

Appendix - II

MICROSCOPIC OBSERVATION OF ROCKS IN THIN SECTION

(Igneous Rock and Sedimentary Rock)

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (1)

Sample Number	Rock Name	Macrospectral features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-009	CAMPTONITE (Carbonatized)	<ul style="list-style-type: none"> • Dark gray, compact and hard • Including lithic fragment • Ophytic, fine-grained intergranular 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende, ≈ 2%, stout prismatic, < 1 mm • Clinopyroxene, ≈ 3%, long prismatic, < 1.5 mm • Titanite, < 1%, wedge-shaped ~ rounded, < 1 mm <p>◇ GROUNDMASS</p> <ul style="list-style-type: none"> • Plagioclase, alkali feldspar, opaque mineral, etc.: > 90% 	Magnetite		
KR-017	CAMPTONITE (Carbonatized)	<ul style="list-style-type: none"> • Pale yellowish brown with pale brown long prismatic crystals rough surface • Including altered tuff fragment • Porphyritic, spherulitic 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende, ≈ 5%, < 4 mm • Completely altered to carbonate, limonite, and chlorite. <p>◇ GROUNDMASS</p> <ul style="list-style-type: none"> • Mainly (< 70%) consists of thin plagioclase and alkali feldspar. • Secondary carbonate and limonite (≈ 20%) 			
KR-018	CAMPTONITE	<ul style="list-style-type: none"> • Medium gray • Compact and seriate • Intergranular 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende (bar-kevikite), ≈ 3%, < 5 mm • Clinopyroxene, ≈ 5%, < 5 mm • Plagioclase, ≈ 5%, < 1.5 mm • Titanite, < 1%, < 1 mm <p>◇ GROUNDMASS (≈ 85%)</p> <ul style="list-style-type: none"> • Hornblende, clinopyroxene, plagioclase, secondary carbonate 	Magnetite < 1%		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (2)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-020A	TRACHYTE	<ul style="list-style-type: none"> • Grayish orange pink and compact, with moderate reddish brown spots • Porphyritic, trachytic 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Plagioclase, ≈ 20%, tabular or prismatic, completely altered to sericite, limonite and smectite • Hornblende, < 1%, prismatic or tabular, < 1.5 mm, completely replaced by limonite and smectite <p>◇ GROUNDMASS (> 75%)</p> <ul style="list-style-type: none"> • Anorthoclase, ≈ 60%, < 0.5 mm • Plagioclase, ≈ 5% • Limonite, irregular • Quartz, interstitial • Titanite, granular • Cristobalite, filling vesicles 	<ul style="list-style-type: none"> • Magnetite, < 1% • granular ~ irregular, < 1 mm, altered to limonite. • Limonite, ≈ 10% 		
KR-020B	TRACHYTE	<ul style="list-style-type: none"> • Porphyritic, pilotaxitic 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Plagioclase, < 7%, prismatic, < 5mm, completely replaced by sericite, limonite and chlorite • Hornblende, < 5%, long prismatic ~ tabular, < 1.5 mm, altered to limonite and smectite ~ nontronite <p>◇ GROUNDMASS (> 85%)</p> <ul style="list-style-type: none"> • Anorthoclase, < 0.5 mm, partially altered to sericite • Limonite, < 0.5 mm as pseudomorph after hornblende • Smectite • Plagioclase, interstitial 			

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (3)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-020C	SYENITE	<ul style="list-style-type: none"> • Very light gray with dark green spots • Compact and hard • Granular 	<ul style="list-style-type: none"> • Plagioclase, ≈ 25%, prismatic ~ tabular with ragged outline, < 5 mm • Alkali feldspar (cryptoperthite ~ micropertthite), ≈ 50%, prismatic ~ tabular with interlocked outline, < 5 mm • Clinopyroxene, ≈ 5%, < 3 mm, marked zoning from Ti-augite (core) to aegirine-augite (rim) • Hornblende, ≈ 3%, prismatic ~ irregular, < 3 mm • Titanite, < 1%, wedge-shaped, < 0.5 mm • Apatite, small amount, prismatic, < 0.2 mm 	<ul style="list-style-type: none"> • Magnetite, < 1% granular, < 0.5 mm 	<ul style="list-style-type: none"> • Aggregates of granular limonite, plagioclase and carbonate occur within feldspar crystals and interstices of crystals. 	
KR-021	CAMPONITE	<ul style="list-style-type: none"> • Dark gray • Compact and hard with black needles and white patches • Porphyritic 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS • Hornblende, ≈ 5%, prismatic, tabular, acicular, < 2 mm • Clinopyroxene, ≈ 5%, long prismatic ~ stout prismatic, tabular, < 2 mm • Titanite, < 1%, wedge-shaped, rectangular grain, < 0.5 mm • Olivine, < 1%, < 1 mm, replaced by nontronite and mantled ◇ GROUNDMASS (> 85%) • Plagioclase, ≈ 50%, interstitial, < 1.5 mm • Hornblende, ≈ 10%, acicular ~ prismatic ~ granular, < 0.5 mm • Clinopyroxene, ≈ 15%, prismatic ~ granular (top or rim altered to secondary minerals.) • Secondary smectite, apatite, titanite and nepheline 	<ul style="list-style-type: none"> • Magnetite, ≈ 1%, granular, < 5 mm some with ragged outline 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (4)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-022	SANNAITE	<ul style="list-style-type: none"> • Dark gray • Compact and hard • Porphyritic, seriate 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende, ≅ 10 %, long prismatic, short prismatic, tabular, < 3 mm • Clinopyroxene, ≅ 7 %, long prismatic ~ short prismatic, < 3 mm <p>◇ GROUNDMASS (≅ 80%)</p> <ul style="list-style-type: none"> • Plagioclase, < 10 %, interstitial and clear < 1 mm • Alkali feldspar, > 50 %, altered to smectite, partially sericite • Clinopyroxene, ≅ 10 %, prismatic ~ granular • Hornblende, ≅ 7 %, acicular ~ short prismatic ~ granular • Olivine, < 1 %, < 1 mm replaced by nontronite • Apatite, small amount • Titanite, small amount 	<ul style="list-style-type: none"> • Magnetite <p>phenocryst: < 1 %, granular < 0.5 mm</p> <p>groundmass: 3 %, granular</p>		
KR-023	CAMPTONITE	<ul style="list-style-type: none"> • Dark gray • Compact and hard • Almost aphyric 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende, ≅ 1 %, long prismatic, < 8 mm • Clinopyroxene, ≅ 2 %, long prismatic ~ tabular, < 2 mm <p>◇ GROUNDMASS (> 95%)</p> <ul style="list-style-type: none"> • Clinopyroxene, ≅ 10 %, acicular, prismatic, granular < 0.5 mm, green aegirine-augite is rare. • Hornblende, ≅ 3 %, acicular, prismatic, granular < 0.5 mm • Plagioclase, ≅ 60 %, replaced by smectite • Apatite as accessory mineral 	<ul style="list-style-type: none"> • Magnetite <p>phenocryst: < 1 %, angular < 0.5 mm</p> <p>groundmass: 3 %</p>		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (5)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-025A	CLINO PYROXENE- HORNBLENDE GABBRO	<ul style="list-style-type: none"> • Light bluish gray base with brownish dark gray crystals • Compact and hard • Very heterogeneous • Medium-grained • Granular 	<ul style="list-style-type: none"> • Hornblende, $\approx 40\%$, < 5 mm inclusion of apatite, biotite, magnetite, clinopyroxene and titanite • Clinopyroxene, $\approx 20\%$, < 5 mm, zoning, inclusion of apatite and magnetite • Plagioclase, $\approx 30\%$, < 5 mm, with inclusion of apatite, titanite, hornblende, clinopyroxene and magnetite, (sericite as alteration product) • Alkali feldspar, $\approx 1\%$, < 1 mm, cryptoperthite • Biotite, $< 1\%$, < 1 mm • Titanite, $\approx 1\%$, < 1 mm, wedge-shaped with inclusion of magnetite and apatite • Apatite, $< 1\%$, < 0.5 mm, prismatic 	<ul style="list-style-type: none"> • Magnetite, $< 1\%$, < 0.5 mm, irregular 		<ul style="list-style-type: none"> • Melanocratic part of KR-025
KR-025B	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Fine-grained • Granular • Alkali feldspar vein 	<ul style="list-style-type: none"> • Alkali feldspar, $\approx 40\%$, < 2 mm, cryptoperthite, dusty • Plagioclase, $\approx 20\%$, < 3 mm • Nepheline, $\approx 25\%$, granular < 1 mm • Hornblende, $\approx 3\%$, prismatic ~ tabular, < 2 mm • Clinopyroxene, $\approx 8\%$, < 3 mm, aegirine-augite • Titanite, $< 1\%$, < 1 mm, wedge-shaped • Apatite, rare, < 0.5 mm, prismatic • Fluorite, $< 1\%$, < 0.5 mm, interstitial 	<ul style="list-style-type: none"> • Magnetite, $\approx 2\%$, < 0.5 mm, granular ~ irregular 		<ul style="list-style-type: none"> • Leucocratic part of KR-025
KR-026	HORNBLENDE GABBRO	<ul style="list-style-type: none"> • Abundant brownish black crystals in light gray matrix • Compact • Medium-grained • Granular 	<ul style="list-style-type: none"> • Hornblende, $\approx 45\%$, $0.2 \sim 1.5$ mm, including apatite, magnetite and titanite grains, and biotite flakes, some with clinopyroxene core • Plagioclase, $\approx 40\%$, $0.4 \sim 0.5$ mm • Alkali feldspar, $< 1\%$, < 0.5 mm • Quartz, $< 2\%$, < 0.5 mm, interstitial 	<ul style="list-style-type: none"> • Magnetite, $< 1\%$, < 0.5 mm, irregular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (6)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(KR-026)			<ul style="list-style-type: none"> • Clinopyroxene, < 1 %, < 2 mm • Biotite, < 1 %, < 2 mm, flaky • Titanite, < 1 %, < 2 mm, wedge-shaped, inclusion of biotite and magnetite 			
KR-027	MONZONITE	<ul style="list-style-type: none"> • Leucocratic (pinkish gray) • Compact • Mosaic • Medium-grained 	<ul style="list-style-type: none"> • Plagioclase, > 60 %, 2 ~ 10 mm, exsolving alkali feldspar • Alkali feldspar, ≈ 35 %, 2 ~ 5 mm, exsolving plagioclase • Hornblende, ≈ 2 %, < 3 mm • Biotite, < 1 %, < 2 mm • Titanite, < 1 %, < 0.5 mm • Clinopyroxene, < 1 %, < 1 mm, short prismatic • Apatite • Hematite • Smectite (secondary) • White mica (secondary) 	<ul style="list-style-type: none"> • Magnetite, < 1 %, < 0.5 mm, irregular 		
KR-028	MONZONITE	<ul style="list-style-type: none"> • Leucocratic (pinkish gray) • Compact • Mosaic • Medium-grained 	<ul style="list-style-type: none"> • Plagioclase, ≈ 40 %, < 2 ~ 6 mm • Alkali feldspar, ≈ 50 %, microperthite ~ cryptoperthite ~ microcline • Hornblende, ≈ 8 %, < 3 mm, some with clinopyroxene core, inclusion of apatite, biotite, magnetite • Titanite, < 1 %, < 1.5 mm, mantled with opaque materials • Aggregate of opaque, titanite and carbonate • Apatite, small, rare, prismatic 	<ul style="list-style-type: none"> • Magnetite, < 1 %, < 0.5 mm, granular, irregular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (7)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-030	NEPHELINE	<ul style="list-style-type: none"> • Grayish olive green • Compact and hard • Fine-grained • Holocrystalline 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS <ul style="list-style-type: none"> • Nepheline, scarce, 0.5 ~ 1 mm, tabular, with cancrinite in cracks and rims • Clinopyroxene, scarce, < 1.5 mm, long prismatic ~ granular, partially altered to nontronite • Titanite, rare, < 0.5 mm, wedge-shaped, irregular ◇ GRANDMASS (≐ 99%) <ul style="list-style-type: none"> • Nepheline, > 70 % • Cancrinite, ≐ 3 % • Clinopyroxene: aegirine-augite, > 20 % • Plagioclase, rare • Zeolite-natrolite • Biotite, small and rare, flaky • Titanite, ≐ 3 % 	<ul style="list-style-type: none"> • Hematite, rare, granular, prismatic 		
KR-031	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Light gray ~ grayish brown • Mosaic • Compact • Coarse-grained 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS <ul style="list-style-type: none"> • Alkali feldspar (perthite), ≐ 55 %, 2 ~ 30 mm, prismatic • Nepheline ≐ 40 %, 1 ~ 5 mm, zoning • Clinopyroxene (aegirine), ≐ 4 %, 0.05 ~ 1.5 mm, prismatic ~ granular ~ irregular, some with aegirine-augite core • Titanite, rare, < 0.6 mm, wedge-shaped • Sodalite, ≐ 1 %, interstitial 	<ul style="list-style-type: none"> • Magnetite, rare, irregular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (8)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-032	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Light brownish gray • Compact and hard • Coarse-grained • Granular 	<ul style="list-style-type: none"> • Nepheline, \approx 50 %, 2 ~ 5 mm, including aegirine and titanite in the core • Alkali feldspar (cryptoperthite), \approx 35 %, 10 mm, including aegirine and sporadically • Clinopyroxene (aegirine), \approx 7 %, < 2 mm, long prismatic ~ acicular ~ granular • Plagioclase, < 2 % • Titanite, scarce, < 1 mm, wedge-shaped • Sodalite, < 1 %, interstitial • Cancrinite, rare, interstitial • Carbonate, rare, interstitial 	<ul style="list-style-type: none"> • Magnetite, small, scarce, < 0.5 mm • Limonite 	<ul style="list-style-type: none"> • reddish brown amorphous 	
KR-033	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Very light gray and brownish gray • Compact • Coarse-grained 	<ul style="list-style-type: none"> • Alkali feldspar (perthite ~ microcline), > 55 %, prismatic • Nepheline, > 40 %, with cancrinite along cracks • Clinopyroxene (aegirine), \approx 3 %, < 1.5 mm, short prismatic ~ granular • Sodalite, \approx 1 %, interstitial • Biotite, tiny, rare, flaky • Titanite, rare, < 0.5 mm, wedge-shaped • Cancrinite, rare • White mica, rare • Carbonate, rare 	<ul style="list-style-type: none"> • Hematite, scarce, prismatic or granular 		
KR-034	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Gray and white • Compact • Fine-grained • Granular • Vein 	<ul style="list-style-type: none"> • Alkali feldspar (cryptoperthite), \approx 40 %, < 2.5 mm, prismatic ~ tabular, clouded • Nepheline, \approx 40 %, < 1 mm, granular • Clinopyroxene (aegirine), \approx 10 %, < 2 mm, prismatic ~ granular 	<ul style="list-style-type: none"> • Magnetite, \approx 2 %, < 0.5 mm 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (9)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(KR-34)			<ul style="list-style-type: none"> Hornblende, rare, < 3 mm, long prismatic, some parallel grown with aegirine Titanite, ≈ 1 %, < 1 mm, wedge-shaped Biotite, rare, < 1 mm, flaky Apatite, rare, < 0.5 mm, long prismatic Sodalite, scarce, interstitial 			
KR-039	ASH-FLOW TUFF	<ul style="list-style-type: none"> Dark reddish brown fragments in yellowish gray matrix (flow structure), loose reddish brown fragments Amorphous, brownish red and black material 			<ul style="list-style-type: none"> Yellowish gray matrix, originally, grass 	<ul style="list-style-type: none"> "agglomerate" Partial facies of alkaline-igneous rocks
KR-101	SANDSTONE	<ul style="list-style-type: none"> Pale yellowish brown Hard Vesicle-rich Fine-grained Granular 	<ul style="list-style-type: none"> Quartz, ≈ 85 %, 0.02 ~ 0.4 mm, granular Barite, scarce, < 0.02 m, irregular 	<ul style="list-style-type: none"> Limonite, ≈ 15 %, granular, forming, pseudomorph after mafic mineral(s), < 0.5 mm 		
KR-102A	BARITE ROCK	<ul style="list-style-type: none"> White and pale brown Heavy 	<ul style="list-style-type: none"> Barite, ≈ 99 %, prismatic (up to 30 mm) ~ granular Quartz, ≈ 1 %, granular, 1 ~ 15 mm 			
KR-102B (1)	CALCITE CARBONATITE	<ul style="list-style-type: none"> Granular 	<ul style="list-style-type: none"> Carbonate (calcite), > 99 %, irregular ~ granular (rounded), mainly 0.4 ~ 1 mm Plagioclase, < 1 %, < 0.03 mm, granular 	<ul style="list-style-type: none"> Magnetite 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (10)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-102B (2)	CALCITE CARBONATITE	<ul style="list-style-type: none"> • Granular • Vein 	<ul style="list-style-type: none"> • Carbonate (calcite), $\approx 90\%$, 0.1 ~ 2 mm, granular • Alkali feldspar, interstitial • Nepheline, prismatic 	<ul style="list-style-type: none"> • Limonite, < 10 %, fine-grained, granular, forming pseudomorphs after magnetite (0.05 ~ 2 mm) 		
KR-104	CAMPTONITE	<ul style="list-style-type: none"> • Olive gray • Compact and hard • Seriate 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Hornblende, < 1 %, 1 ~ 2.5 mm, prismatic, inclusions: magnetite, apatite and clinopyroxene • Clinopyroxene (Ti-augite), $\approx 3\%$, 0.5 ~ 2 mm, prismatic, inclusions: magnetite and apatite • Titanite, < 1 %, 0.5 ~ 2 mm, wedge-shaped, inclusions: magnetite, clinopyroxene and clorite • Apatite, < 1 mm, long prismatic • Olivine, altered to chlorite and serpentine <p>◇ GROUNDMASS (> 95%)</p> <ul style="list-style-type: none"> • Clinopyroxene } , Prismatic, 0.1 ~ 0.2 mm • Hornblende } • Plagioclase, poikilitic, intersertal • Nepheline • Alkali feldspar • Smectite • Calcite 	<ul style="list-style-type: none"> • Magnetite, < 2 %, < 0.3 mm, cube ~ irregular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (11)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
KR-106	CAMPONITE	<ul style="list-style-type: none"> • Dark gray • Compact and hard • Fine-grained • Porphyritic, fluidal 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Olivine, = 7 %, 0.2 ~ 1.5 mm, granular ~ prismatic • Clinopyroxene (augite), < 1 %, 0.3 ~ 1 mm, short prismatic ~ tabular <p>◇ GROUNDMASS (> 90%)</p> <ul style="list-style-type: none"> • Clinopyroxene, = 70 %, 0.1 mm, prismatic • Olivine, 2 %, < 0.05 mm, granular • Plagioclase, 15 %, < 0.1 mm, prismatic • Nepheline, < 1 %, intersertal 	<ul style="list-style-type: none"> • Magnetite, < 1 % (phenocryst), = 3 % (groundmass) 		
KR-109	LAPILLI TUFF	<ul style="list-style-type: none"> • Lithic fragments such as sandstone and limonite mass 	<ul style="list-style-type: none"> • Calcicly, = 30 %, radial aggregate • Alkali feldspar, = 30 %, irregular • Barite, = 3 %, aggregate 	<ul style="list-style-type: none"> • Limonite, = 35 %, irregular 		<ul style="list-style-type: none"> • "agglomerate" • Partial facies of alkaline igneous rocks
SH-34	MONCHIQUE	<ul style="list-style-type: none"> • Olive gray with white and black spots • Compact and hard • Porphyritic • Vein (calcite) 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Olivine, = 3 %, 1 mm, completely replaced by aggregate of calcite, magnetite, agate, white mica and serpentine • Clinopyroxene (augite), = 2 %, 2 mm, prismatic • Biotite, = 3 %, 0.5 ~ 1 mm, flaky, forming ophitic plates with clinopyroxene and calcite prisms <p>◇ GROUNDMASS (> 90%)</p> <ul style="list-style-type: none"> • Carbonate (calcite) > 30 % • Clinopyroxene • Biotite • Augite • Chlorite • Glass devitrified to smectite and chlorite 	<ul style="list-style-type: none"> • Magnetite, rare, < 0.1 mm • Hematite 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (12)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
SH-35	SPESSARTITE	<ul style="list-style-type: none"> • Olive gray • Compact and hard • Aphyric 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Clinopyroxene; augite, rare, long ~ short prismatic <p>◇ GROUNDMASS (> 99%)</p> <ul style="list-style-type: none"> • Brown hornblende, ≅ 30 %, prismatic • Clinopyroxene (augite), ≅ 30 % • Glass, ≅ 30 %, interstitial • Plagioclase, < 1 % 	<ul style="list-style-type: none"> • Magnetite, ≅ 8 %, granular 		
SH-36	HORNBLENDE ANDESITE	<ul style="list-style-type: none"> • Light olive gray with white prismatic crystals • Porphyritic, pilotaxitic 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Plagioclase, ≅ 10 %, 0.5 ~ 5 mm, prismatic, replaced by sericite along rim and cracks • Hornblende, ≅ 5 %, 0.2 ~ 4 mm, long ~ stout prismatic, replaced by smectite and limonite • Clinopyroxene, ≅ 2 %, short prismatic, completely replaced by opaque granules, smectite, chlorite and limonite • Olivine, rare, < 1 mm, replaced by smectite, calcite, limonite and chalcedony <p>◇ GROUNDMASS (> 80%)</p> <ul style="list-style-type: none"> • Plagioclase, ≅ 40 % • Carbonate (calcite), ≅ 30 % • Apatite 	<ul style="list-style-type: none"> • Magnetite • Hematite, granules 		
SH-39	HORNBLENDE ANDESITE	<ul style="list-style-type: none"> • Gray • Compact and hard • Porphyritic, fluidal 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Plagioclase, ≅ 7 %, 0.5 ~ 5 mm, prismatic, some with dusty inclusion-rich core, altered to sericite partially 	<ul style="list-style-type: none"> • Magnetite, ≅ 1 %, < 0.5 mm, granular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (13)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(SH-39)			<ul style="list-style-type: none"> • Hornblende } • Clinopyroxene } ≅ 5%, 0.5 ~ 4 mm, long prismatic ~ granular, altered to calcite, chlorite or smectite, opaque • Titanite, rare; < 0.5 mm, wedge-shaped <p>◇GROUNDMASS (> 85%)</p> <ul style="list-style-type: none"> • Carbonate (calcite), ≅ 40 % • Plagioclase, ≅ 40 % • White mica • Apatite 			
MR-106	CALCITE-CARBONATITE	<ul style="list-style-type: none"> • Grayish brown and white 	<p>⊙ Brown portion:</p> <ul style="list-style-type: none"> • Carbonate (calcite), ≅ 80 %, fine grains without definite outline <p>⊙ White portion:</p> <ul style="list-style-type: none"> • Carbonate (calcite), > 98%, 0.2 ~ 10 mm • Apatite, < 1 %, < 0.1 mm, granular 	<ul style="list-style-type: none"> • Limonite, ≅ 20 %, irregular • Magnetite, rare, irregular • Limonite, ≅ 10 %, irregular 		
MR-108	SYENITE	<ul style="list-style-type: none"> • Dark greenish gray • Compact and hard 	<ul style="list-style-type: none"> • Alkali feldspar, ≅ 88 %, 0.2 ~ 0.5 mm, prismatic ~ granular, dusty, Apatite and magnetite inclusions. • Hornblende, rare, < 1 mm, prismatic ~ granular, pleochroism; grass green ~ pale greenish yellow. • Replacement by limonite is noted along rim and cracks. • Carbonate interstitial, prismatic • Apatite, ≅ 1 %, < 0.5 mm, prismatic ~ granular 	<ul style="list-style-type: none"> • Magnetite, ≅ 15%, intersertal, prismatic 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (14)

Sample Number	Rock Name	Macroscopical features and macroscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(MF-108)			<ul style="list-style-type: none"> • Plagioclase, rare, < 1.5 mm, prismatic • Titanite, rare, < 1 mm 			
MR-111	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Dark gray • Compact and hard • Granular 	<ul style="list-style-type: none"> • Nepheline, \approx 80%, 0.2 ~ 5 mm, tabular, inclusions (clinopyroxene, hornblende and titanite altered white mica along rim and cracks) • Alkali feldspar, < 5%, interstitial • Hornblende, \approx 15%, 0.05 ~ 2 mm, prismatic ~ granular, pleochroism; light ~ pale green or yellowish gray (aegirine - auite ~ aegirine) • Clinopyroxene, \approx 2%, 1 mm, pleochroism; pale green (core) or grayish green • Sodalite, < 2%, interstitial • Titanite, \approx 1%, < 1 mm • Biotite, < 1%, < 0.5 mm • Apatite, < 1%, prismatic ~ granular, pleochroism; brown ~ pale green 	<ul style="list-style-type: none"> • Magnetite, < 1%, < 0.5 mm, irregular 		
MR-112	NEPHELINE SYENITE	<ul style="list-style-type: none"> • Light gray with moderate brown spots • Coarse - grained mosaic 	<ul style="list-style-type: none"> • Plagioclase, \approx 30%, < 10 mm, prismatic, altered to carbonate partially • Alkali feldspar, \approx 40%, < 10 mm, parthite • Hornblende, \approx 20%, 0.2 ~ 4 mm, prismatic ~ granular, pleochroism; green ~ pale green • Sodalite, < 1%, < 2 mm, interstitial • Titanite, < 1%, < 2 mm, wedge-shaped • Clinopyroxene (aegirine), pleochroism; light green (core) or dark green (rim) ~ yellowish green 	<ul style="list-style-type: none"> • Magnetite, < 1%, < 0.5 mm, irregular 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (15)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(MR-112)			<ul style="list-style-type: none"> • Biotite , < 1%, < 0.2 mm, pleochloism; dark~ pale brown 			
MR-113	LAPILLI TUFF	<ul style="list-style-type: none"> • Light brownish gray with dark gray, moderate brown, white and very pale orange fragments • Lithic fragments, ≈ 10% (Sandstone ~ Mudstone, Limestone) 	<p>CRYSTALS</p> <ul style="list-style-type: none"> • Apatite , ≈ 5%, prismatic • Augite , ≈ 1%, fragmental • Alkali feldspar (cryptoperthite - microcline), ≈ 2%, granular, fragmental • Plagioclase , ≈ 1%, granular, fragmental • White mica , rare, < 0.5 mm <p>(Matrix , ≈ 70% Carbonate , ≈ 50% White mica , rare</p>	<ul style="list-style-type: none"> • Magnetite , < 1% • Limonite , ≈ 10% 		<ul style="list-style-type: none"> • "agglomerate" • Partial facies of alkaline igneous rocks
MR-114	PHONOLITE	<ul style="list-style-type: none"> • Dark greenish gray • Compact and hard • Porphyritic 	<p>◇ PHENOCRYSTS</p> <ul style="list-style-type: none"> • Nepheline , ≈ 15%, < 2 mm, • Plagioclase , ≈ 10%, < 0.4 mm, prismatic • Hornblende , ≈ 2%, < 2.5 mm, prismatic ~ fragmental, pleochloism; reddish brown ~ dark yellowish orange • Clinopyroxene , ≈ 2%, < 2.5 mm, (Ti-augite ~ aegirine-augite) , light brownish gray (core) ~ deep green (rim) • Titanite , < 1%, < 0.5 mm, wedge - shaped <p>◇ GROUNDMASS (≈ 70%)</p> <ul style="list-style-type: none"> • Plagioclase , < 10% • Nepheline ~ Cancrinite , ≈ 50% • Clinopyroxene, Hornblende , < 5% 	<ul style="list-style-type: none"> • Magnetite , < 1%, irregular, < 0.5 mm 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (16)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(MR-114)			<ul style="list-style-type: none"> • Apatite • Carbonate 			
MR-117	NEPHELINE-SYENITE	<ul style="list-style-type: none"> • Greenish black and greenish orange (pink) • Compact and hard • Medium ~ coarse-grained • Granular 	<ul style="list-style-type: none"> • Nepheline, ≈ 75%, < 10 mm, short prismatic • Alkali feldspar, < 10%, < 10 mm, prismatic • Cancrinite, < 3%, interstitial • Clinopyroxene, < 5%, < 2 mm, prismatic (augite ~ aegirine - augite) • Hornblende, ≈ 2%, < 2 mm, pleochroism • Sodalite, < 1%, interstitial • Titanite, < 1%, < 1 mm, wedge shaped • Biotite, pleochroism; dark ~ pale brown • Apatite 	<ul style="list-style-type: none"> • Magnetite, < 1%, irregular, < 0.5 mm 		
MK-01	CAMPTONITE (carbonatized)	<ul style="list-style-type: none"> • Dark greenish gray • Compact • With black crystals • Porphyritic 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS • Clinopyroxene, ≈ 10%, < 3 mm, long ~ short prismatic, aegirine rim replaced with carbonate, partially along rim and cracks • Plagioclase, ≈ 10%, < 2 mm, tabular, completely replaced by carbonate and white mica. • Hornblende, < 1%, < 1 mm, long prismatic, pleochroism; greenish ~ pale brown • Apatite, < 1%, < 0.5 mm, Prismatic ◇ GROUNDMASS (≈ 75%) • Carbonate, ≈ 30% • White mica, ≈ 15% • Hornblende, prismatic, ≈ 5% • Clinopyroxene • Biotite 	<ul style="list-style-type: none"> • Magnetite, < 1% • Hematite, < 1% 		

Microscopic Observation of Rocks in Thin Section (Igneous Rocks) (17)

Sample Number	Rock Name	Macroscopical features and microscopical texture and structure	Identified minerals	Unidentified Minerals		Remarks
				Opaque minerals	Transparent minerals	
(MK-01)			<ul style="list-style-type: none"> • Nepheline, baskittitic, < 20% • Titanite 			
MK-26	CAMPONITE	<ul style="list-style-type: none"> • Olivine gray • Compact and Hard • Fine-grained • Porphyritic • Hyalopilitic 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS • Clinopyroxene, ≈ 3%, < 2 mm, long ~ short prismatic ◇ GROUNDMASS (>95%) • Hornblende, ≈ 10%, < 1 mm, long prismatic, pleochroism; light ~ pale brown • Glass, 80%, partially to smectite and chlorite • Plagioclase, < 2% • Apatite, < 1% • Montmorillonite • Clinopyroxene, ≈ 10%, long prismatic • Carbonate, ≈ 1% 	<ul style="list-style-type: none"> • Magnetite, < 1%, < 0.8 mm, granular or irregular • Magnetite, < 3%, granular 		
MW-03	MONCHIQUE	<ul style="list-style-type: none"> • Dark gray • Compact and hard • Fine-grained • Porphyritic • Hyalopilitic 	<ul style="list-style-type: none"> ◇ PHENOCRYSTS • Clinopyroxene, ≈ 7%, < 5 mm, short prismatic • Olivine, ≈ 3%, < 2 mm, completely replaced, short prismatic ◇ GROUNDMASS (>85%) • Clinopyroxene, ≈ 50%, < 0.5 mm, prismatic • Carbonate, ≈ 10%, irregular • White mica, ≈ 2% • Glass, 20%, devitrified to smectite or white mica. • Biotite, < 1%, flaky, < 0.1 mm 	<ul style="list-style-type: none"> • Magnetite, ≈ 1%, 0.05 mm, altered to limonite 		

**Photomicrographs of Rocks in Thin Section
(Igneous Rocks)**

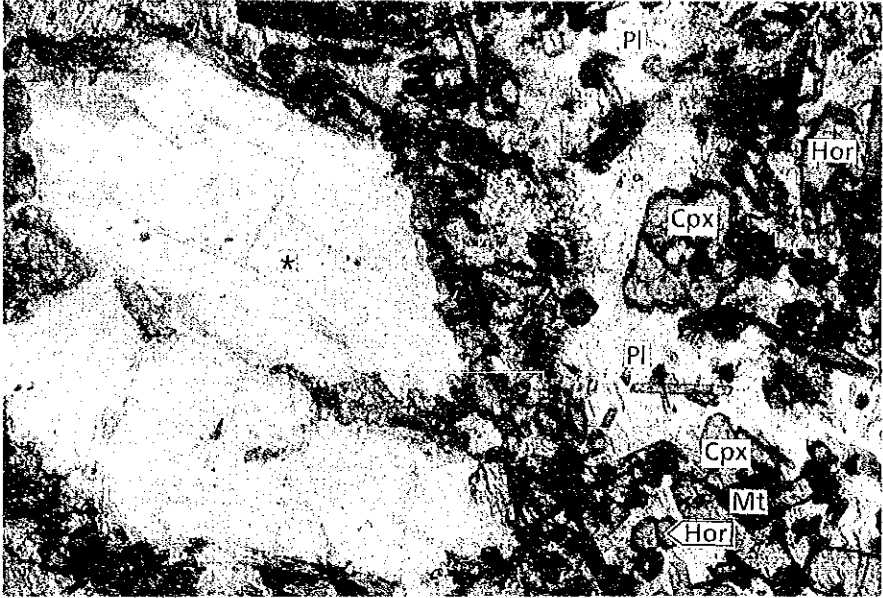
Abbreviations

Minerals

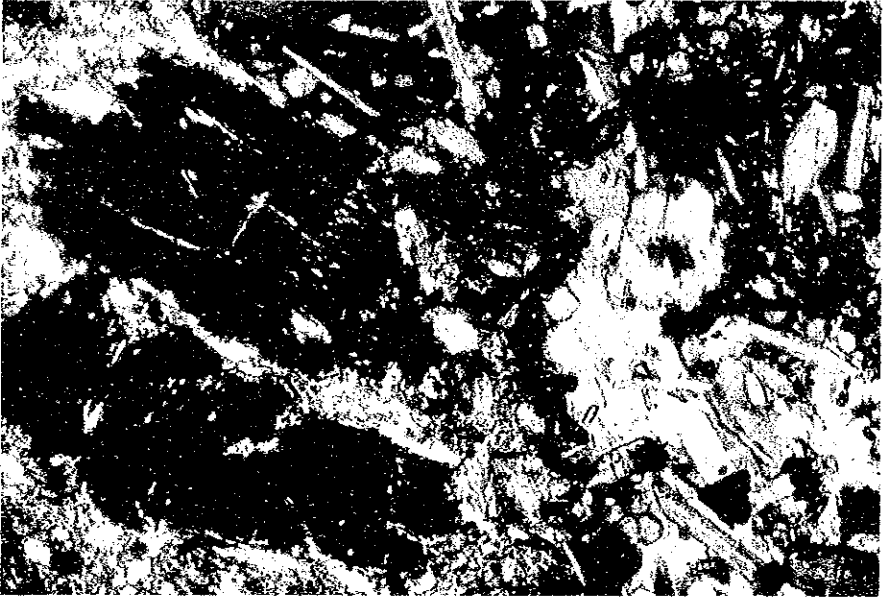
Qtz : quartz	Kf : potassium feldspar
Pl : plagioclase	Bi : biotite
Hor : hornblende	Cpx : clinopyroxene
Ne : nepheline	Ol : olivine
Cn : cancrinite	Sd : sodalite
Ap : apatite	Ti : titanite
Gar : garnet	Tor : tourmaline
Zir : zircon	Ru : rutile
Chl : chlorite	Serp : serpentine
Mus : muscovites	Ca : calcite
Cr : cristobalite	Se : sericite
Non : nontronite	Sm : smectite
Anl : analcime	Lim : limonite
Mt : magnetite	

Others

Cly : clay	Opq : opaque minerals
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one polar



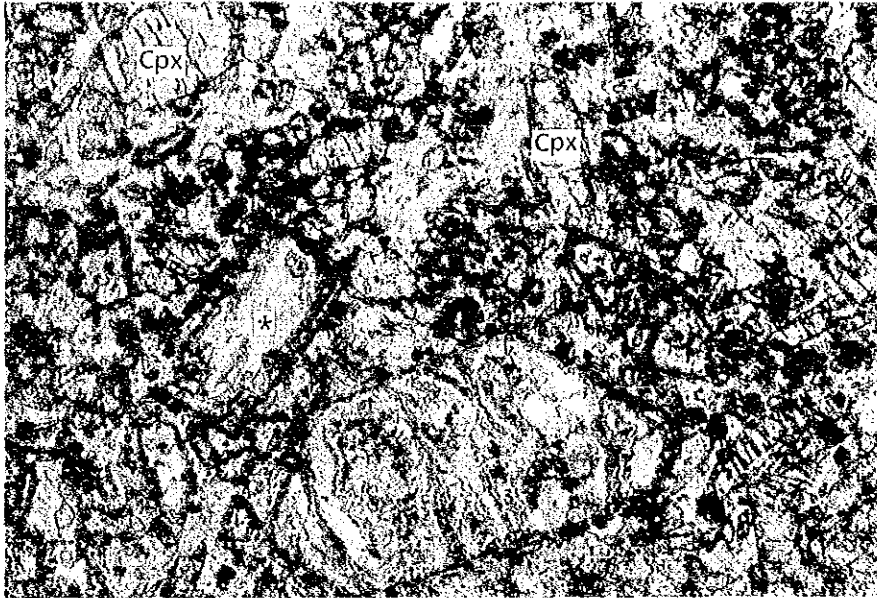
crossed polars

1mm

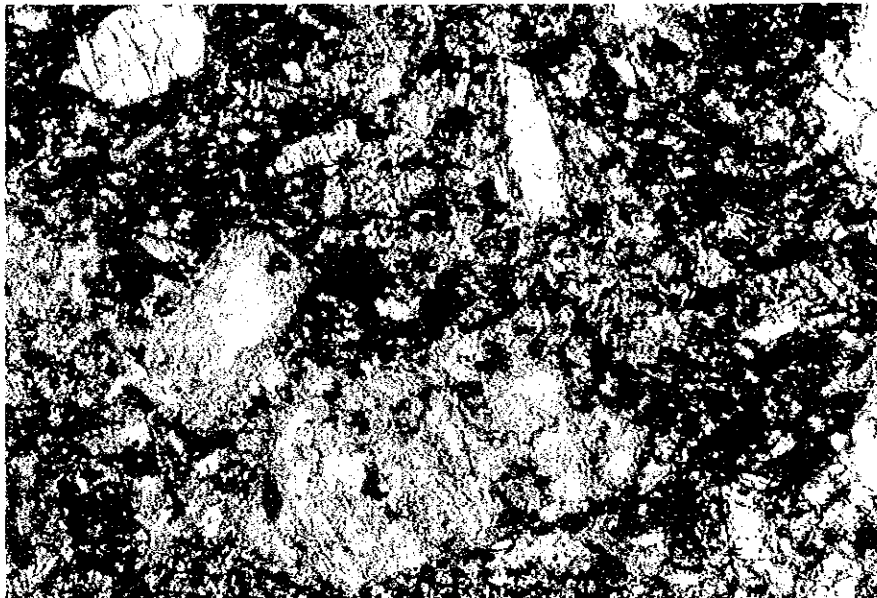
* Serp + Chl
(Pseudomorph after Ol)

Sample No.: KR-104
Location : Mwangulu
Rock name : Camptonite

Photomicrographs (thin section)



one polar

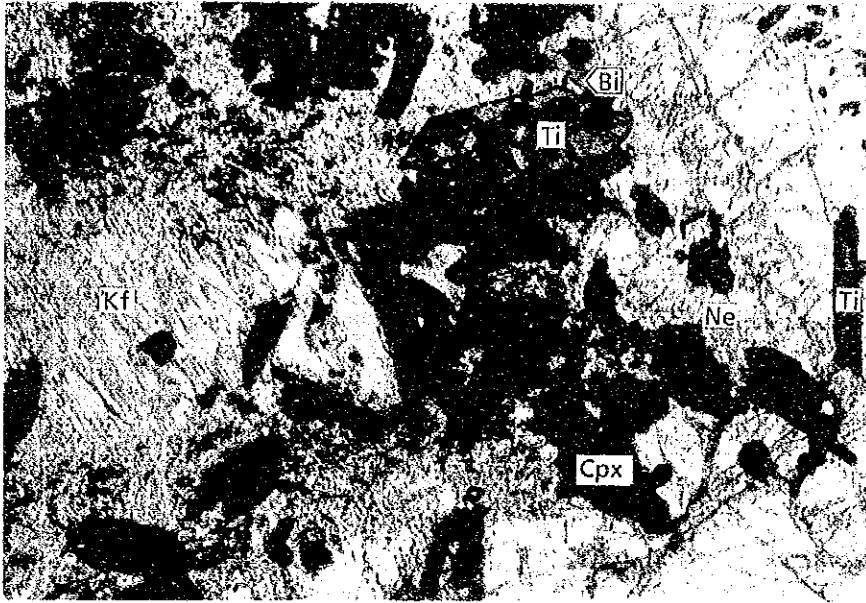


crossed polars

* Ca
(Pseudomorph after Ol)

Sample No.: MW-03
Location : Northwest of Mwena
Rock name : Monchiquite

Photomicrographs (thin section)



one polar



crossed polars

Sample No.: KR-032

Location : Jombo Hill

Rock name : Nepheline Syenite

Photomicrographs (thin section)



one polar

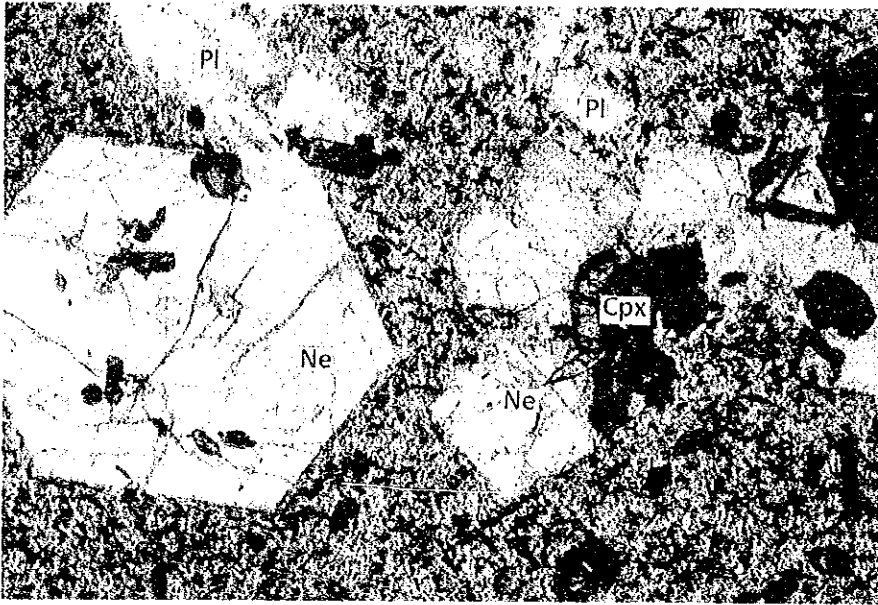


crossed polars

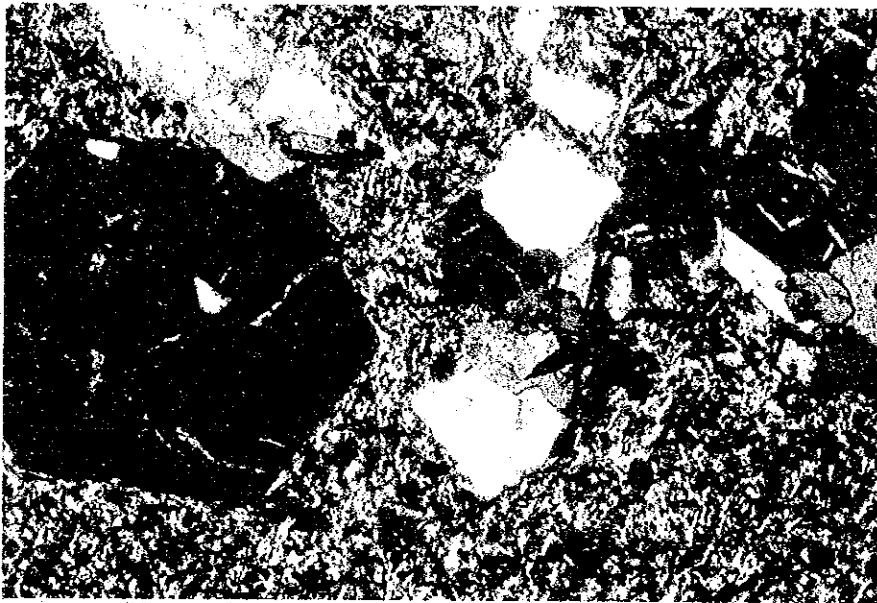
1mm

Sample No.: KR-020C
Location : Dzirihini
Rock name : Syenite

Photomicrographs (thin section)



one polar

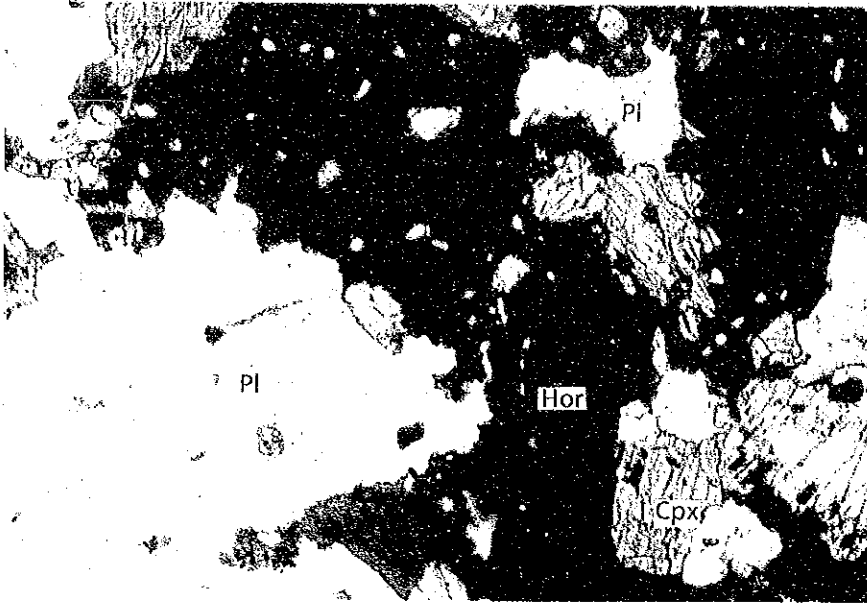


crossed polars

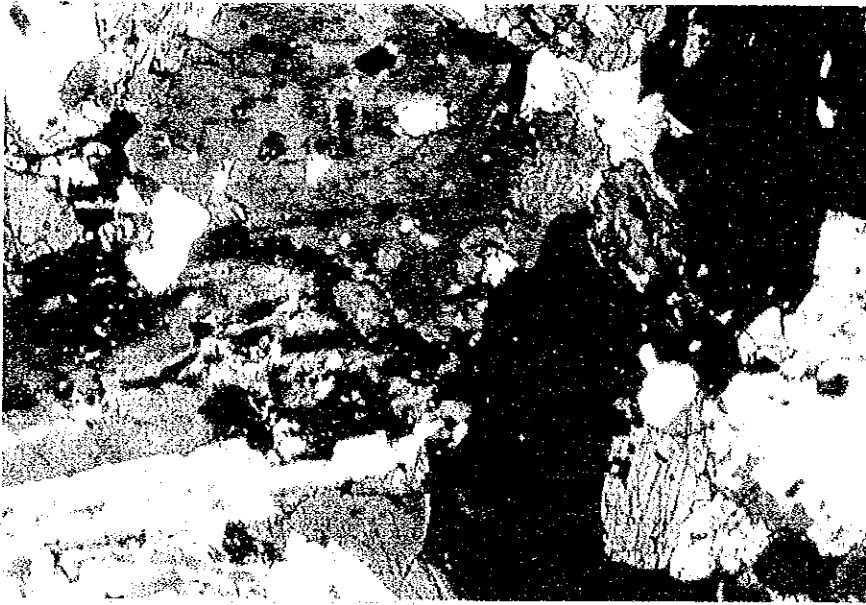
1 mm

Sample No.: MR-114
Location : Henzamwenye
Rock name : Phonolite

Photomicrographs (thin section)



one polar



crossed polars

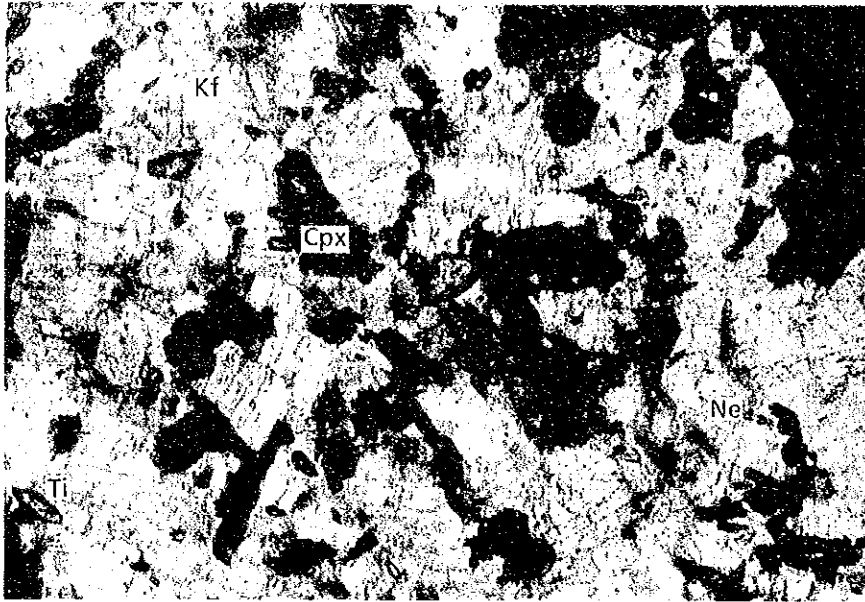
1 mm

Sample No.: KR-025A

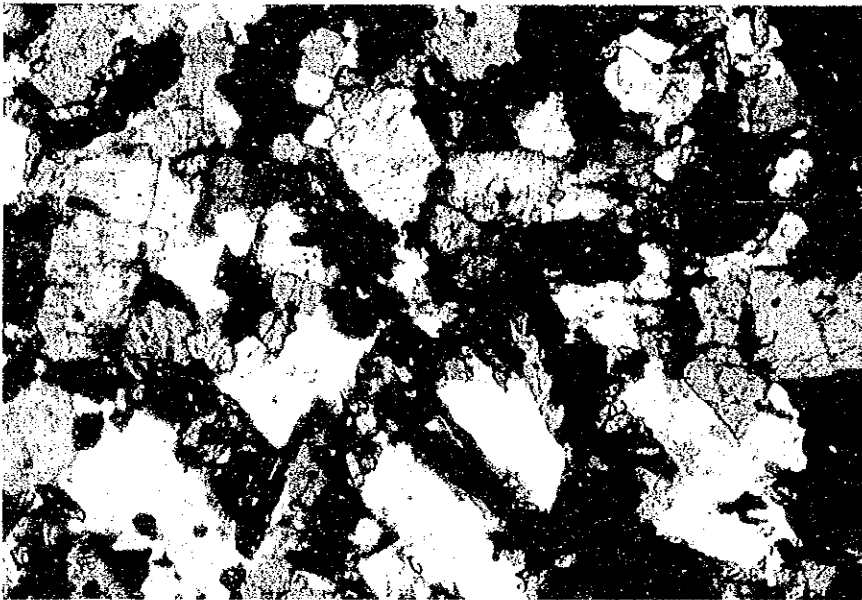
Location : South of Jombo Hill

Rock name : Gabbro

Photomicrographs (thin section)



one polar



crossed polars

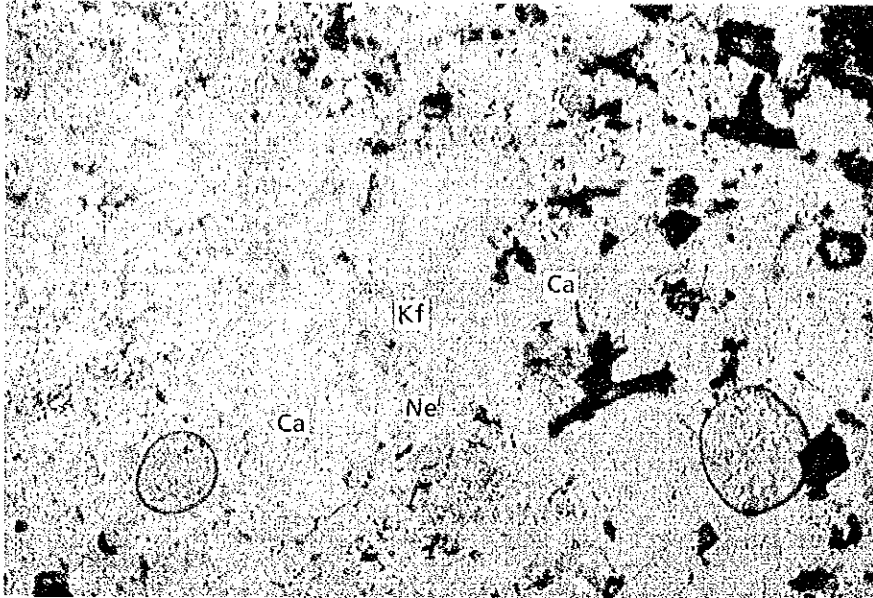
1mm

Sample No.: KR-025B

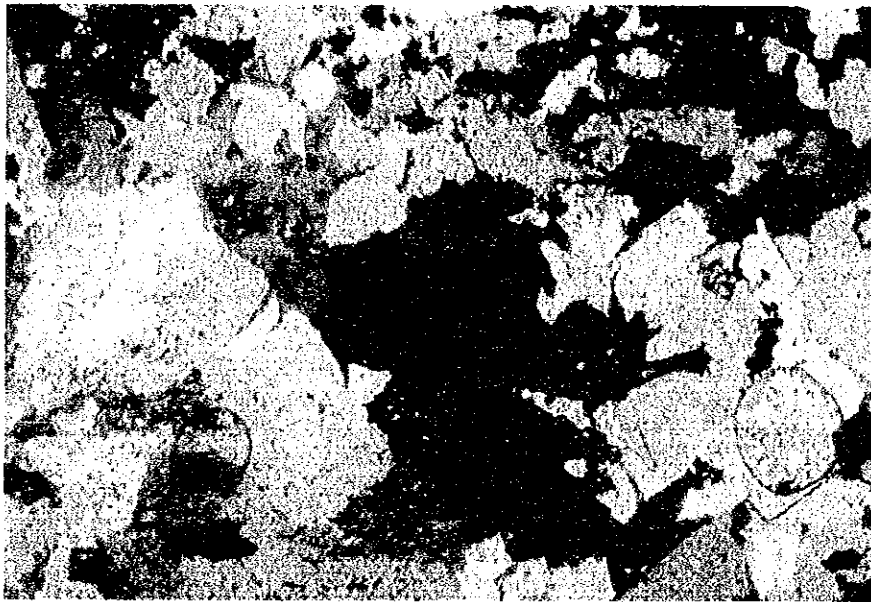
Location : South of Jombo Hill

Rock name : Nepheline Syenite

Photomicrographs (thin section)



one polar

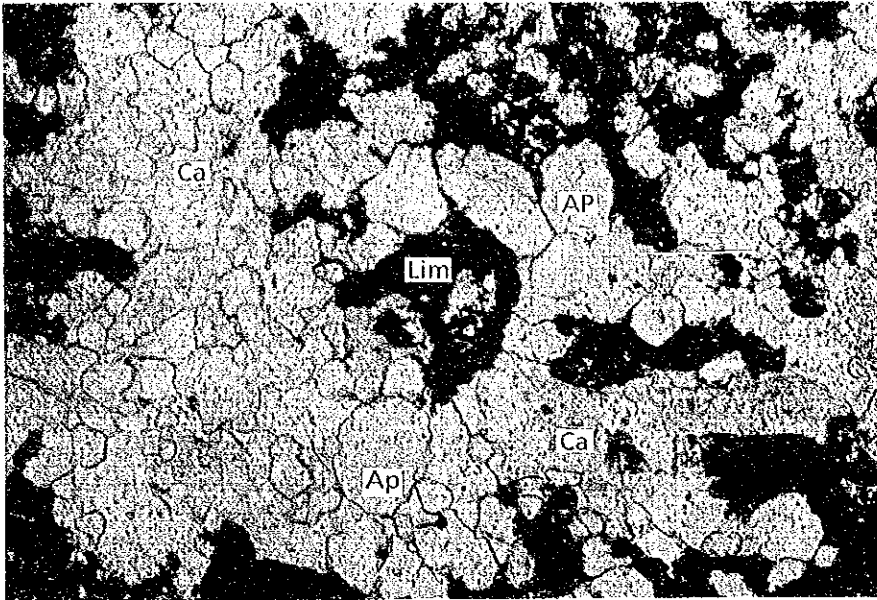


crossed polars

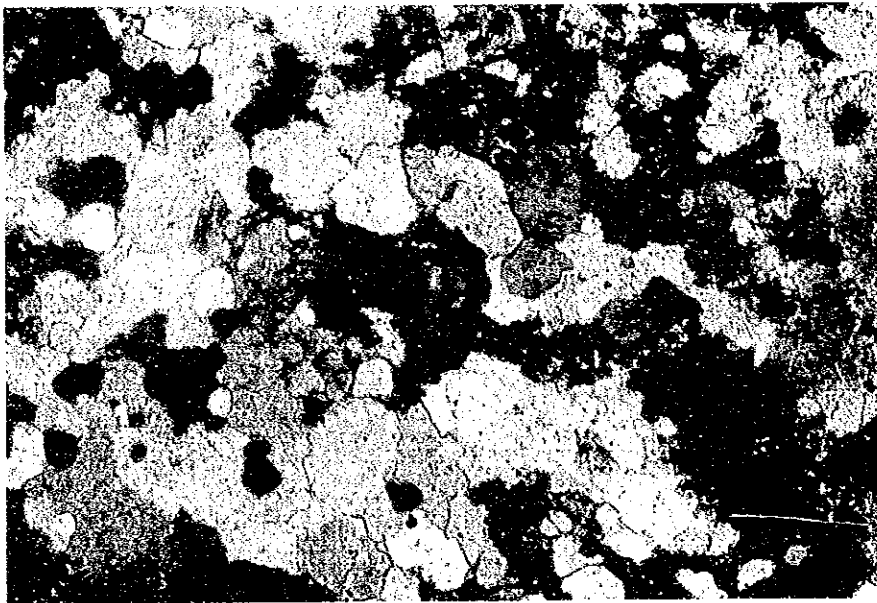
1mm

Sample No. : KR-102 (B)
Location : Mrima Hill
Rock name : Calcite Carbonatite

Photomicrographs (thin section)



one polar

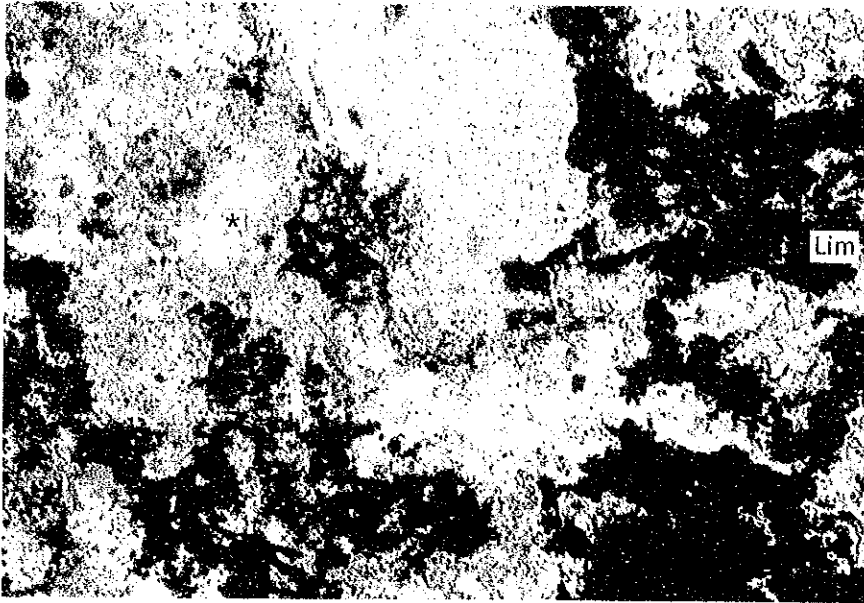


crossed polars

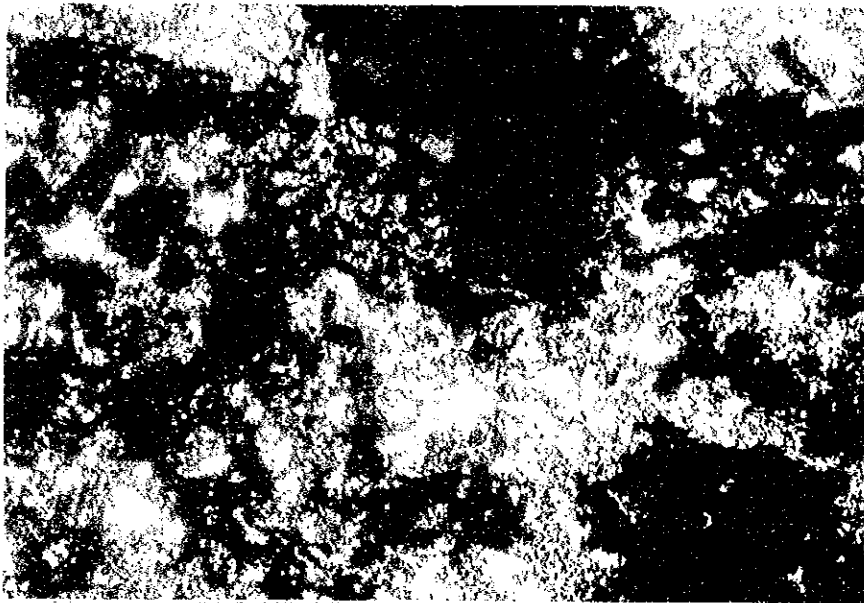
1 mm

Sample No.: MR-106
Location : Mrima Hill
Rock name : Carbonatite

Photomicrographs (thin section)



one polar



crossed polars

1mm

* chalcedony

Sample No.: KR-109

Location : Kiruku Hill

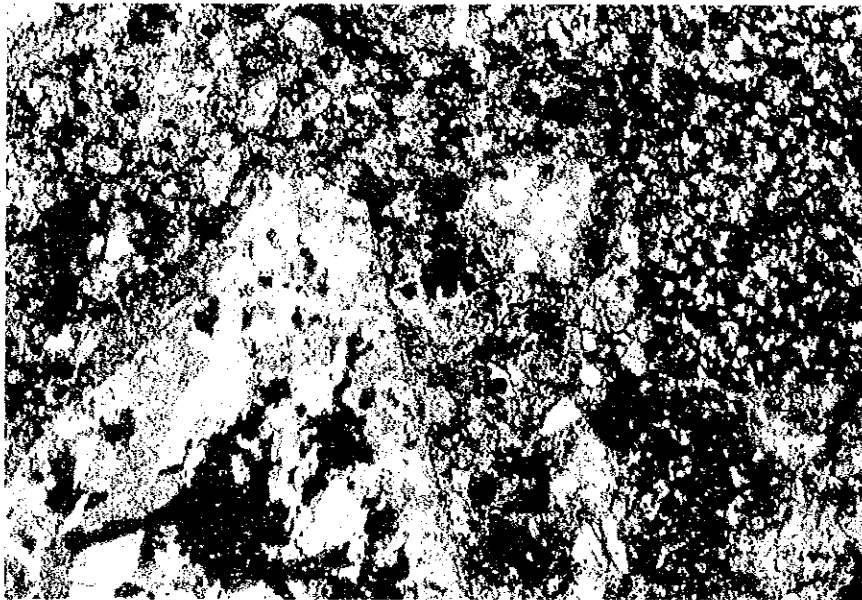
Rock name : Lapilli Tuff

("agglomerate")

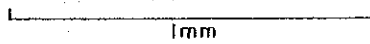
Photomicrographs (thin section)



one polar



crossed polars



* lithic fragment
(sandstone)

Sample No.: MR-113
Location : Mwananyamala
Rock name : Lapilli Tuff

Photomicrographs (thin section)

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (1)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
KR-014	SANDSTONE	<ul style="list-style-type: none"> • Light gray • Compact • Transparent grains (dominant) and milky white grains. • No lamination and grading texture • Including mudstone clasts. 	<ul style="list-style-type: none"> • Moderately - sorted • Immature 	<ul style="list-style-type: none"> • Quartz, \approx 85%, < 3mm, subangular to angular, mostly monocrystalline (igneous origin) • Alkali feldspar, \approx 35%, < 2 mm, altered to calcite and sericite • Plagioclase, \approx 25%, < 1.5 mm, subangular to angular, altered to sericite • Chlorite • Muscovite • Calcite • Biotite • Garnet 	<ul style="list-style-type: none"> • (< 5 %, very little) • Calcite 	Clay material	<p>Granitic rocks and/or gneiss</p> <p>Formation: Taru (middle)</p>
SH-28	SILTSTONE	<ul style="list-style-type: none"> • Light grayish brown • Massive • No lamination and grading • Compact 	<ul style="list-style-type: none"> • Roughly parallel alignment of muscovite flakes, indicating bedding or lamination • Well-sorted • Much matrix and mineralogically immature. 	<ul style="list-style-type: none"> • (\approx 50%) • Quartz, \approx 33 %, < 0.2 mm, subround ~ subangular • Plagioclase, \approx 10 %, smaller than Quartz, subangular • Alkali feldspar, < 5 %, smaller than Quartz • Muscovite, < 2 % 	<ul style="list-style-type: none"> • Clay material • Sericite or illite • Chlorite 	<ul style="list-style-type: none"> • Clay material • Opaque minerals 	<p>Granitic rocks and/or gneiss</p> <p>Formation: Taru (upper)</p>

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (2)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
CO-09	LIMESTONE	<ul style="list-style-type: none"> • Cray ~ dark gray • Massive • Compact/not porous 	<ul style="list-style-type: none"> • Consisting mainly of micrite. • Recrystallized peloids • Porous parts filled with sparry calcite 	<ul style="list-style-type: none"> • Calcite, > 95 %, (calcite vein) (i) peloid-like grains lacking internal structure and composed of micrite (ii) very fine-grained micrite. (iii) secondarily precipitated sparry calcite • Quartz, silt size, subangular ~ angular, monocrystalline 		<ul style="list-style-type: none"> • Clay material 	<p>Formation: Maji ya Chumvi (lower)</p>
KR-013	SANDSTONE	<ul style="list-style-type: none"> • Light brown • Compact and Massive • With obscure lamination 	<ul style="list-style-type: none"> • Well-sorted • Mature 	<ul style="list-style-type: none"> (> 90 %) • Quartz, \approx 50 %, < 0.2 mm, subangular ~ angular • Plagioclase, \approx 30 %, < 0.2 mm, subangular ~ angular • Alkali feldspar, \approx 10 %, < 0.2 mm, subangular ~ angular, cloudy due to alteration, altered to sericite • Muscovite, rare • Zircon • Apatite 	<ul style="list-style-type: none"> (< 10 %) • Sericite, chlorite, other clay minerals. 	<ul style="list-style-type: none"> • Clay material • Opaque minerals 	<ul style="list-style-type: none"> • Granitic and/or gneissose rocks <p>Formation: Maji ya Chumvi (lower)</p>

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (3)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
KR-011	SANDSTONE		<ul style="list-style-type: none"> Moderately sorted Roughly parallel alignment of muscovite and biotite, flakes, indicating bedding. 	<ul style="list-style-type: none"> (80 ~ 85 %) Quartz, > 50 %, < 0.15 mm, angular ~ subangular Plagioclase, ≈ 20 %, < 0.15 mm, angular ~ subangular Alkali feldspar, ≈ 15 %, < 0.15 mm, angular ~ subangular, altered to sericite. Chlorite, ≈ 5 % Biotite, ≈ 5 % Muscovite, a few % Tourmaline, a few % Zircon, a few % 	<ul style="list-style-type: none"> Chlorite Clay minerals 	<ul style="list-style-type: none"> Clay material Opaque minerals 	<ul style="list-style-type: none"> Formation: Maji ya Chumvi (middle)
SH-32	SILTSTONE	<ul style="list-style-type: none"> Yellowish brown Compact and massive No lamination 	<ul style="list-style-type: none"> Well-sorted Mineralogically immature 	<ul style="list-style-type: none"> Quartz, ≈ 30 %, < 0.2 mm, subangular, indicating metamorphic origin. Plagioclase, ≈ 20 %, smaller than Quartz Alkali feldspar, ≈ 10 %, small, subangular, cloudy due to alteration, altered to sericite Muscovite, a few % Chlorite Zircon 	<ul style="list-style-type: none"> (35 ~ 40 %) Clay mineral Opaque mineral 	<ul style="list-style-type: none"> Clay material Opaque minerals 	<ul style="list-style-type: none"> Formation: Maji ya Chumvi (middle) Fossil bed

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (4)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
SH-23	SILTSTONE	<ul style="list-style-type: none"> • Light brownish gray • Laminated texture • Compact 	<ul style="list-style-type: none"> • Well-sorted • Irregular grain contacts (sometimes), because of pressure-solution during diagenesis. 	<ul style="list-style-type: none"> (\approx 80%) • Quartz, \approx 45%, < 0.15 mm, subangular ~ angular • Plagioclase, \approx 25%, subangular ~ angular • Alkali feldspar, \approx 5%, altered to sericite • Chlorite, < a few % • Muscovite • Tourmaline • Zircon • Opaque minerals 	<ul style="list-style-type: none"> • Clay 	<ul style="list-style-type: none"> • Clay material • Opaque minerals 	Formation: Maji ya Chumvi (upper)
KR-010	SANDSTONE	<ul style="list-style-type: none"> • Light gray ~ white • Obscure lamination • Arkosic 	<ul style="list-style-type: none"> • Moderately - Sorted • Originally "clean" sandstone, lacking clay matrix • Irregular and wavy grain contacts, because of pressure-solution during diagenesis 	<ul style="list-style-type: none"> (\approx 85%) • Quartz, \approx 30%, < 0.025 mm, subangular ~ angular • Plagioclase, \approx 25%, < 0.025 mm, subangular ~ angular • Alkali feldspar, \approx 25%, < 0.025 mm, subangular ~ angular • Chlorite (origin biotite) • Muscovite • Zircon • Sphere • Tourmaline 	<ul style="list-style-type: none"> (\leq 15%) • Calcite • Clay minerals (chlorite) 	<ul style="list-style-type: none"> • Clay material 	Formation: Maji ya Chumvi (upper)

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (5)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
KR-007	SANDSTONE	<ul style="list-style-type: none"> • Light gray • Milky white patches • Massive and compact • No lamination 	<ul style="list-style-type: none"> • Moderately - sorted • Irregular grain contacts because of pressure - solution during diagenesis 	<ul style="list-style-type: none"> ($\geq 90\%$) • Quartz, $\approx 35\%$, < 0.25 mm, subangular \sim subrounded • Plagioclase, $\approx 30\%$, < 0.25 mm, subangular \sim subrounded • Alkali feldspar, $\approx 25\%$, < 0.25 mm, subangular \sim subrounded, frequently altered • Chlorite (origin biotite), 5% • Muscovite • Garnet • Zircon • Allanite 	<ul style="list-style-type: none"> • Calcite (Clay) 	<ul style="list-style-type: none"> • Clay material 	<ul style="list-style-type: none"> Formation: Mariakani (lower)
KR-006	MICACEOUS SANDSTONE	<ul style="list-style-type: none"> • Gray • Lamination due to mica flakes • Compact 	<ul style="list-style-type: none"> • Poorly or moderately - sorted • Parallel alignment of biotite flakes (indicating bedding and/or lamination) 	<ul style="list-style-type: none"> (80 ~ 85%) • Quartz, $\approx 30\%$, < 0.2 mm, subrounded \sim subangular • Plagioclase, $\approx 20\%$, subangular • Alkali feldspar, $\approx 20\%$, subrounded, altered to sericite • Biotite and Chlorite, $\approx 15\%$ • Muscovite 	<ul style="list-style-type: none"> • Chlorite • Clay material 		<ul style="list-style-type: none"> Formation: Mariakani (lower)

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (6)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
SH-05	CALCAREOUS SANDSTONE (SILTSTONE)	<ul style="list-style-type: none"> Light gray Massive Obscure lamination Compact and hard 	<ul style="list-style-type: none"> Moderately sorted clastic grains abundant. 	<ul style="list-style-type: none"> Quartz, \approx 25 %, < 0.2 mm, subrounded \sim subangular Plagioclase, \approx 10 %, < 0.2 mm, subrounded \sim subangular Alkali feldspar, \approx 10 %, < 0.2 mm, subrounded \sim subangular, altered to sericite. Muscovite Chlorite Zircon Sphene Tourmaline Garnet (\bullet) Biotite 	<ul style="list-style-type: none"> (\approx 50 %) Calcite (\bullet) Chlorite Clay 	Clay material	Formation: Mariakani (middle)
SH-04	SANDSTONE	<ul style="list-style-type: none"> Light yellowish brown Massive Compact, not so hard 	<ul style="list-style-type: none"> Moderately sorted Parallel alignment of biotite flakes, indicating bedding or lamination. 	<ul style="list-style-type: none"> (80 \sim 85 %) Quartz, \approx 35 %, < 0.25 mm, subangular Alkali feldspar, \approx 25 %, < 0.2 mm, subangular, altered to sericite Plagioclase, \approx 20 %, < 0.2 mm, subangular Chlorite (origin biotite), \approx 5 % Muscovite Zircon Garnet 	<ul style="list-style-type: none"> Calcite (\bullet) Chlorite (\bullet) Clay Opaque 	<ul style="list-style-type: none"> Clay material Opaque minerals 	Formation: Mariakani (middle)

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (7)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
KR-005	CALCAREOUS SANDSTONE		<ul style="list-style-type: none"> Moderately ~ well-sorted Roughly parallel alignment of biotite flakes 	<ul style="list-style-type: none"> (\approx 50%) Quartz, \approx 25%, < 0.25 mm, subangular Plagioclase, \approx 15%, < 0.25 mm, subangular Alkali feldspar, \approx 10%, altered to calcite or sericite Chlorite (origin biotite) Garnet Apatite Zircon Sphene 	<ul style="list-style-type: none"> (\approx 50%) Calcite Clay 	<ul style="list-style-type: none"> Clay material 	<ul style="list-style-type: none"> Formation: Mariakani (upper)
SH-13	SANDSTONE	<ul style="list-style-type: none"> Light gray Hard, but porous 	<ul style="list-style-type: none"> Originally porous quartzose sandstone with rounded quartz grains Well-cemented by secondarily quartz 	<ul style="list-style-type: none"> (\approx 85%) Quartz, 40%, \approx 0.5 mm, rounded ~ subrounded Plagioclase, 25%, \approx 0.5 mm, subrounded Alkali feldspar, \approx 15% Garnet Zircon 	<ul style="list-style-type: none"> Opaque materials Chlorite Secondary precipitated quartz (\approx Clay) 	<ul style="list-style-type: none"> Opaque minerals Clay material 	<ul style="list-style-type: none"> Formation: Mazaras (upper)

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (8)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
KR-001	SANDSTONE		<ul style="list-style-type: none"> Moderately to poorly sorted Well-cemented by secondarily precipitated silica (similar to SH-13) 	<ul style="list-style-type: none"> (≈ 80%) Quartz, ≈ 40%, < 1.0 mm, originally rounded ~ subrounded Plagioclase, ≈ 25%, < 0.5 mm, subrounded Alkali feldspar, ≈ 15%, subrounded, altered to sericite Zircon (• Dolomite) 	<ul style="list-style-type: none"> Calcite Opaque mineral (• Clay) 	<ul style="list-style-type: none"> Opaque minerals Clay material 	<ul style="list-style-type: none"> Formation: Mazeras (middle)
SH-12	SANDSTONE	<ul style="list-style-type: none"> Light brownish gray Massive Porous No lamination 	<ul style="list-style-type: none"> Moderately ~ well sorted Originally porous sandstone Quartz grains are well cemented by over growth silica precipitated during diagenesis. 	<ul style="list-style-type: none"> (≈ 90%) Quartz, ≈ 45%, < 0.45 mm, originally rounded Plagioclase, ≈ 30%, < 0.45 mm, rounded, slightly altered Garnet Apatite Zircon Sphene Muscovite 	<ul style="list-style-type: none"> Secondary quartz Clay material (sericite) 	<ul style="list-style-type: none"> Clay material 	<ul style="list-style-type: none"> Formation: Mazeras (upper)
JA-09	LIMESTONE	<ul style="list-style-type: none"> Light yellowish white Compact Porous No lamination and stratified texture 	<ul style="list-style-type: none"> Recrystallized limestone (dolomite) Mosaic texture is similar to neomorphic fabric. 	<ul style="list-style-type: none"> Calcium carbonate (or dolomite), > 95% Detrital quartz grains, a few %, mostly rounded Alkali feldspar, rare, altered 	<ul style="list-style-type: none"> Calcite 	<ul style="list-style-type: none"> Formation: Kambe 	

Microscopic Observation of Rocks in Thin Section (Sedimentary Rocks) (9)

Code No.	Sample Name	Macroscopic Features	Microscopic Features	Identified Minerals and Material		Unidentified Minerals and Material	Source (or remarks)
				Detrital Material	Matrix		
MW-05	SANDY OOLITIC LIMESTONE (Sandy oösparite)	<ul style="list-style-type: none"> • Gray • Massive • With dark transparent spots • No lamination or stratification 	<ul style="list-style-type: none"> • Spherical or ellipsoidal grains, showing radial and concentric structure • are ooids. (Nuclei of them are probably micrite.) • Matrix among the ooids is sparry calcite cement. • No carbonate-mud in matrix shows "wash-out" • Rarely, ooids with a large nuclei of quartz and thin oölitic lamina. (Superficial ooids) 	<ul style="list-style-type: none"> • Ooid, \approx 30 %, < 2 mm • Detrital Quartz, \approx 15 %, < 2 mm, subangular • Detrital plagioclase, \approx 5 % • Detrital alkali feldspar • Echinoderm fragments • Zircon 	<ul style="list-style-type: none"> • Sparry Calcite (Secondarily precipitated calcite.) 	<ul style="list-style-type: none"> • Clay material 	<p>Formation: Kambe</p>
MD-08	SANDY OOLITIC LIMESTONE (Sandy, poorly-washed, oösparite)	<ul style="list-style-type: none"> • Light gray • Compact and massive • No lamination and stratification 	<ul style="list-style-type: none"> • Abundant ooids with poorly-preserved concentric structure. • Nuclei of them are quartz, calcite, garnet, and foraminifer. • The structure may have been lost by micritization 	<ul style="list-style-type: none"> • Ooid, \approx 35 %, < 0.5 mm • Detrital quartz, \approx 5 %, < 1.0 mm • Detrital Plagioclase 	<ul style="list-style-type: none"> (\geq 55 %) • Sparry calcite • Micritic calcite (• Clay material.) 		<p>Formation: Kambe</p>

Photomicrographs of Rocks in Thin Section
(Sedimentary Rocks)

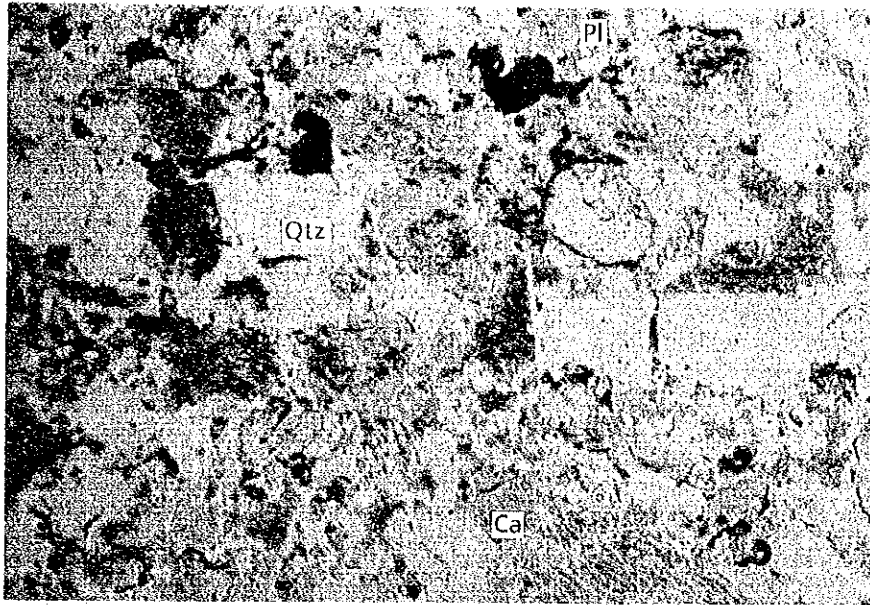
Abbreviations

Minerals

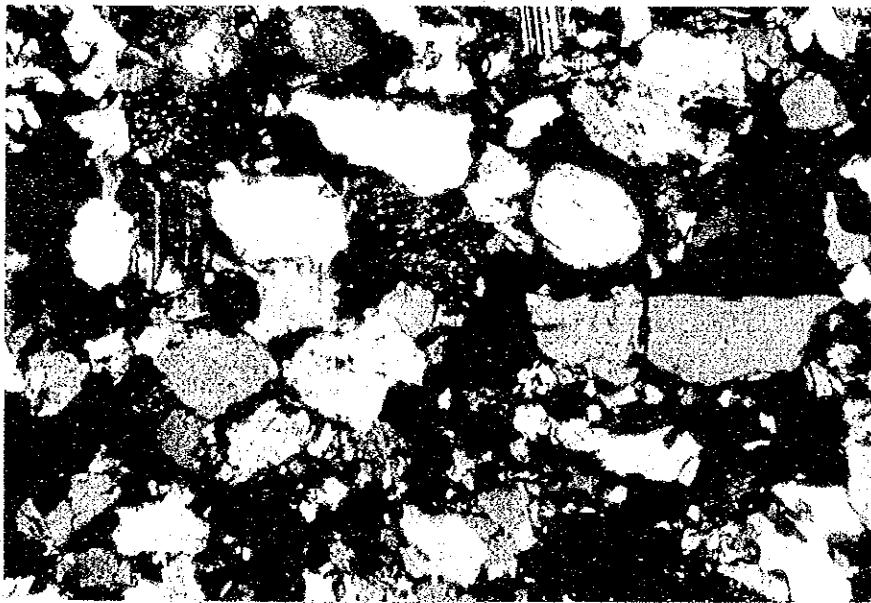
Qtz : quartz	Kf : potassium feldspar
Pl : plagioclase	Bi : biotite
Hor : hornblende	Cpx : clinopyroxene
Ne : nepheline	Ol : olivine
Cn : cancrinite	Sd : sodalite
Ap : apatite	Ti : titanite
Gar : garnet	Tor : tourmaline
Zir : zircon	Ru : rutile
Chl : chlorite	Serp : serpentine
Mus : muscovites	Ca : calcite
Cr : cristobalite	Se : sericite
Non : nontronite	Sm : smectite
Anl : analcime	Lim : limonite
Mt : magnetite	

Others

Cly : clay	Opq : opaque minerals
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one polar

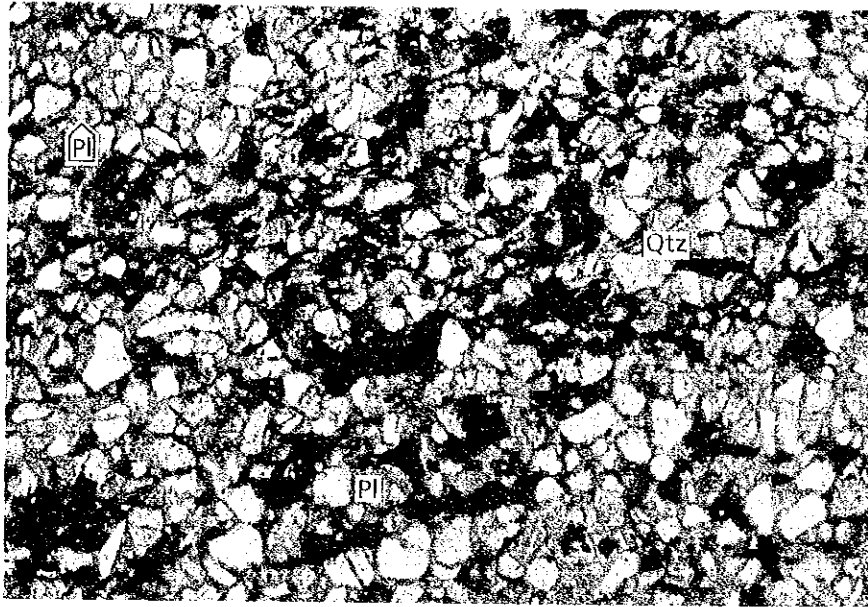


crossed polars

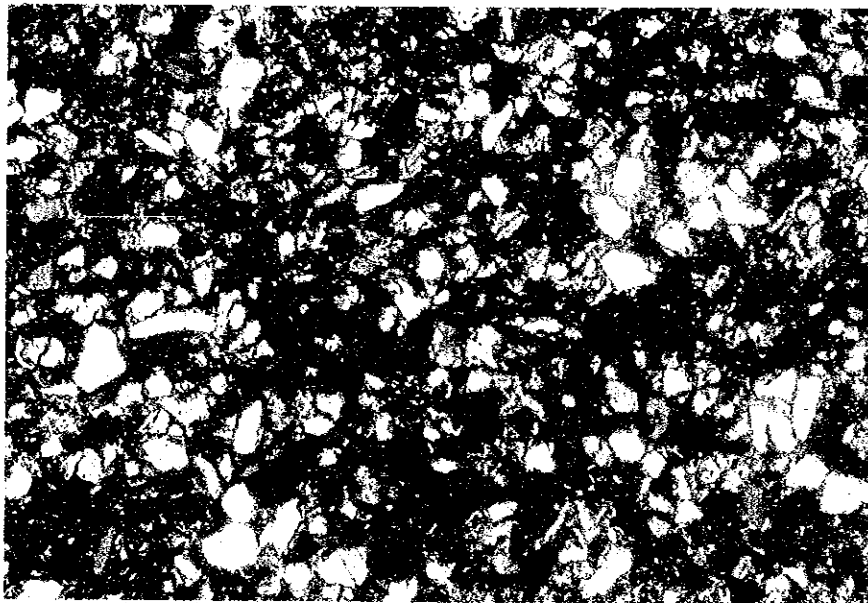
10mm

Sample No. : KR-014
Formation : Taru Formation
(middle)
Location : East of Taru Town
Rock name : Sandstone

Photomicrographs (thin section)



one polar



crossed polars

10mm

Sample No. : SH-32

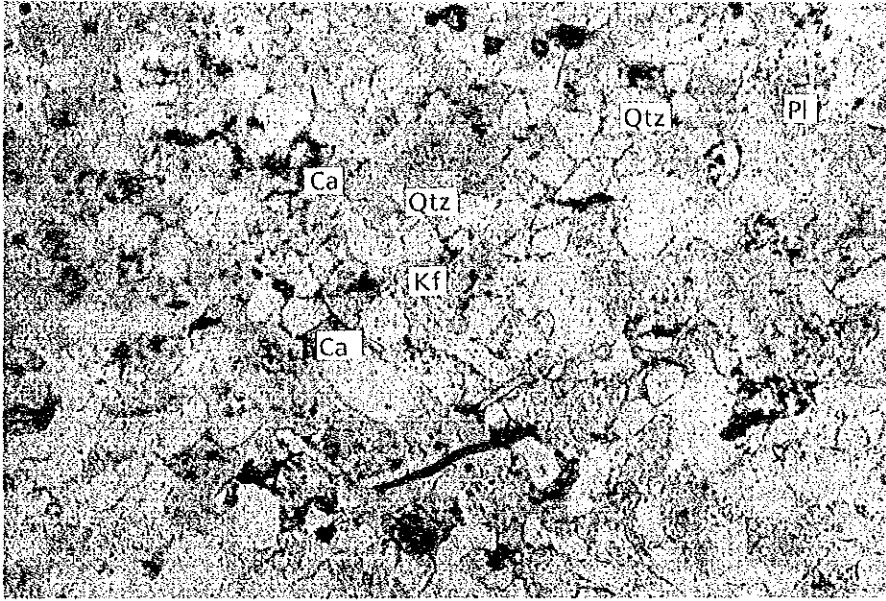
Formation : Maji ya Chumvi

Formation (middle)

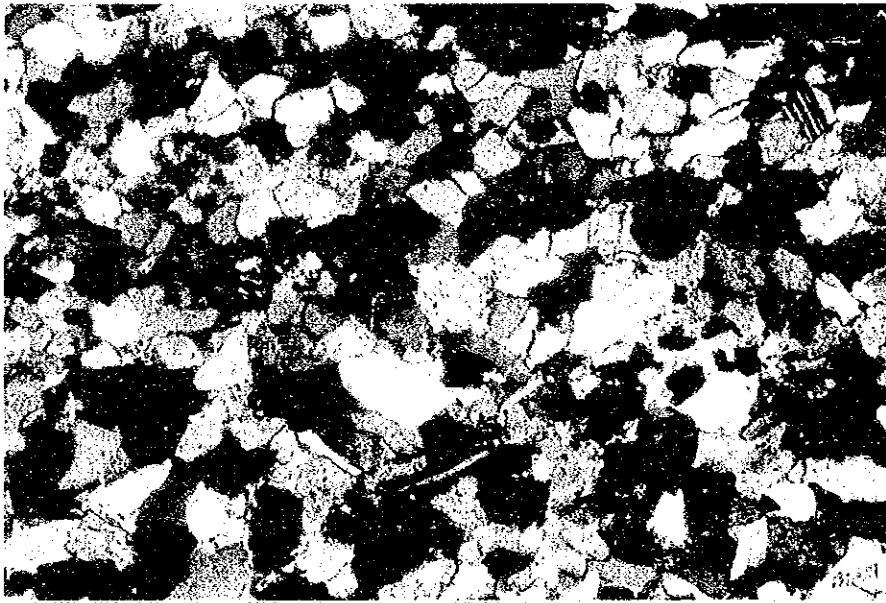
Location : West of Bamba

Rock name : Siltstone

Photomicrographs (thin section)



one polar

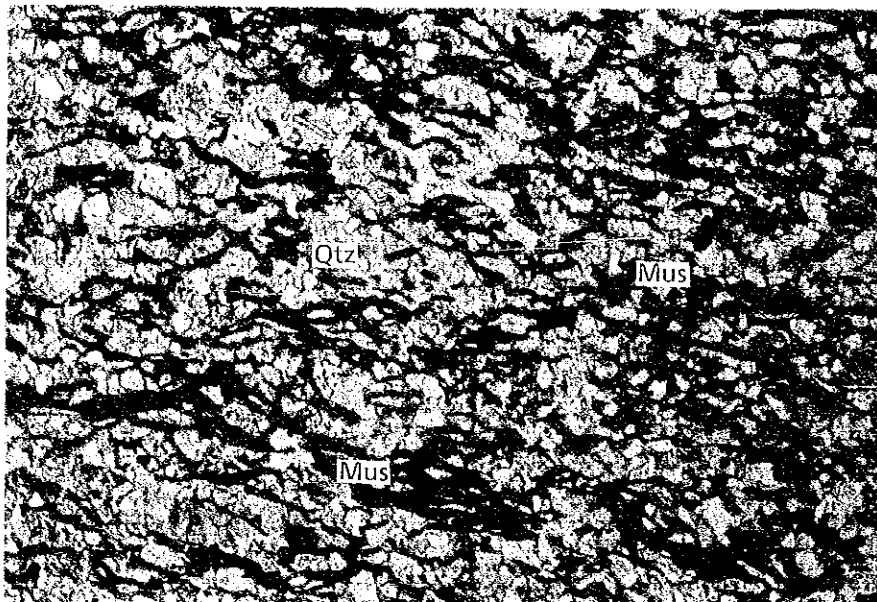


crossed polars

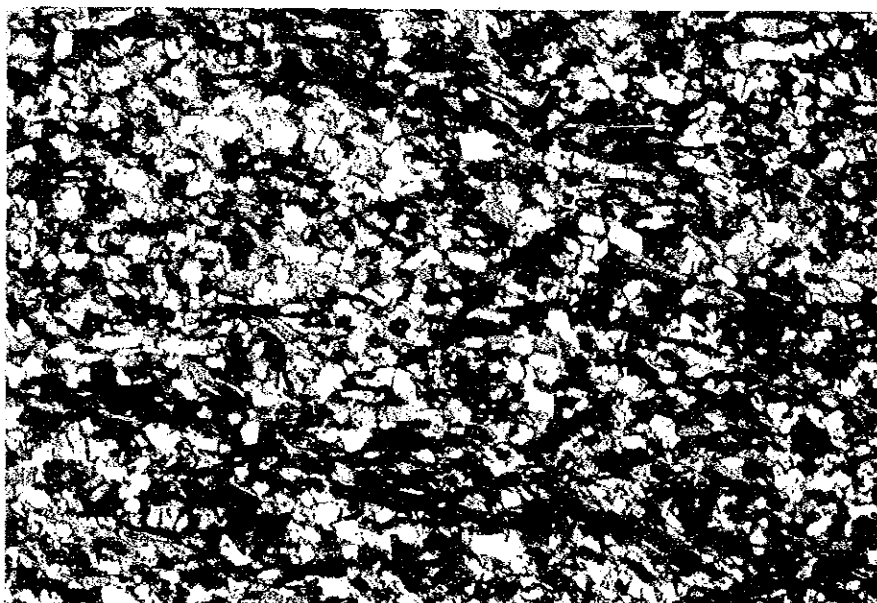
10mm

Sample No.: KR-010
Formation : Maji ya Chumvi
Formation (upper)
Location : Maji ya Chumvi
Rock name : Sandstone

Photomicrographs (thin section)



one polar



crossed polars

1mm

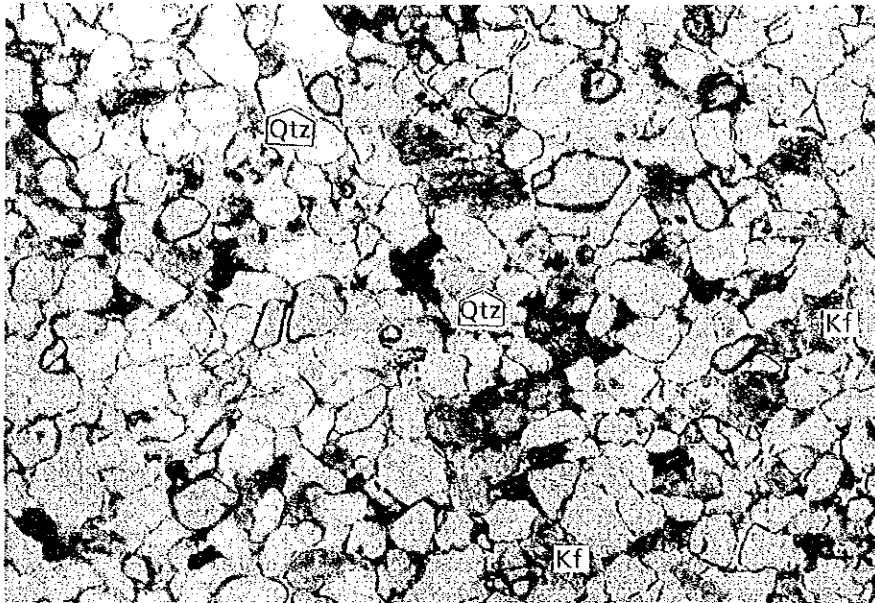
Sample No.: KR-006

Formation : Mariakani Formation
(lower)

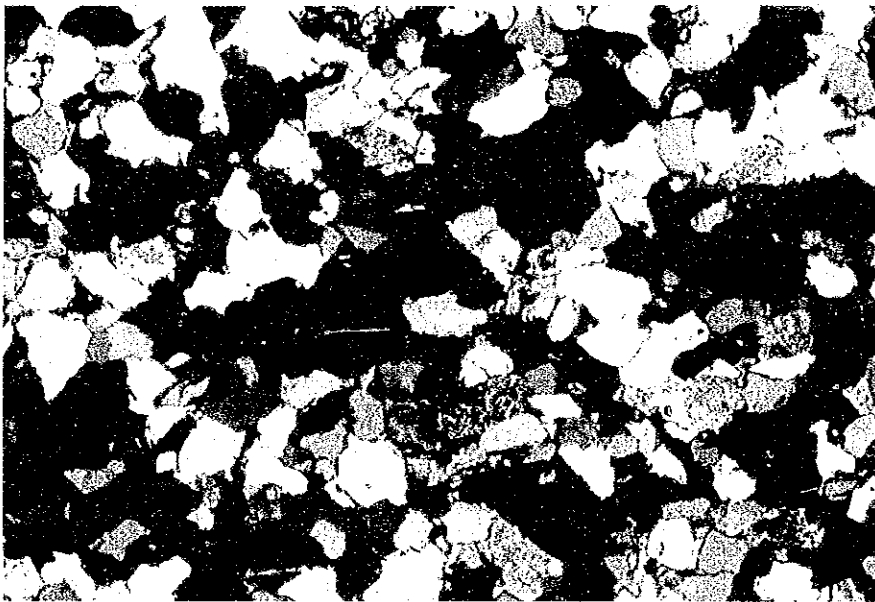
Location : Northwest of Mazeras

Rock name : Sandstone

Photomicrographs (thin section)



one polar

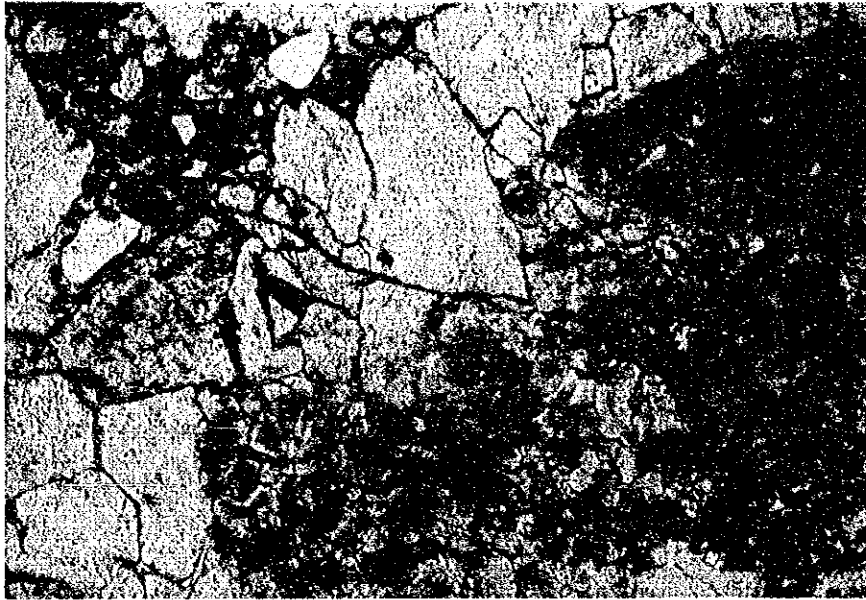


crossed polars

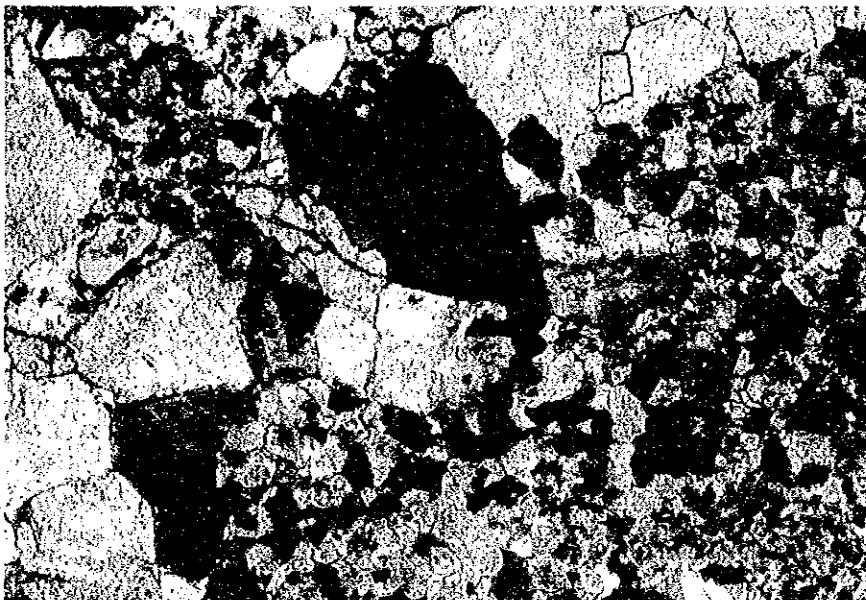
1mm

Sample No.: SH-12
Formation : Mazeras Formation
(upper)
Location : South of Bamba
Rock name : Sandstone

Photomicrographs (thin section)



one polar

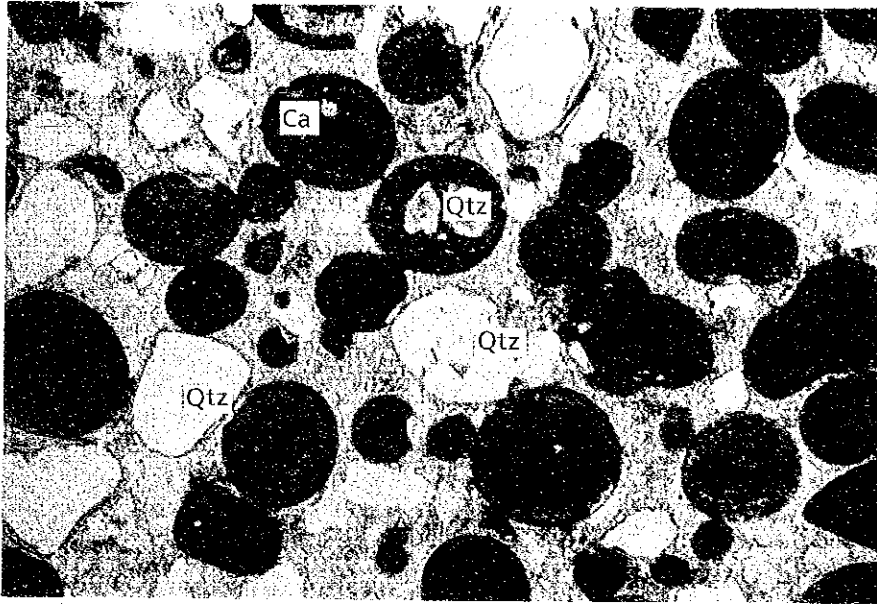


crossed polars

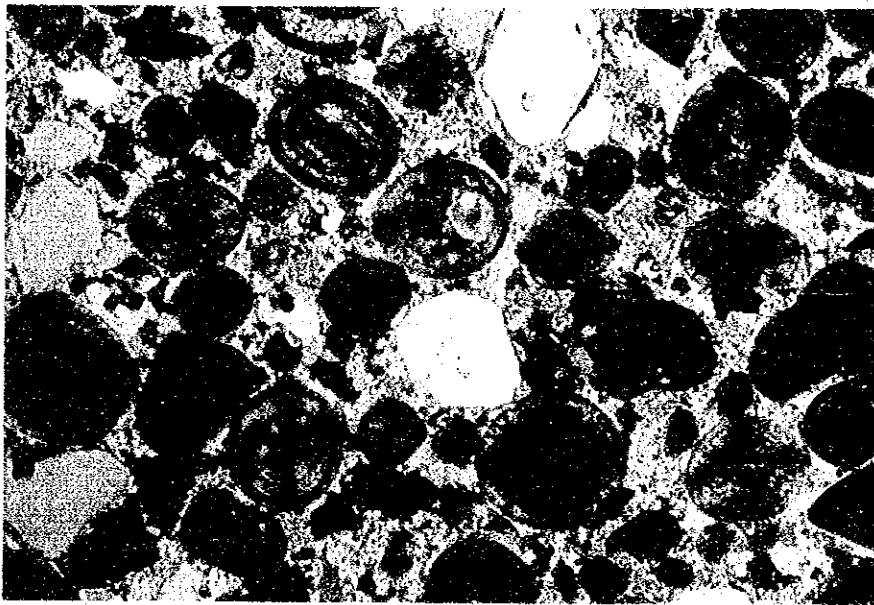
1mm

Sample No. : JA-09
Formation : Kambe Formation
Location : Jaribuni
Rock name : Limestone

Photomicrographs (thin section)



one polar



crossed polars

1mm

Sample No.: MW-05
Formation : Kambe Formation
Location : Mwachi Forest
Rock name : Sandy Ölitic
Limestone

Photomicrographs (thin section)

