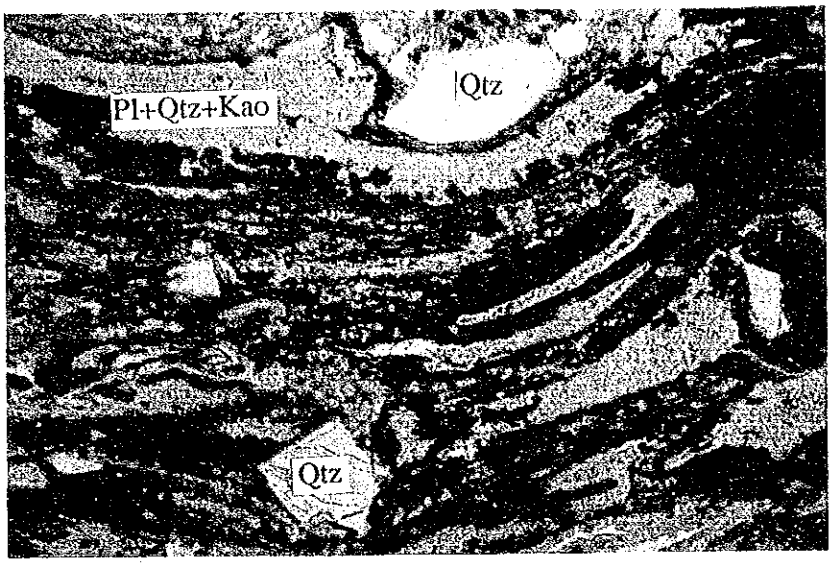
Cross polarized

0.5 mm

Sample No.: 327
Rock name: Rhyolite
Formation (Locality):
Description:

This sample is composed of quartz and plagioclase with cryptocrystalline groundmass containing very fine grains (< 0.1 mm in grain size) of quartz, plagioclase and K-feldspar. In the matrix part there is secondary chlorite.

Euhedral to subhedral plagioclase phenocryst (0.5-5.0 mm) alters to calcite and opaque minerals. Especially fine plagioclase phenocryst (less than 0.5 mm) is completely replaced by calcite. Variolite (< 0.6 mm in diameter) contains tridymite.



Plane polarized

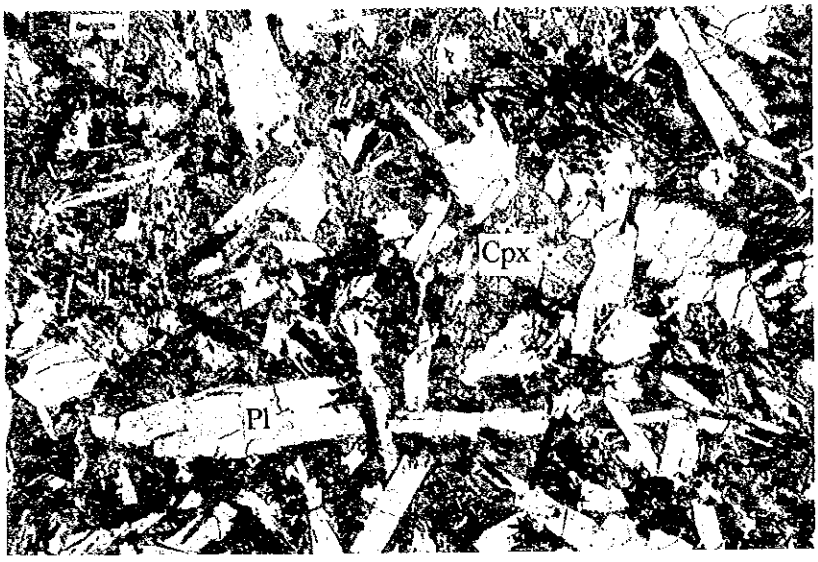
Cross polarized

0.5 mm

Sample No.: 328
Rock name: Rhyolite
Formation (Locality):
Description:

The rock shows typical eutaxitic texture. It has remarkable layering containing brownish glassy part and plagioclase+quartz+kaolinite part.

Subhedral to anhedral quartz phenocryst (0.2-2.5 mm in grain size) can be observed. Quartz vein (< 0.02 mm in width) cut obliquely eutaxitic layering. Glassy part in the matrix alters to saponite where calcite also occurs. This rhyolite contacts directly to the basalt, which completely same to the sample TS 329.



Plane polarized

Cross polarized

0.5 mm

Sample No.: 329
Rock name: Basalt
Formation (Locality):
Description:

This specimen shows intergranular to intersertal texture and is composed of plagioclase and clinopyroxene phenocrysts with groundmass minerals. Plagioclase phenocryst (0.2-1.0 mm in grain size) shows euhedral to subhedral shape and zonal structure. Subhedral to anhedral clinopyroxene phenocryst (0.2-1.0 mm) alters to biotite (oxychlorite?) and/or saponite. Groundmass contains fine plagioclase lath, opaque mineral, clinopyroxene and glass where glass alters completely to saponite and chlorite-saponite mixed layer.

Amygdule is filled with quartz, tridymite, saponite, chlorite and chlorite-saponite mixed layer.

plane polarized

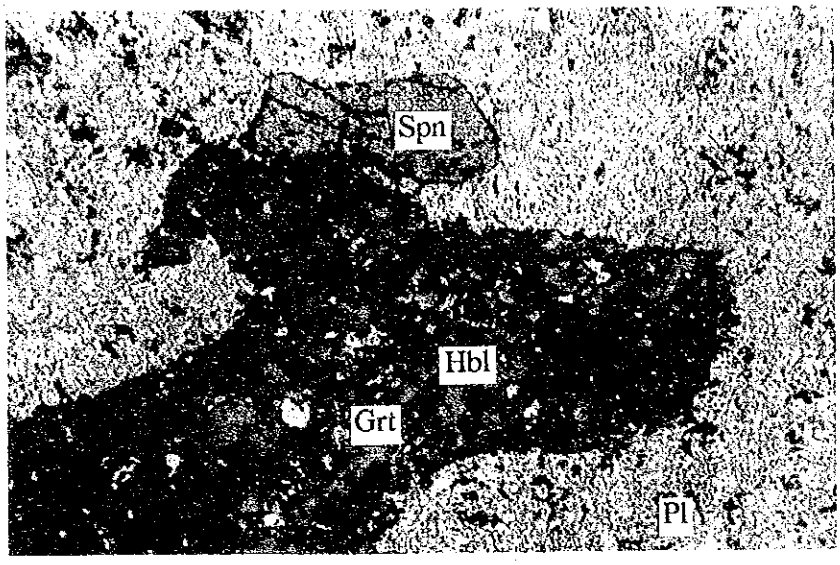
Cross polarized

0.5 mm

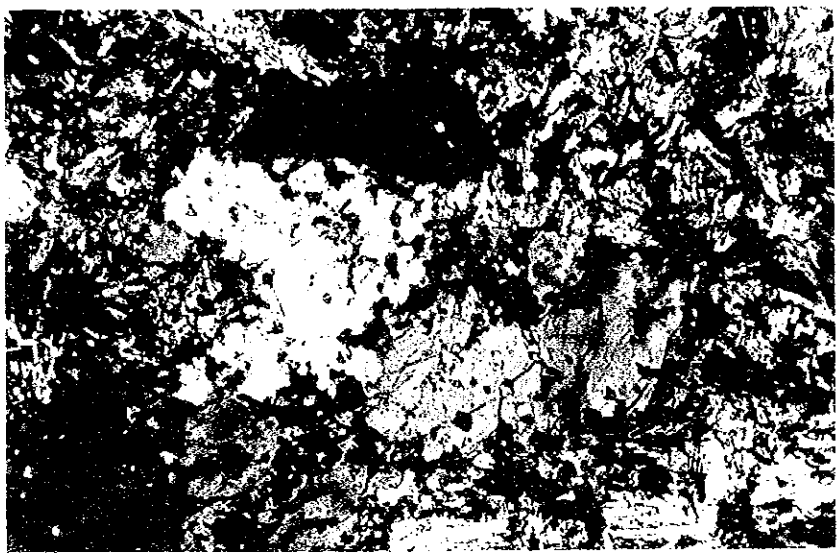
Sample No.: 330
Rock name: Basalt
Formation (Locality):
Description:

The rock shows intergranular to intersertal texture and is containing phenocryst of plagioclase (euhedral to subhedral, 0.08-1.5 mm in grain size) and clinopyroxene (subhedral, 0.05-1.5 mm) set in a matrix of plagioclase, clinopyroxene, opaque mineral (< 0.05 mm) and glass.

Large plagioclase phenocryst (> c. 1.0 mm) alters to saponite, chlorite and chlorite-saponite mixed layer at the brownish core part. Some clinopyroxene phenocrysts show the herring-bone pattern. Glass in a groundmass is replaced by secondary saponite and oxidized chlorite. Quartz, saponite, calcite and chlorite association can be seen in amygdaloidal part.



Plane polarized



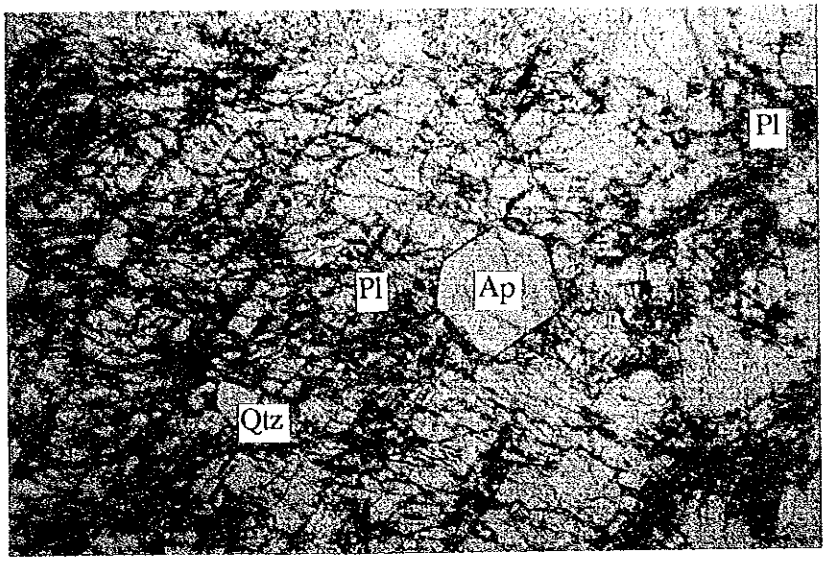
Cross polarized

0.5 mm

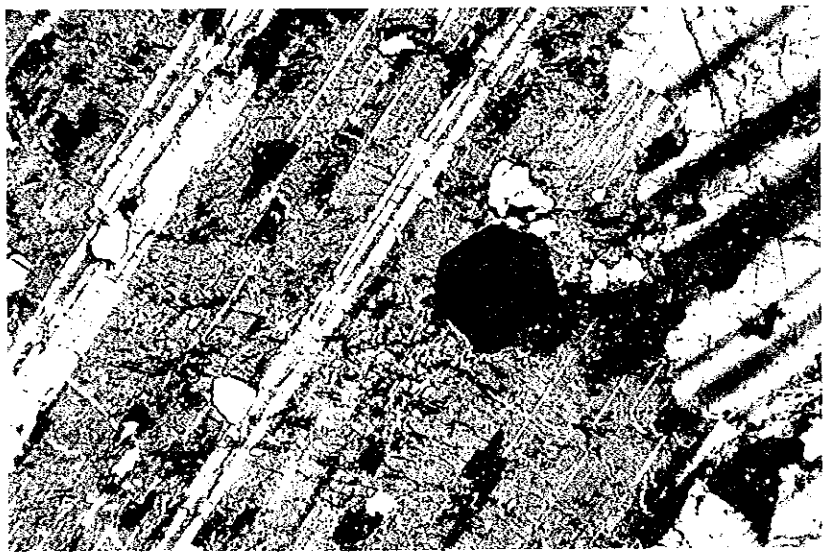
Sample No.: 333
Rock name: Calc-silicate gneiss
Formation (Locality):
Description:

The specimen is composed of clinopyroxene and sphene porphyroblasts with matrix containing plagioclase, garnet, clinopyroxene and muscovite. No mineral preferred orientation can be seen.

Subhedral to anhedral clinopyroxene porphyroblast (0.2-2.0 mm in grain size) shows pleochroism from green to yellowish green and remarkable zoning, which includes garnet, quartz and plagioclase poikiloblastically. Clinopyroxene is cut by symplectite composed of garnet and quartz along the crack. Sphene includes quartz and clinopyroxene. Garnet-plagioclase-muscovite symplectite (max. 0.5 mm in diameter) is also included in sphene. Garnet (0.05-0.3 mm) is clear identified by its characteristic yellow to orange yellow color. Very fine garnet (< 0.01 mm) aggregates occur as veins and spots.



plane polarized



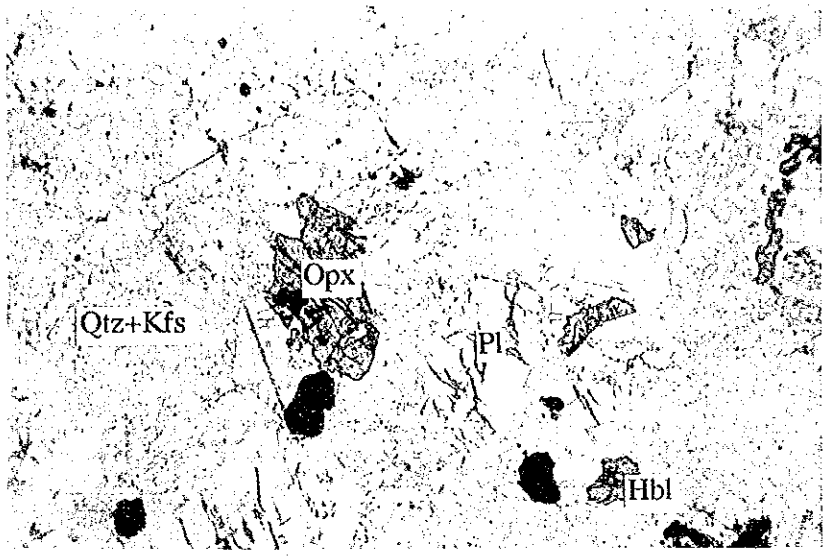
Cross polarized

0.5 mm

Sample No.: 334
Rock name: Anorthosite
Formation (Locality):
Description:

The rock is composed essentially of plagioclase (> 90 modal percentage) with subordinate apatite, K-feldspar, quartz and biotite. Accessory minerals are zircon and sphene.

Euhedral to subhedral plagioclase shows albite and carlsbad twins and is 0.2 to 10.0 mm in grain size. Some plagioclases show antiperthitic texture including K-feldspar poikilitically. Minor constituents are microcline (subhedral to anhedral, 0.5-2.0 mm), quartz, apatite (euhedral to subhedral, 0.1-1.3 mm) and biotite (subhedral, 1.0-2.5 mm). Plagioclase and microcline are occasionally replaced by epidote and zoisite. Biotite alters to chlorite.



Plane polarized

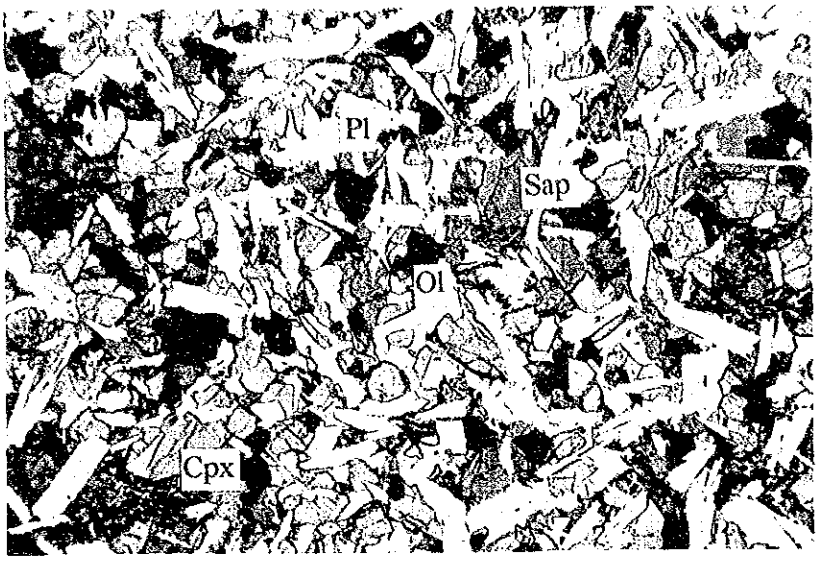
Cross polarized

0.5 mm

Sample No.: 337
Rock name: Charnockite
Formation (Locality):
Description:

The rock shows granophyric texture and is composed mainly of plagioclase, quartz and K-feldspar with subordinate amounts of orthopyroxene, hornblende, garnet and biotite. Accessories are apatite, zircon and opaque mineral.

Plagioclase (0.7-2.3 mm in grain size) is euhedral crystal and shows albite twin with zonal structure. The plagioclase is surrounded by granophyric texture containing K-feldspar and quartz. Plagioclase often alters to secondary chlorite-saponite mixture and montmorillonite. Subhedral to anhedral orthopyroxene (0.2-1.2 mm) shows weal pleochroism from pale green to pale pinkish green. Subhedral hornblende (0.2-1.5 mm) shows remarkable pleochroism from pale green to pale brownish green. Orthopyroxene and hornblende are ofetn replaced by chlorite and chlorite-saponite mixed layer. Garnet (0.03-0.2 mm) occurs as inclusion in quartz.



Plane polarized

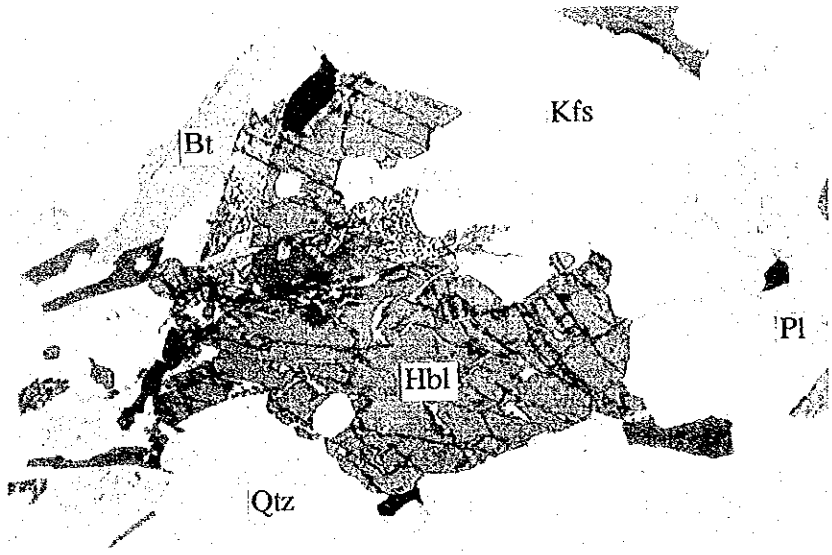
Cross polarized

0.5 mm

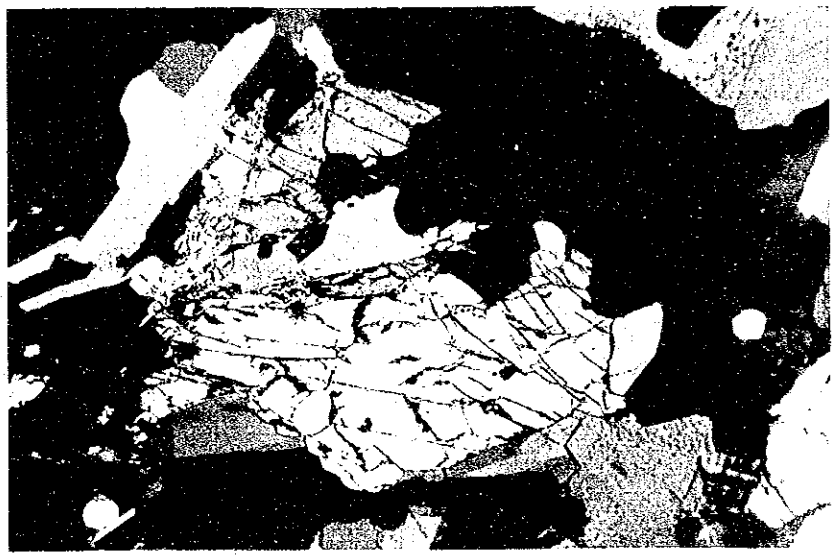
Sample No.: 354
Rock name: Basalt
Formation (Locality):
Description:

The rock shows intergranular to intersertal texture and is composed mainly of phenocrysts with subordinate amounts of matrix (groundmass). Phenocrysts are plagioclase (euhedral to subhedral, 0.1-0.8 mm in grain size), clinopyroxene (euhedral to subhedral, 0.1-0.5 mm), opaque minerals (0.05-0.3 mm) and rare olivine (subhedral to anhedral, 0.05-0.1 mm). Only clinopyroxene often alters to saponite.

Orange brownish matrix, which is replaced by saponite and/or chlorite-saponite mixed layer, is composed of plagioclase lath, biotite(?), opaque minerals and altered glass. Amygdal in the groundmass is filled with saponite.



Plane polarized



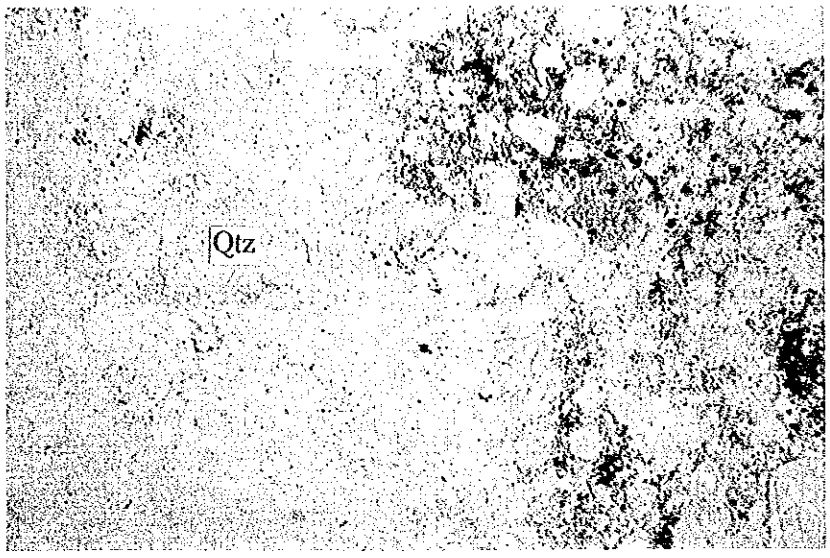
Cross polarized

0.5 mm

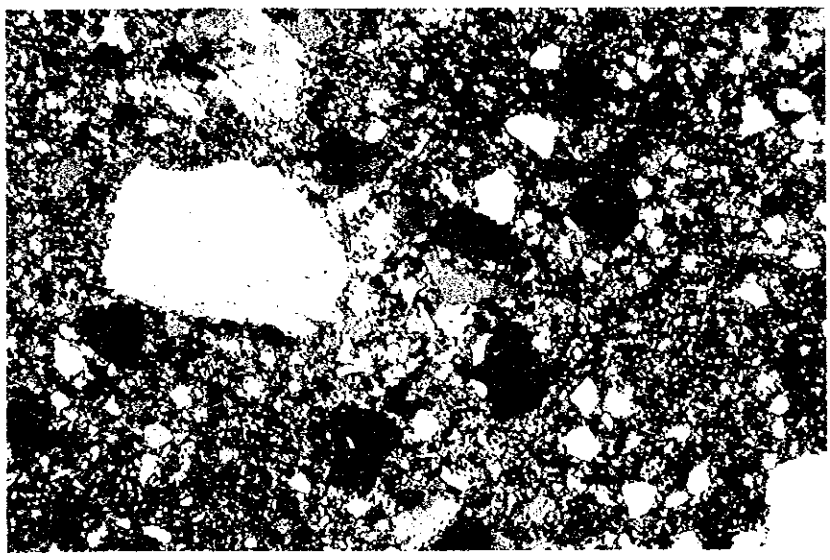
Sample No.: 356
Rock name: Quartzofeldspathic hornblende-biotite gneiss
Formation (Locality):
Description:

The rock shows granoblastic texture with weak biotite preferred orientation. The main constituents are plagioclase, quartz, K-feldspar, biotite, hornblende, epidote and zoisite. Accessories are zircon, monazite, apatite and opaque mineral. Myrmekite occupies interspace between plagioclase and K-feldspar.

Plagioclase (0.25-2.5 mm in grain size) is subhedral to anhedral shaped crystal with albite twin. It often alters to sericite in the interior. K-feldspar (0.1-0.5 mm) shows subhedral to anhedral shape and often includes euhedral biotite grains. Euhedral to subhedral biotite (0.1-1.3 mm) coexists with hornblende and epidote and is weakly altered by chlorite. Subhedral to anhedral hornblende (0.25-2.0 mm) is often replaced by biotite and epidote.



plane polarized



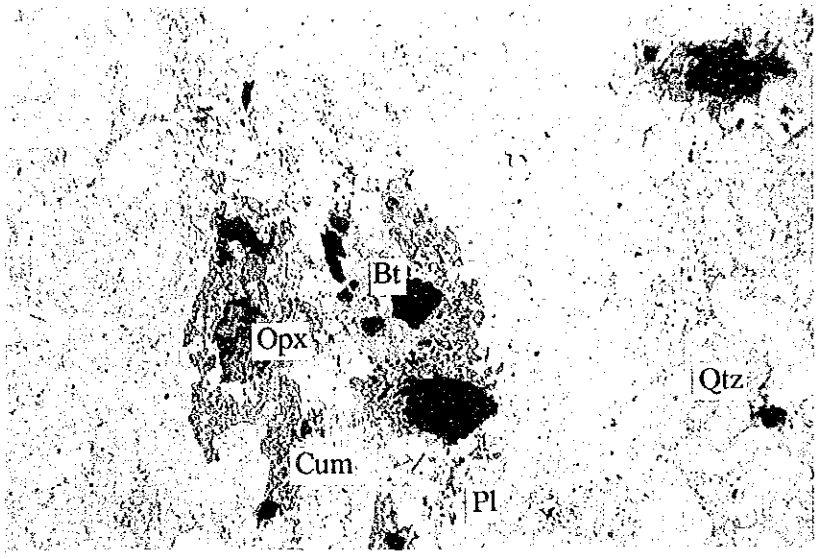
Cross polarized

0.5 mm

Sample No.: 362
Rock name: Quartz rock
Formation (Locality):
Description:

This specimen is arkose (quartzite) and mud stone granule-bearing poor sorted sand stone. The rock is composed essentially of irregular to corroded quartz grains (0.1-1.5 mm in grain size) with much finer grains (< 0.05 mm) of quartz, opaque mineral (haematite?) and zircon.

Arkose to quartzite granules are as much as 4.0 mm (1.3-4.0 mm) in diameter and are composed mainly of quartz grains with subordinate opaque minerals. Pale brownish mud stone granule is 0.3 to 4.0 mm in diameter that contains quartz and haematite.



Plane polarized

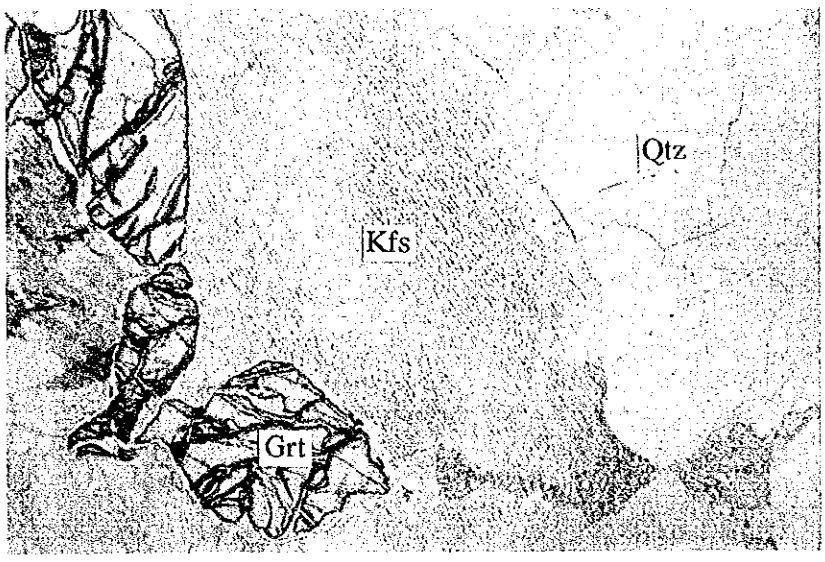
Cross polarized

0.5 mm

Sample No.: 370
Rock name: Charnockitic microgranite
Formation (Locality):
Description:

The rock shows typical granophyric texture and is composed mainly of plagioclase, quartz and K-feldspar with subordinate cummingtonite, biotite and orthopyroxene. Accessories are opaque mineral, zircon and monazite.

Albite-twined euhedral to subhedral plagioclase (0.5-2.0 mm in grain size) is surrounded by quartz and K-feldspar intergrowth (granophyric texture). K-feldspar shows two types of occurrences, one makes intergrowth with quartz and the other is associated with plagioclase. The latter K-feldspar shows subhedral to anhedral shape (0.5-2.5 mm) with perthite texture. Subhedral pale greenish cummingtonite includes orthopyroxene and shows intergrowth with quartz.



plane polarized

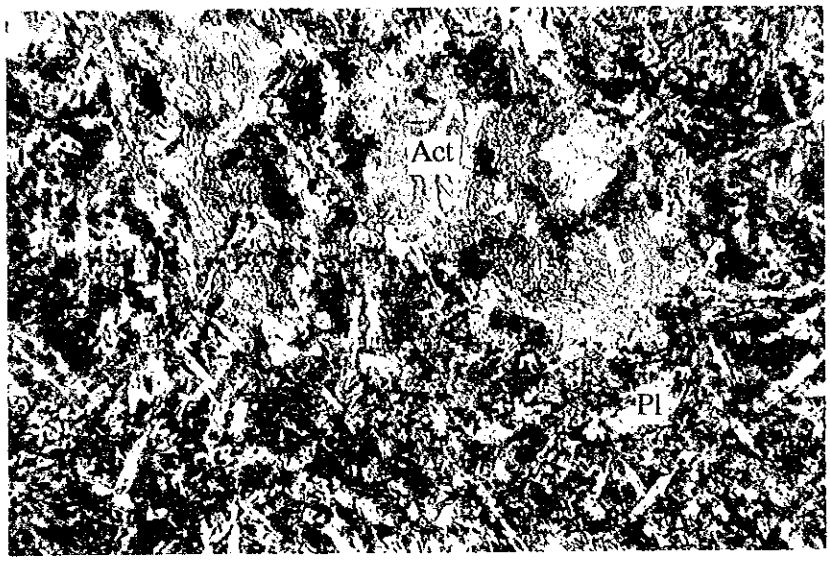
Cross polarized

0.5 mm

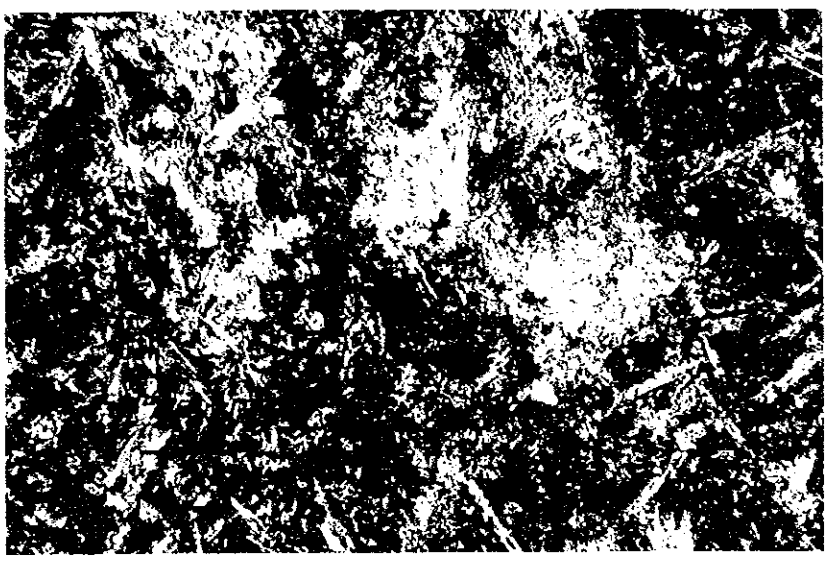
Sample No.: 372
Rock name: Granet-bearing granite
Formation (Locality):
Description:

The specimen is granular textured typical leucoclatic granite containing K-feldspar, quartz, plagioclase and subordinate garnet. Small patchs of myrmekite are also recognized.

Subhedral to anhedral K-feldspar (0.5-8.0 mm in grain size) shows perthite texture, that is cut by later kaolinite veins. Anhedral quartz (0.2-8.0 mm) is recognized in plain polarized view by the lack of alteration. Plagioclase is 0.6 to 1.5 mm in grain size with subhedral to anhedral shape. The plagioclase often alters to sericite. Garnet (anhedral granular, 0.2-1.8 mm) is subordinately present which is replaced by secondary biotite and chlorite.



Plane polarized

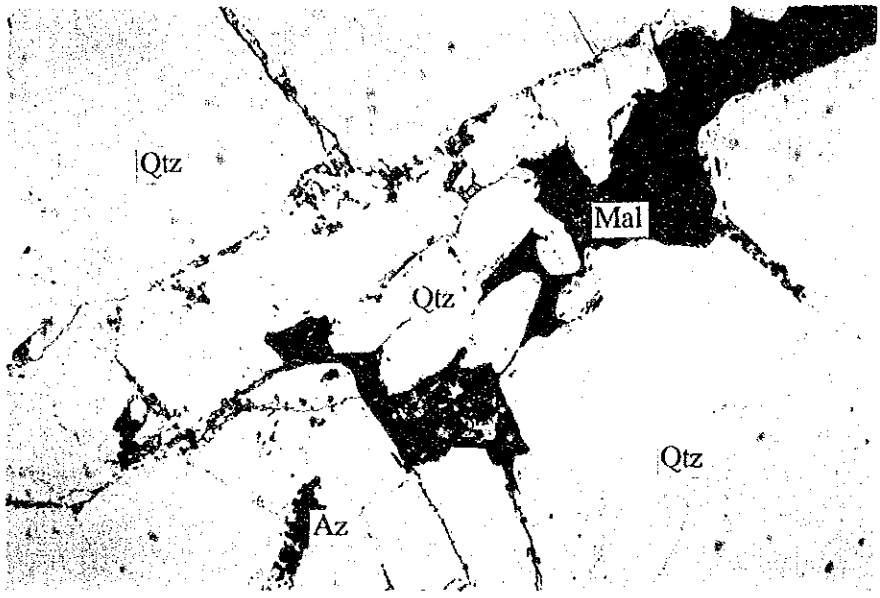


Cross polarized

0.2 mm

Sample No.: 374
Rock name: Aphyric basalt
Formation (Locality):
Description:

The rock consists mainly of subhedral (partially euhedral) plagioclase laths (0.05 to 0.30 mm in grain size) with intergranular and intersertal textures. The interstitial regions are of much finer grain size (< 0.1 mm) and consist of opaque minerals (magnetite?), clinopyroxene and plagioclase. Cryptocrystalline materials, which probably derived from interstitial glasses, can also be seen in groundmass. Subspherical gas cavities are poorly distributed which contains actinolite, epidote, quartz and minor zircon. Clinopyroxene, actinolite and epidote are often altered to chlorite and/or chlorite-montmorillonite mixed layer.



Plane polarized

Cross polarized

0.5 mm

Sample No.: 515
Rock name: Quartz vein with Cu-mineral
Formation (Locality):
Description:

The rock shows mosaic texture and is composed mainly of quartz (subhedral to anhedral, 0.5-5.0 mm in grain size) with subordinate plagioclase and calcite. Zircon also appears as accessory mineral.

Quartz is very clear without alteration, but plagioclase weakly alters to sericite. Mosaic quartz is cut by ore mineralized veins containing much finer (0.02-0.1 mm) quartz, bluish copper mineral (azurite), greenish copper mineral (malachite) and opaque minerals. Sometimes these veins proceed along the grain boundaries among quartz.

Ap. 5 Microphotographs and Microscopic Ovservations of Polished Sections

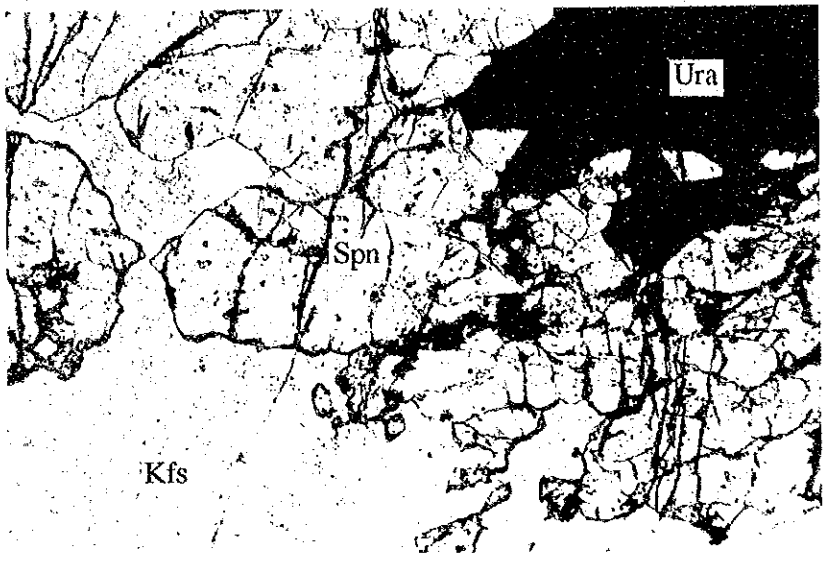
No.	Sample No.	Locality	Rock name	Primary minerals							Secondary minerals									Remarks
				Qtz	Pl	Kfs	Aln	Bt	Spn	Ura	Qtz	Akr	Cht	Dig	Cov	Mal	Pml	Az	Bot	
1	351	TW	Uranothorianite ore	○		○	*	*	*	*										Carbonate veinlet
2	514	SM	Green copper	○	*						△	*	*	*	*	*	*	*	*	Ore in secondary vein
3	515	SM	Green copper	○	*						△	*	*	*	*	*	*	*	*	Ore in secondary vein

Mineral abbreviations

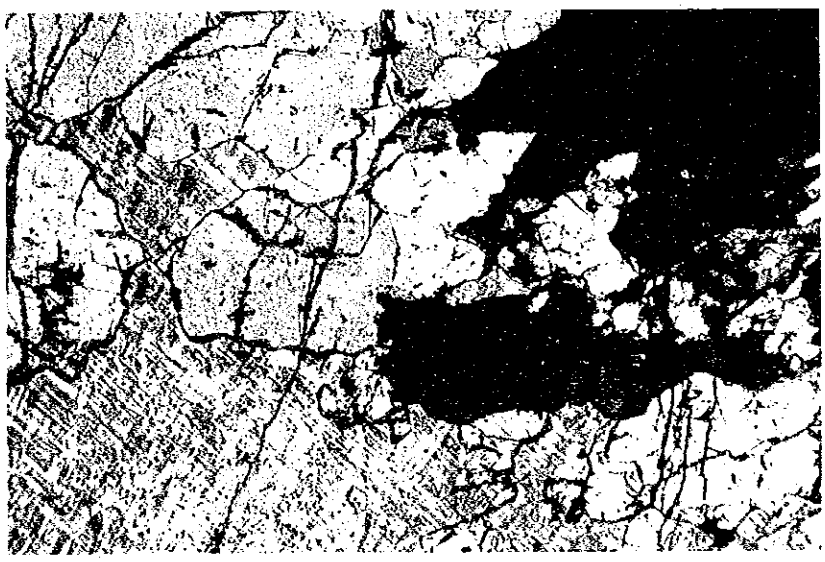
Qtz: quartz, Pl: plagioclase, Kfs: K-feldspar, Aln: allanite, Bt: biotite, Spn: sphene, Ura: uranothorianite

Akr: ankerite, Cht: chalcocite, Dig: digenite, Cov: covellite, Mal: malachite, Pml: pseudomalachite, Az: azurite, Bot: boothite

Circle: abundant, Triangle: medium, Star: minor



plane polarized (transmitted light)

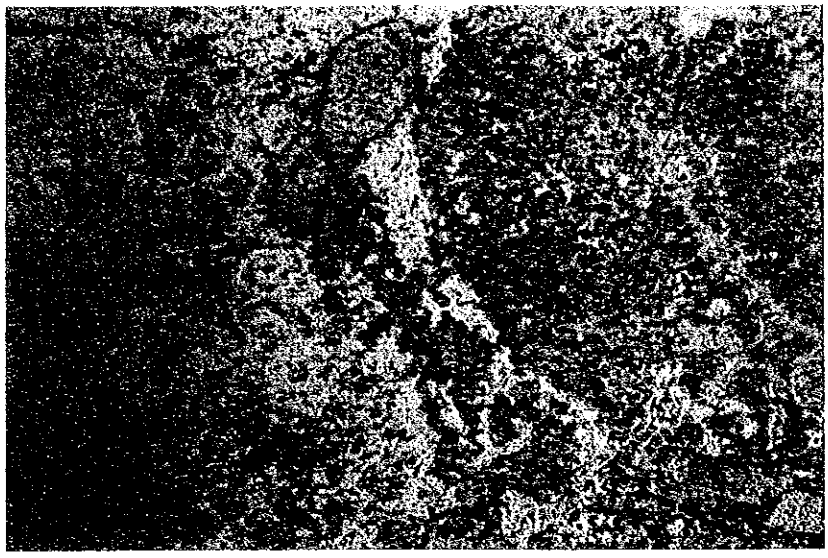


Cross polarized (transmitted light)

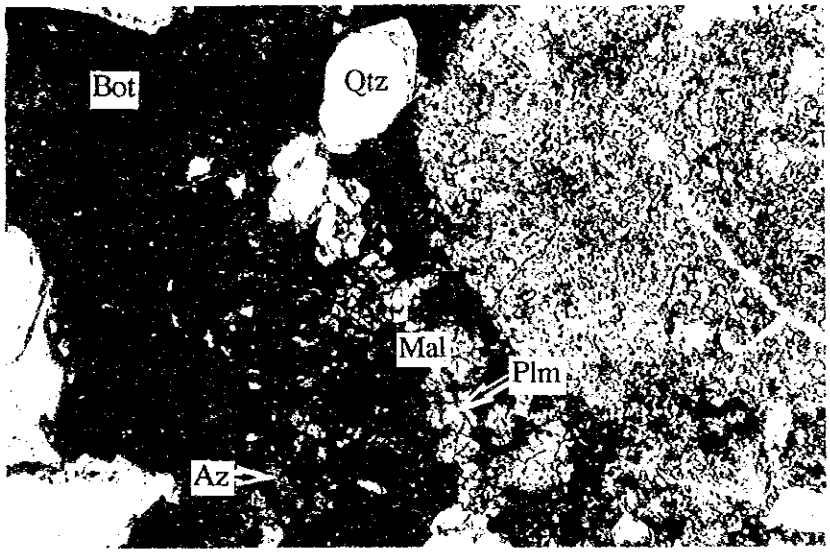
0.5 mm

Sample No.: 351
Rock name: Uranothorianite ore (pegmatite)
Formation (Locality):
Description:

The specimen consists of large granular quartz (1-5 mm), microcline (1-10 mm) with perthite structure, euhedral allanite (0.5-3 mm), sphene, biotite and opaque mineral. Opaque mineral is uranothorianite, which has blackish brown color with brownish grey in reflected light. Some fine carbonate veinlets cut these minerals.



Plane polarized (reflected light)

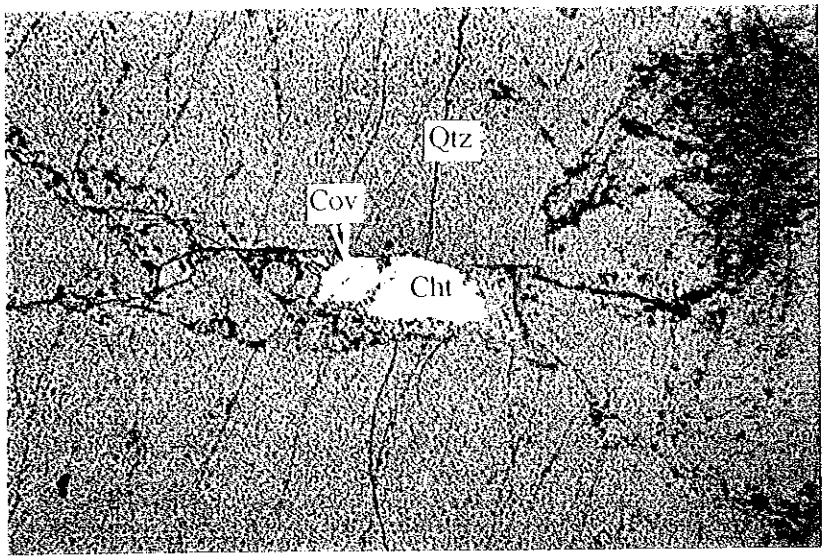


Plain polarized (transmitted light)

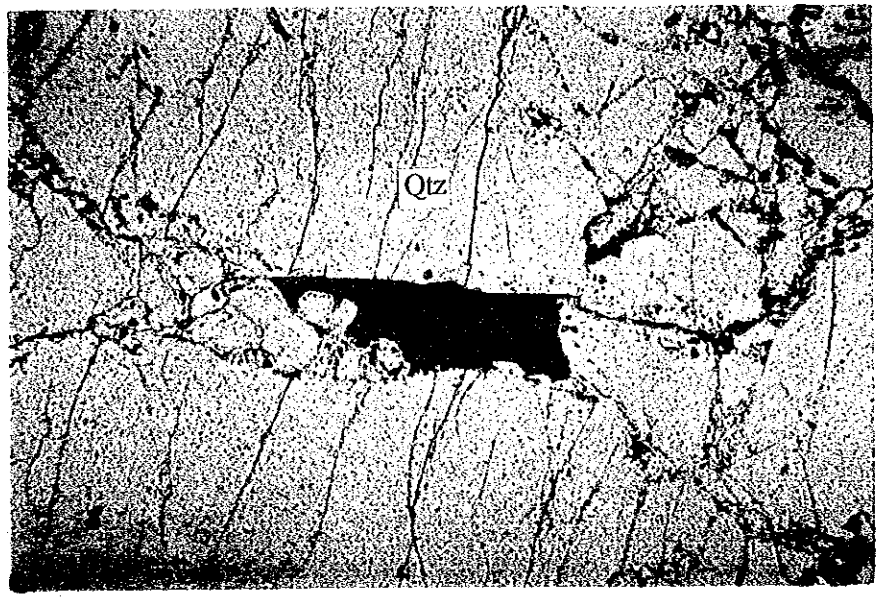
0.5 mm

Sample No.: 514
Rock name: Green copper (quartz vein with copper mineralization)
Formation (Locality):
Description:

The specimen is composed of large granular quartz (1.0-5.0 mm) and subordinate plagioclase with mosaic texture and quartz-ankerite veins with some copper minerals. They are chalcocite, digenite, covellite (white, bluish white, and blue color in reflected light, respectively), malachite, granular pseudomalachite, azurite, and fibrous boothite (green, bluish breen, blue, and blue color in transmitted light, respectively). The latter four minerals are secondary origin from the former three minerals.



plane polarized (reflected light)



Plain polarized (transmitted light)

0.5 mm

Sample No.: 515
Rock name: Green copper (quartz vein with copper mineralization)
Formation (Locality):
Description:

The rock is completely same to P 514. The specimen is composed of large granular quartz (1.0-5.0 mm) and subordinate plagioclase with mosaic texture and quartz-ankerite veins with some copper minerals. They are chalcocite, digenite, covellite (white, bluish white, and blue color in reflected light, respectively), malachite, granular pseudomalachite, azurite, and fibrous boothite (green, bluish breen, blue, and blue color in transmitted light, respectively). The latter four minerals are secondary origin from the former three minerals.

Ap. 6 Summary of X-Ray Diffractive Analysis

No.	Sample No.	Locality	Rock name	tridimite	quartz	epistilbite	kaolinite	sericite	chlorite	serpentine	talc	plagioclase	K-feldspar	biotite	amphibole	clinopyroxene	marialite	natrojarosite	calcite	magnetite	hematite	goethite	malachite	azurite	brochantite
1	313	SM	Gossan		◎			·													·	○			
2	317	SM	Serpentinite	△?	△				○	◎	○														
3	325	TW	Basaltic brecciated rock		○	·			○			△	△						·						
4	339	TW	Clay mineral				○					·													
5	351	TW	Uranothorianite ore		◎							△	◎	◎	·					△					
6	352	TW	Uranothorianite ore		◎			○					◎		△	△	◎								
7	359	SM	Gossan		△													△			△	·			
8	511	SM	Copper ore									◎	◎	○	○								△		
9	515	SM	Quartz vein with copper ore		◎																		◎	◎	○
10	518	SM	Copper ore									◎	○										○	○	

◎:abundant ○:common △:poor ·:rare

Abbreviations; SM:Soamanonga area, TM:Toranomaro western area