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Mining District File Summary Sheet

DISTRICT	Rosebud
DIST_NO	4010
COUNTY If different from written on document	Pershing
TITLE If not obvious	See title page
AUTHOR	Clark, J.; Allen K
DATE OF DOC(S)	2000
MULTI_DIST Y / (N?) Additional Dist_Nos:	
QUAD_NAME	Sulphur 7.5
P_M_C_NAME (mine, claim & company names)	Rosebud Mine; Rosebud Mining Co LLC; Applied Petrographics
COMMODITY If not obvious	gold; silver
NOTES	Petrographic report; geology; photographs 34p

Keep docs at about 250 pages if no oversized maps attached
(for every 1 oversized page (>11x17) with text reduce
the amount of pages by ~25)

SS: DD 7/28/08
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PETROGRAPHY OF SELECTED SAMPLES FROM THE ROSEBUD MINE AREA, NEVADA

(Rosebud Petrographic Report #6)

By

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APPLIED PETROGRAPHICS
Tucson, Arizona

26 April 2000

Prepared for
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Winnemucca, Nevada

INTRODUCTION

Applied Petrographics was requested to conduct detailed petrographic analyses on five samples from the Rosebud mine area. Two of the samples are from drill core, and the other three samples are selected chips from reverse circulation (RVC) drill holes. The objectives of the petrographic analyses are: 1) to characterize the lithologies and attendant alteration and mineralization, and 2) to look specifically for the presence of adularia in the selected RVC drill chip samples. Adularia was identified tentatively under the hand lens by one of the Rosebud Mining company geologists.

METHODOLOGY

Five polished thin sections were prepared by Quality Thin Sections of Tucson, Arizona from samples selected by Kurt Allen, chief geologist for the Rosebud Mining Company LLC. Sample numbers and interpreted lithologies are listed below:

RSD344-99/Btuff	Bedded tuff deposit
RSD344-99/Tcs	Carbonaceous epiclastic volcanic sandstone
RS4948, 1585	Quartz matrix hydrothermal breccia or breccia vein
494-810	Quartz matrix hydrothermal breccia or breccia vein
Green	Latitic or dacitic lava

Each section was examined subsequently in transmitted and reflected light using an Olympus BX60 polarizing microscope, and under cathodoluminescence using a Nuclide ELM-2b Luminoscope mounted on a Nikon SMZ-1 stereo microscope with polarizing capability. Results are documented on photomicrographs taken with an Olympus OM-2 photographic system. The photomicrographs accompany this report as Figures 1 23. Results from the study are presented in the following section.

Abbreviations used in the text for standard petrographic observations are:

TLX - transmitted light, crossed polars

TLP - transmitted light, plane polarized

RL - reflected light

CL - cathodoluminescence

RESULTS

Sample RSD344-99/Btuff

In hand specimen sample RSD344-99/Btuff is a white, porcelainous felsite with traces of very fine disseminated pyrite and narrow, discontinuous fracture veinlets filled with fine gray quartz.

In thin section sample RSD344-99/Btuff is identified as a bedded tuff. It is extremely fine-grained and shows faint stratification under the polarizing microscope. The sample consists primarily of a well-consolidated, crude mesh of microcrystalline quartz and a cloudy grayish brown, nearly amorphous material interpreted to be partly devitrified fine, glassy ash. Average grain size of the ash is less than 0.05mm diameter, while the quartz tends to be finer yet (<0.02mm diameter). Locally the grayish brown fine ash has faint birefringence. The microcrystalline quartz and the faint birefringence developed within the fine, glassy ash probably result from devitrification of the fine ash deposit. The stratification is imparted by elongate zones with a slightly higher abundance of the grayish brown glassy ash. Ash particle shapes are generally irregular, but range from crudely equant to nearly rectangular. Present also are traces of wispy sericite (after pyrogenic biotite?) to 0.04mm in length.

Scattered throughout the sample are patches of slightly coarser polycrystalline quartz with crystal sizes between 0.01 and 0.06mm diameter. The patches are irregularly-shaped and discontinuous, but generally are elongate roughly parallel to the stratification. These quartz segregations may result from vapor phase alteration or, less likely, from the onset of hydrothermal silicification.

The sample is traversed by narrow (≤ 0.1mm width), undulating, and sometimes discontinuous veinlets of very fine-grained polycrystalline quartz. Individual quartz crystals are irregularly-shaped and up to 0.07mm in length/diameter. One of the veinlets contains several opaque crystals to 0.16mm in length.

Very fine-grained, disseminated opaques are present in only trace amounts.

RL: The sample contains traces of very fine-grained, subhedral disseminated pyrite with generally cubic morphology. Maximum crystal size is about 0.03mm diameter. One of the quartz-filled fracture veinlets contains several crudely tabular crystals of an isotropic or very weakly anisotropic phase with moderate reflectance (R=± 40). This phase has a white to creamy white color with a faint pinkish tint and is identified tentatively as galena. The crystals reach about 0.16mm in length by 0.045mm width.

CL: The groundmass has reddish orange CL. Subsequent examination of the sample under the polarizing microscope suggests that this reddish orange CL may result from luminescence of the relict glassy ash. The quartz in the veinlets does not luminesce.

Representative photomicrographs from sample RSD344-99/Btuff appear in Figures 1 - 4.

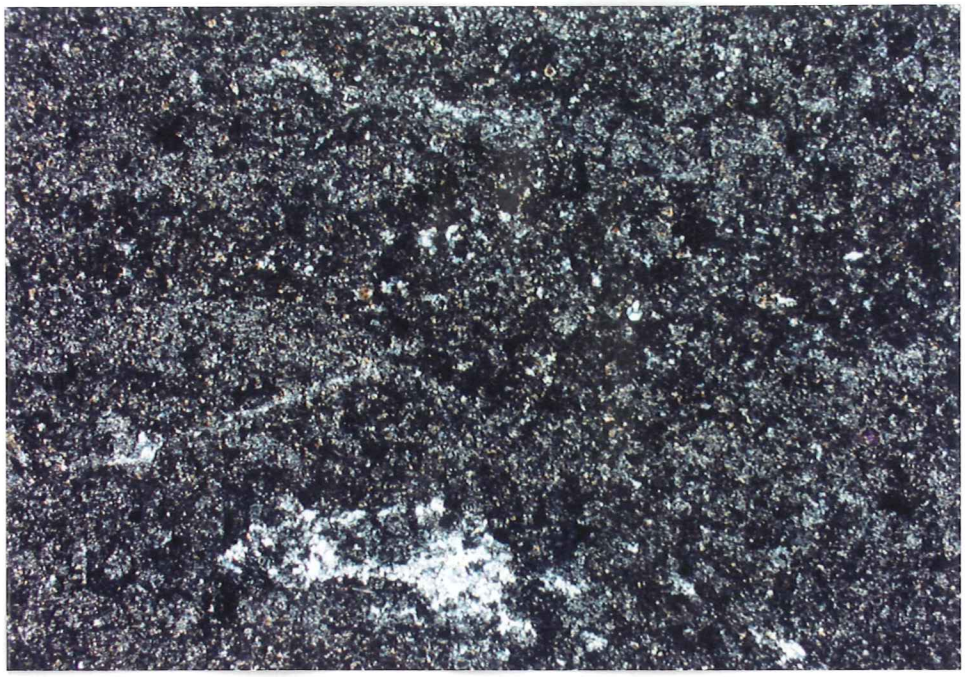

Figure 1a. RSD344-99/Btuff. The sample is a bedded tuff deposit that consists dominantly of fine, glassy ash and its devitrification products. It shows crude stratification and weak silicification (note patch of fine, polycrystalline quartz near lower edge center of photo). TLX; 1cm on the photo= 0.532mm.

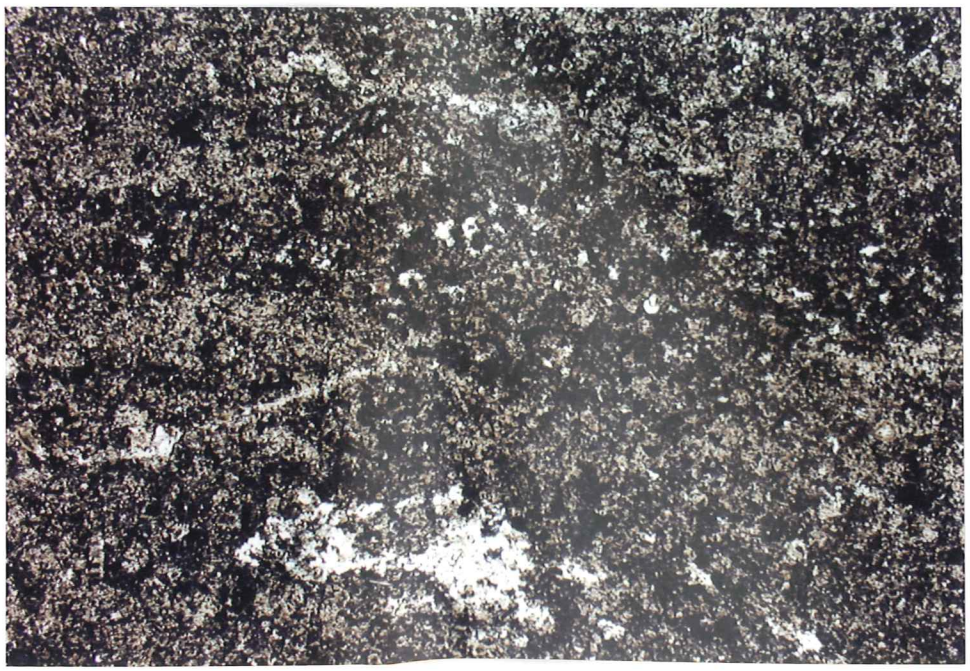

Figure 1b. RSD344-99/Btuff. Same view and scale as figure 1a. TLP; 1cm on the photo= 0.532mm.

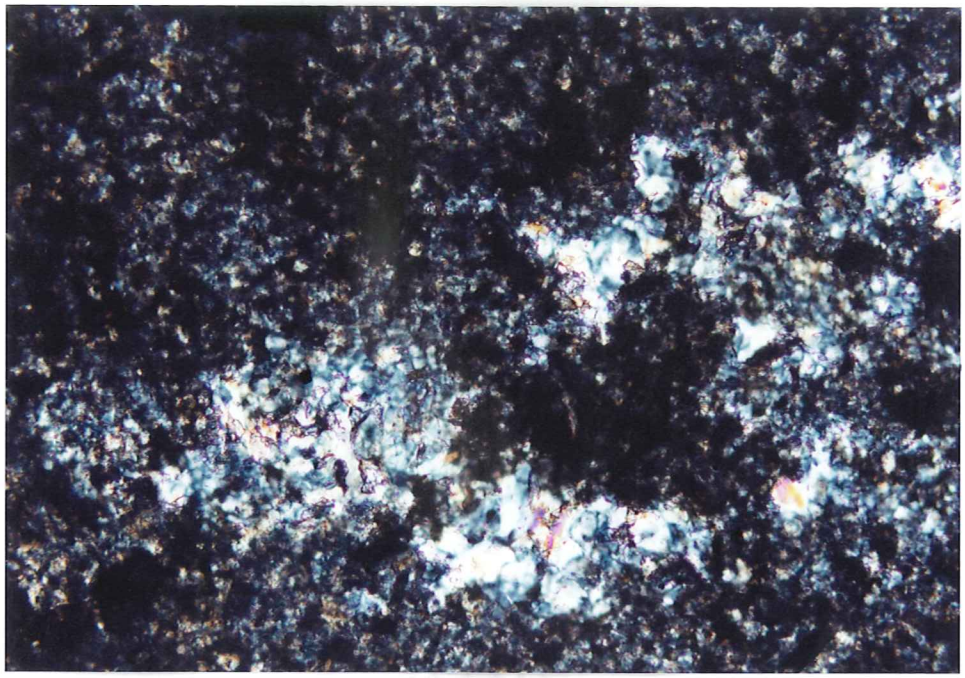

Figure 2a. RSD344-99/Btuff. Bedded tuff deposit. Fine, brown glassy ash and microcrystalline quartz with patches of coarser, polycrystalline quartz silicification. TLX; 1cm on the photo= 0.106mm.

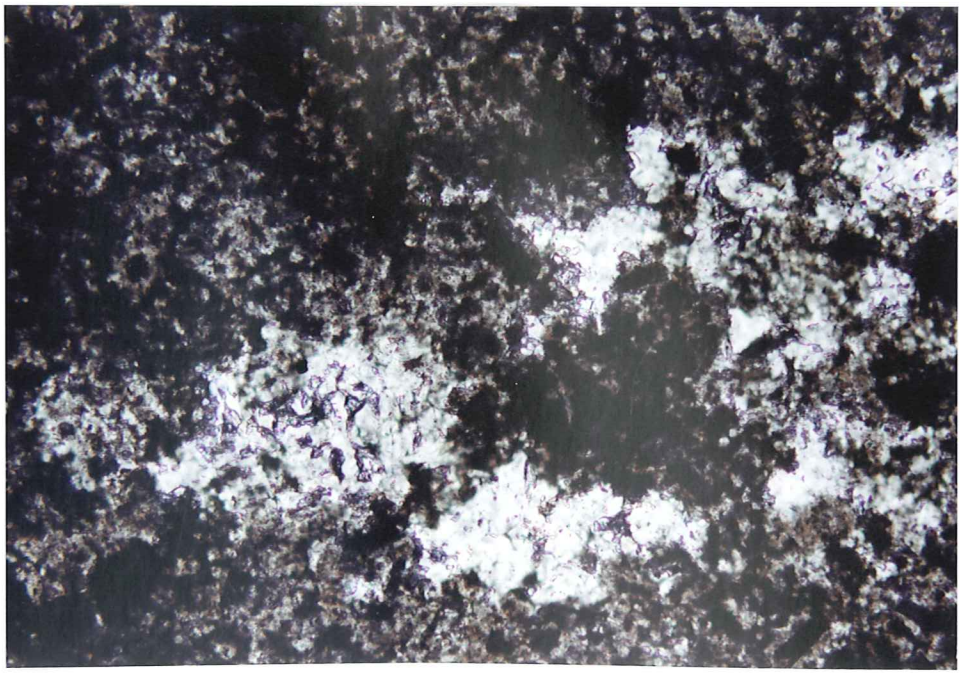

Figure 2b. RSD344-99/Btuff. Same view and scale as Figure 2a. TLP; 1cm on the photo= 0.106mm.

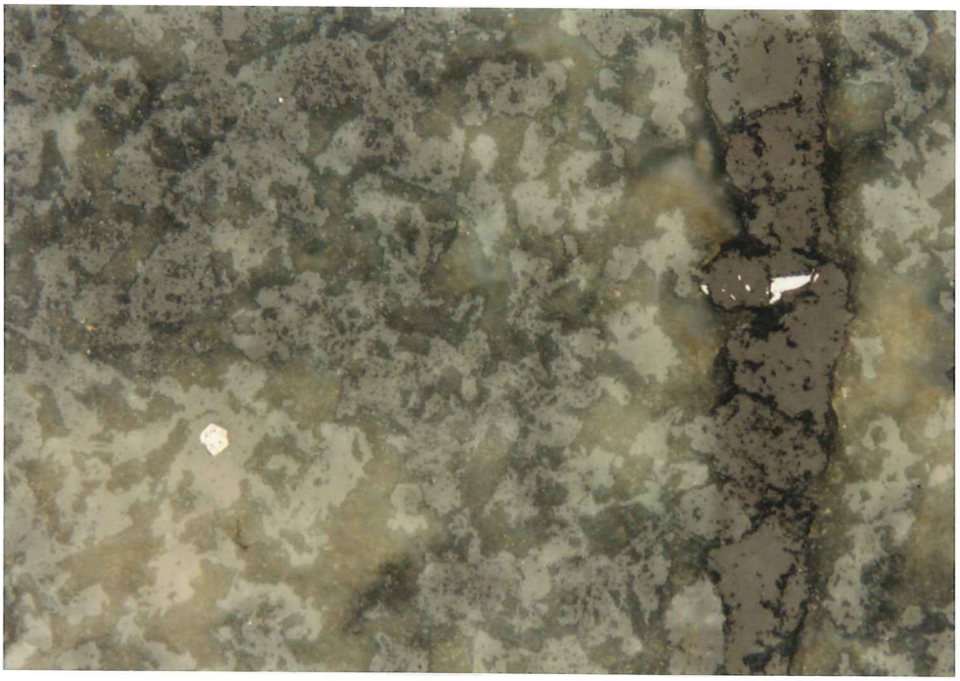

Figure 3. RSD344-99/Btuff. Galena in a quartz veinlet that cuts the bedded tuff (white; moderate reflectance); trace of disseminated pyrite (lower left photo quadrant). RL; 1cm on the photo= 0.053mm.

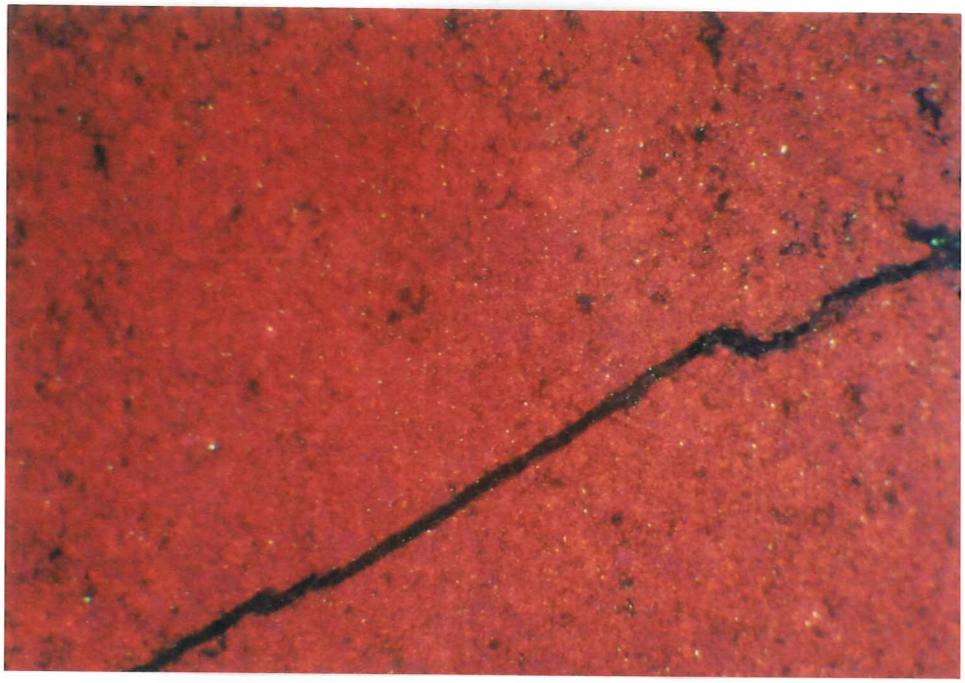

Figure 4a. RSD344-99/Btuff. Bedded tuff deposit. The fine, glassy ash matrix has reddish orange CL, probably due to an activator within the glass itself. The veinlet quartz does not luminesce. CL; 1cm on the photo= 0.558mm.

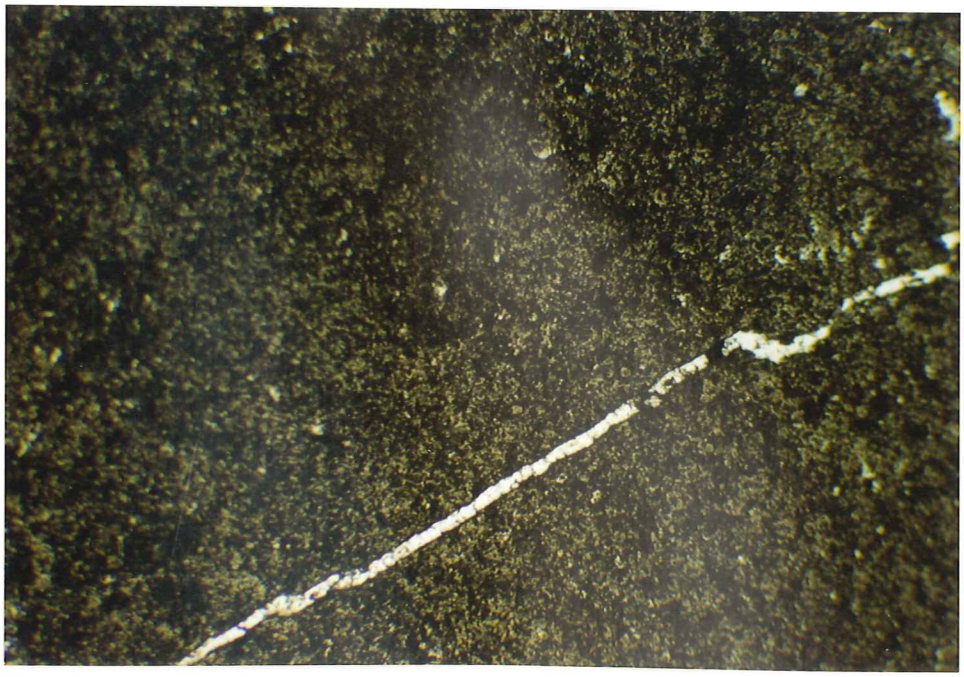

Figure 4a. RSD344-99/Btuff. Bedded tuff deposit. Same view and scale as Figure 4a. TLX; 1cm on the photo= 0.558mm.

Sample RSD344-99/Tcs

In hand specimen sample RSD344-99/Tcs is a grayish brown, fine-grained, laminated epiclastic volcanic sandstone. The laminations are imparted by elongate bits of black carbonaceous material.

Sample RSD344-99/Tcs is classified upon petrographic analysis as a fine-grained, laminated carbonaceous epiclastic volcanic sandstone. The fine sandstone is generally well-sorted and consists predominantly of very fine angular monocrystalline quartz grains, bits of mica (sericite derived from pyrogenic biotite?), polycrystalline quartz grains, volcanically-derived lithic fragments, and wispy bits of carbonaceous material dispersed in a cloudy, brownish gray matrix of very fine, devitrified glassy ash dust. Present also are traces of very fine disseminated opaques. Estimated abundances of individual components are:

Monocrystalline quartz crystal fragments	10-12%
Mica fragments (sericitized biotite?)	2-3%
Polycrystalline quartz grains	2-3%
Volcanic lithic fragments	20-25%
Carbonaceous material	7-10%
Opaques	<0.25%
Partly devitrified fine ash matrix	45-55%

The monocrystalline quartz crystal fragments are angular and range up to 0.3mm in length/diameter. They are interpreted to represent original pyrogenic quartz.

The mica fragments are monocrystalline and have prismatic to equant to somewhat wispy morphology. They reach 0.2mm in length. All of the mica crystal fragments are sericite; no relict biotite remains. They are interpreted to be sericitized pyrogenic biotite crystals.

The polycrystalline quartz grains have xenomorphic-granular texture. Individual crystals reach 0.2mm in diameter, though most are much smaller. The polycrystalline quartz fragments are subangular to subround and up to 0.35mm in diameter. They may represent pieces of quartz vein or fragments of silicified volcanic host rock.

The volcanic lithic fragments are relatively abundant. They are subangular to subround in form and reach 0.35mm in length. Varieties include fragments composed of cryptocrystalline quartz (devitrified tuffaceous matrix) and those that appear to have been hydrothermally altered to fine sericite and quartz. One fragment contained a trace of fine pyrogenic plagioclase.

The carbonaceous material forms wispy to undulatory bits to ≥ 1mm in length. It has black to dark brown color and imparts a moderately well-formed laminated texture to the sample.

Disseminated opaques are very fine-grained, mostly anhedral, and ≤ 0.05mm in length/diameter. They occur as discrete crystal fragments, and in association with quartz vein or altered lithic volcanic fragments.

The matrix of the epiclastic volcanic sandstone is a very fine-grained, cloudy grayish brown mass of relict fine glassy ash dust material and devitrified cryptocrystalline quartz derived

from the fine glassy ash. The devitrification has resulted in a well-compacted epiclastic volcanic sandstone lithology.

RL: The sample contains traces of very fine-grained disseminated pyrite. Individual pyrite crystals are generally anhedral and up to 0.05mm in length/diameter. Some of the disseminated pyrite occurs within epiclastic volcanic lithic grains. Pyrite occurs also as discrete individual crystals. Traces of pyrite are enveloped by some bits of wispy organic material. The carbonaceous material has very low reflectance.

CL: Minor disseminated fine-grained apatite has straw yellow CL (Mn2+ activation). A trace of disseminated calcite has reddish orange CL (Mn2+ activation). The quartz mineral fragments (pyrogenic quartz) have dull blue CL.

Representative photomicrographs from sample RSD344-99/Tcs are given in Figures 5 - 7.

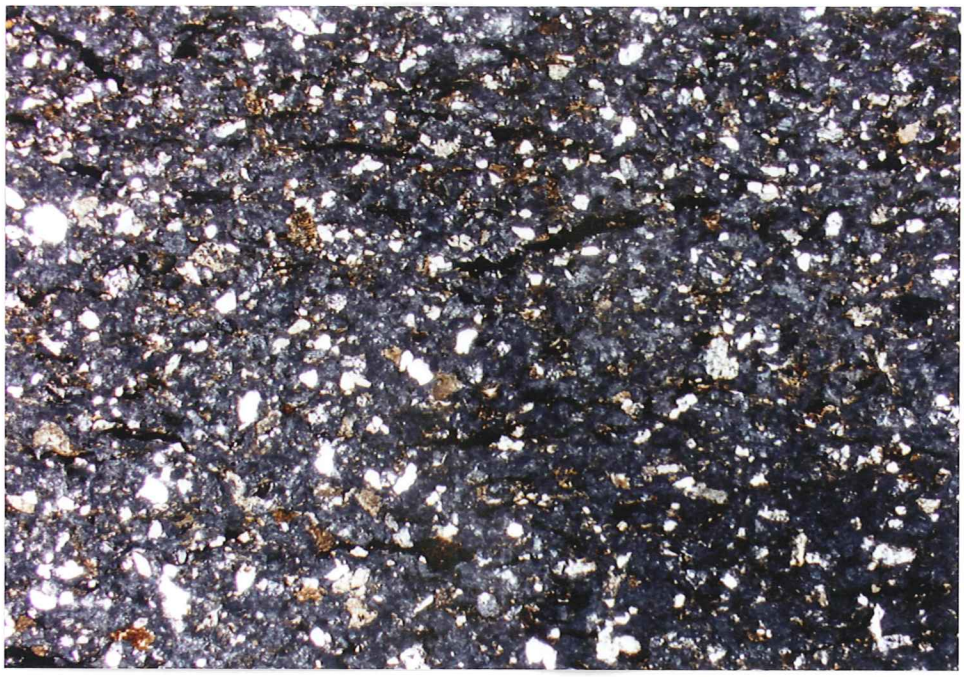

Figure 5a. Sample RSD344-99/Tcs. Carbonaceous epiclastic volcanic sandstone. Elongate wisps of carbonaceous material impart a moderate laminated texture to the fine sandstone, which also contains lithic volcanic fragments and chips of pyrogenic quartz in a matrix of devitrified ash dust. TLX; 1cm on the photo= 0.532mm.

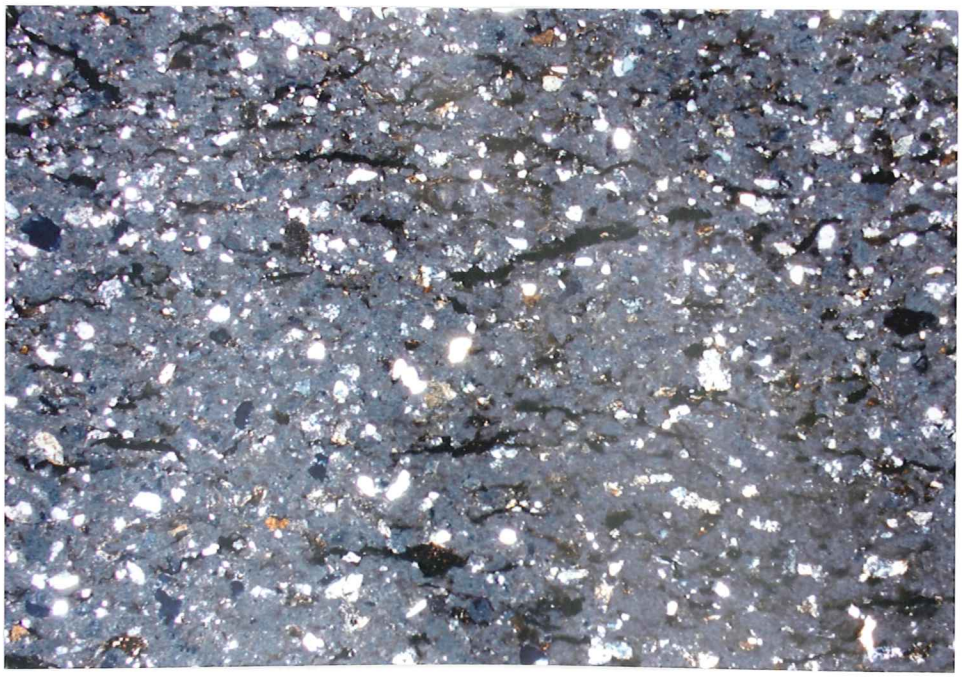

Figure 5b. Sample RSD344-99/Tcs. Carbonaceous epiclastic volcanic sandstone. Same view and scale as Figure 5a. TLP; 1cm on the photo= 0.532mm.

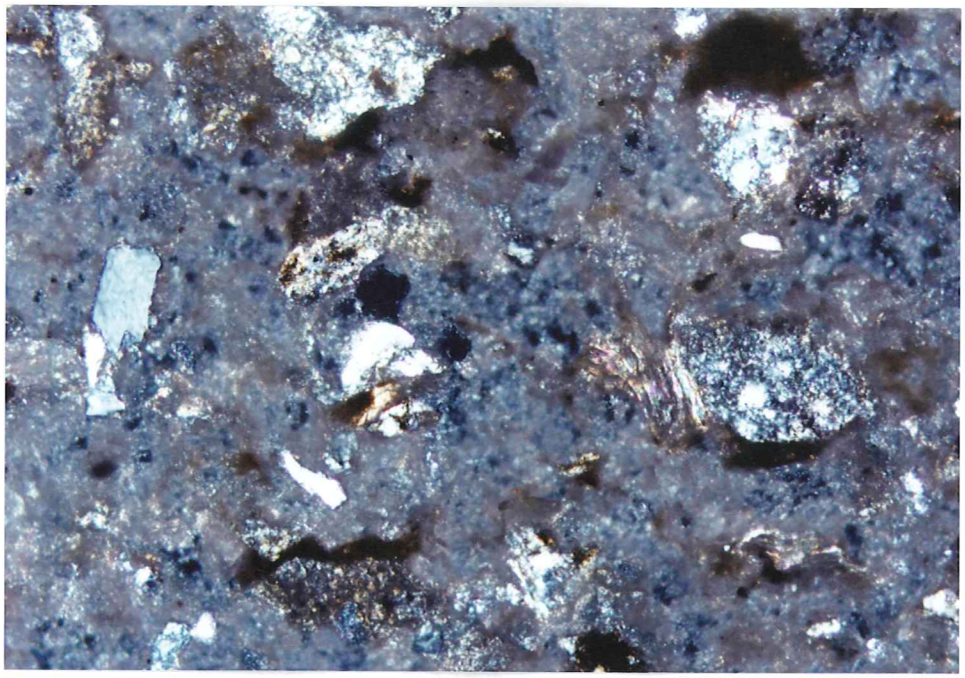

Figure 6a. Sample RSD344-99/Tcs. Carbonaceous epiclastic volcanic sandstone. Altered lithic volcanic fragments, pyrogenic quartz and sericitized biotite, and wispy organic bits in a matrix of devitrified fine ash dust. TLX; 1cm on the photo= 0.106mm.

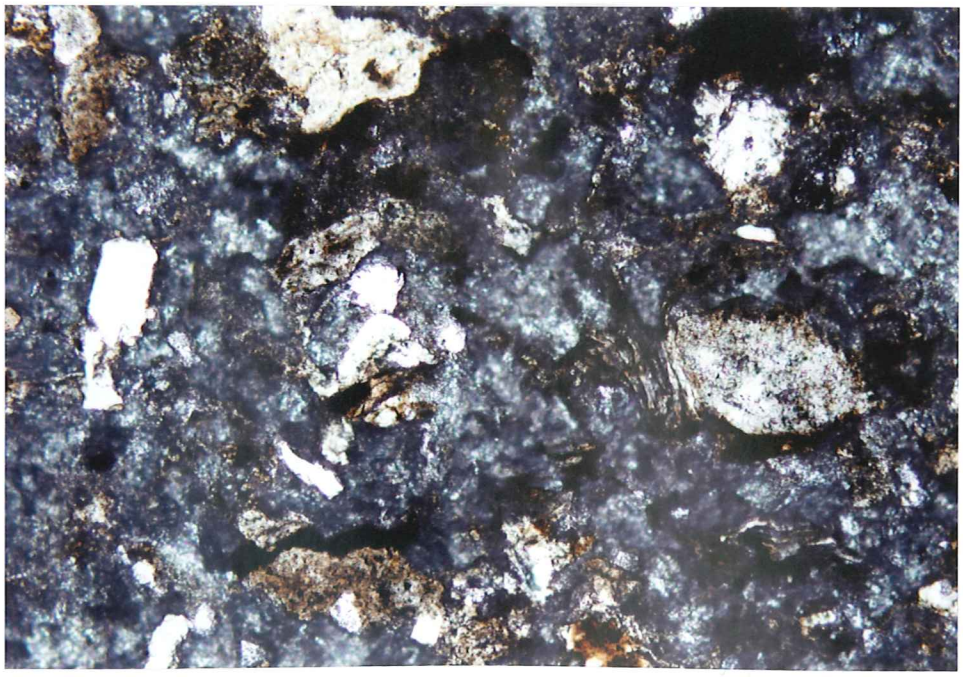

Figure 6b. Sample RSD344-99/Tcs. Carbonaceous epiclastic volcanic sandstone. Same view and scale as Figure 6a. TLP; 1cm on the photo= 0.106mm.

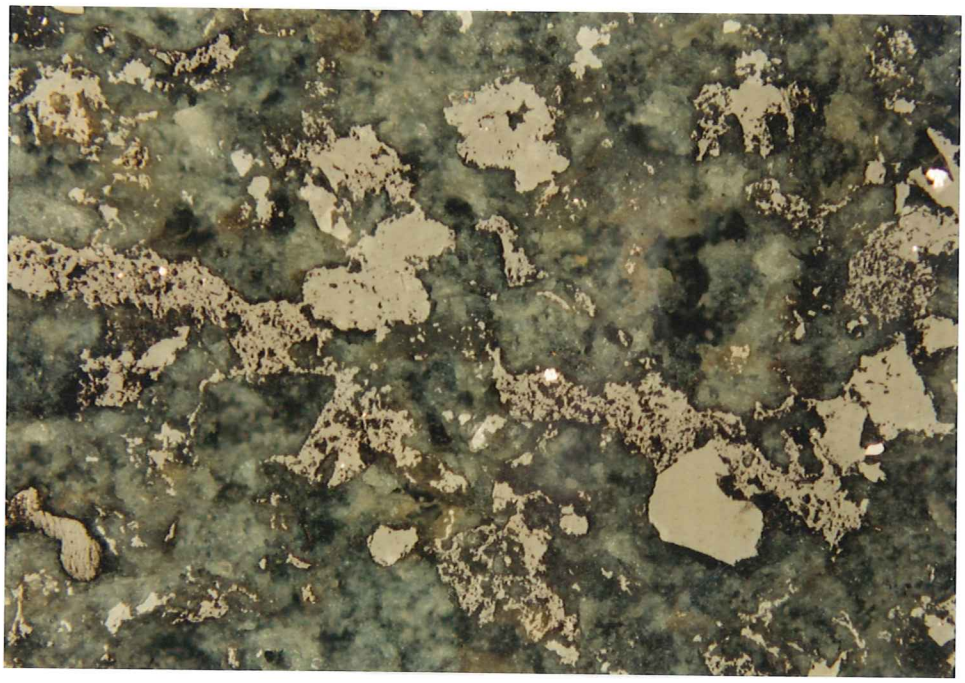

Figure 7. Sample RSD344-99/Tcs. Carbonaceous epiclastic volcanic sandstone. Traces of disseminated pyrite in altered lithic volcanic fragments and wispy carbonaceous bits. The carbonaceous material has very low reflectance. RL; 1cm on the photo= 0.106mm.

Sample RS4948, 1585

Sample RS4948/1585 consists of four selected RVC drill chips. The chips are angular to subangular and up to 1.5cm in length/diameter. Megascopically the chips appear to consist of angular white to light gray silicified lithic fragments dispersed in a very fine-grained matrix of light to medium gray quartz. One of the chips is traversed by a drusy quartz veinlet that cuts the finer-grained vein/breccia matrix quartz. Present also in the microcrystalline quartz matrix are disseminated fine to coarse pyrite and bits of a pinkish white to pinkish brown mineral phase (?) that may be adularia (?).

In thin section the four chips all appear to be pieces of a quartz matrix hydrothermal breccia or vein breccia . Angular fragments of a silicified tuffaceous volcanic lithology are invaded and partly to completely encompassed by a matrix of very fine-grained, xenomorphic-granular quartz. Some of the fragments are crackled by narrow, thread-like to cuneiform veinlets of fine quartz. One of the hydrothermal breccia chips is cut by a sinuous drusy quartz veinlet about 1.1mm in width that transects both volcanic host and fine quartz matrix. Most of the chips carry fine disseminated opaques.

The lithic fragments encompassed by the quartz matrix are dominantly fragmental, glassy pyroclastic rocks that have been variably silicified. Some appear to have been welded lapilli tuffs. The protoliths were composed of brown glass that has been partly devitrified to microcrystalline quartz and alkali feldspar. The devitrification texture is micropoikilitic, in which fine needles of alkali feldspar are encased in fine patches of optically continuous quartz. Individual lapilli within these fragments are angular to subround and up to 4.5mm in length/diameter, although most are much smaller. The lapilli are autolithic to the host. No pyrogenic crystal fragments were noted in lapilli or host. The fragments show variable weak to moderately strong silicification. The silicification fronts migrate along fractures and spread from the fractures into irregularly-shaped patches. Individual crystals within the polycrystalline patches may exceed 0.2mm in diameter. In some cases the silicification is accompanied by relatively abundant opaque minerals (pyrite and/or marcasite).

The fine-grained quartz matrix has an xenomorphic-granular texture, and individual quartz crystals range from < 0.01mm to 0.2mm in diameter. Disaggregated glassy, lithic volcanic material is variably distributed throughout the quartz matrix, as are disseminated opaques. No adularia was identified in either fragments or matrix. It may be that some of the disaggregated lithic volcanic material (pinkish white to pinkish brown in hand specimen) in the quartz matrix was mistaken for adularia.

RL: The sample contains 1 - 2% total sulfides as generally fine-grained pyrite and marcasite. Pyrite is more abundant than marcasite, and marcasite is present only as intergrowths with pyrite. Pyrite occurs as individual crystals and clusters to 0.2mm diameter. The crystals are subhedral to anhedral with cubic, trapezoidal, pyritohedron, and irregular morphologies. Pyrite occurs also intergrown with marcasite in skeletal to acicular crystals to 0.12mm in length. The sulfides are dispersed throughout the quartz matrix hydrothermal breccia.

CL: One of the chips hosting a quartz matrix breccia vein has patchy red and blue CL (quartz and Kspar?). The hydrothermal quartz does not luminesce. Subsequent to the CL examination, the individual zones with red and blue CL were re-examined under the

polarizing microscope at high magnification (200X). Poikilitic devitrification of glassy volcanic ash material appears to be better developed in the red CL zones, where microcrystalline quartz and alkali feldspar (albite?) are intergrown. In the blue CL zones relict glass is more abundant. Alkali feldspar (Kspar-sanidine?) laths are apparent, but quartz crystallization is not well-developed. This relationship is interpreted to result most probably from the devitrification process, but an alternative explanation may be that it is related to alteration associated with hydrothermal brecciation and quartz deposition.

Representative photomicrographs from sample RS4948, 1585 appear in Figures 8 - 13.

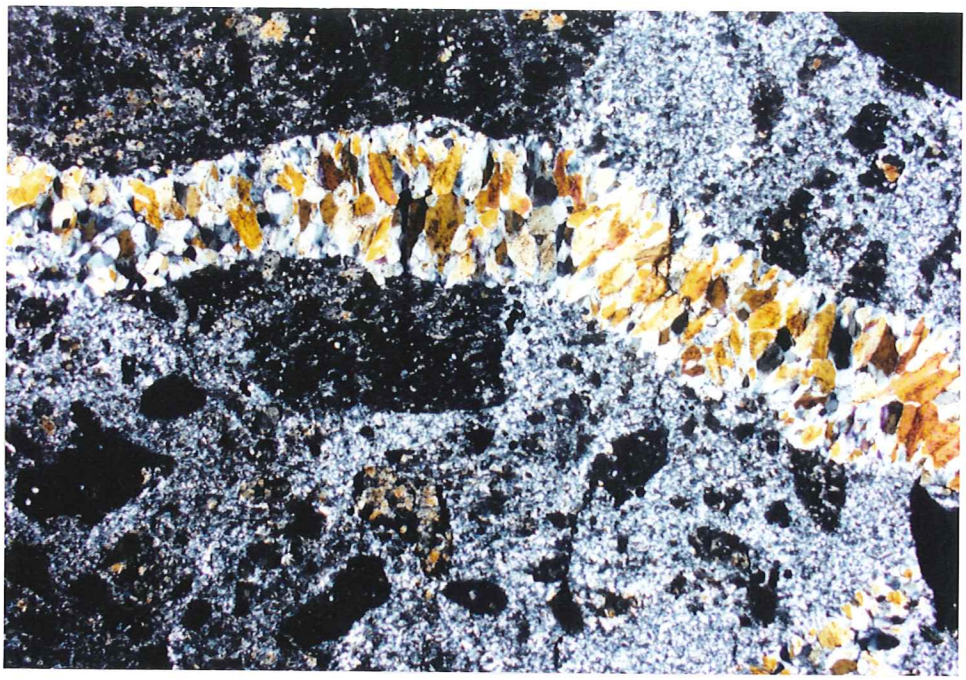

Figure 8a. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. A drusy quartz vein transects the volcanic host and matrix quartz. The volcanic fragments are pyroclastic in origin. Abindant small fragments are dispersed in the fine, polycrystalline quartz matrix. TLX; 1cm on the photo= 0.532mm.

Figure 8b. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Same view and scale as Figure 8a. TLP; 1cm on the photo= 0.532mm.

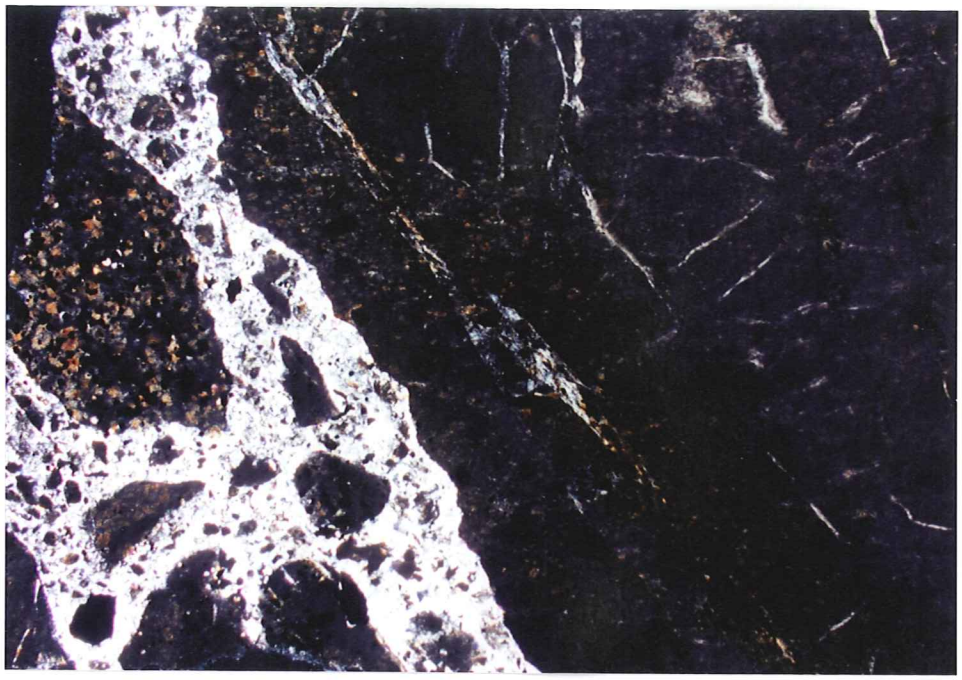

Figure 9a. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Densely welded volcanic host in the right half of the photo is crackled by tiny quartz veinlets. The large fragment at left edge center of the photo has patchy silicification. TLX; 1cm on the photo= 0.532mm.

Figure 9b. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Same view and scale as Figure 9a. TLP; 1cm on the photo= 0.532mm.

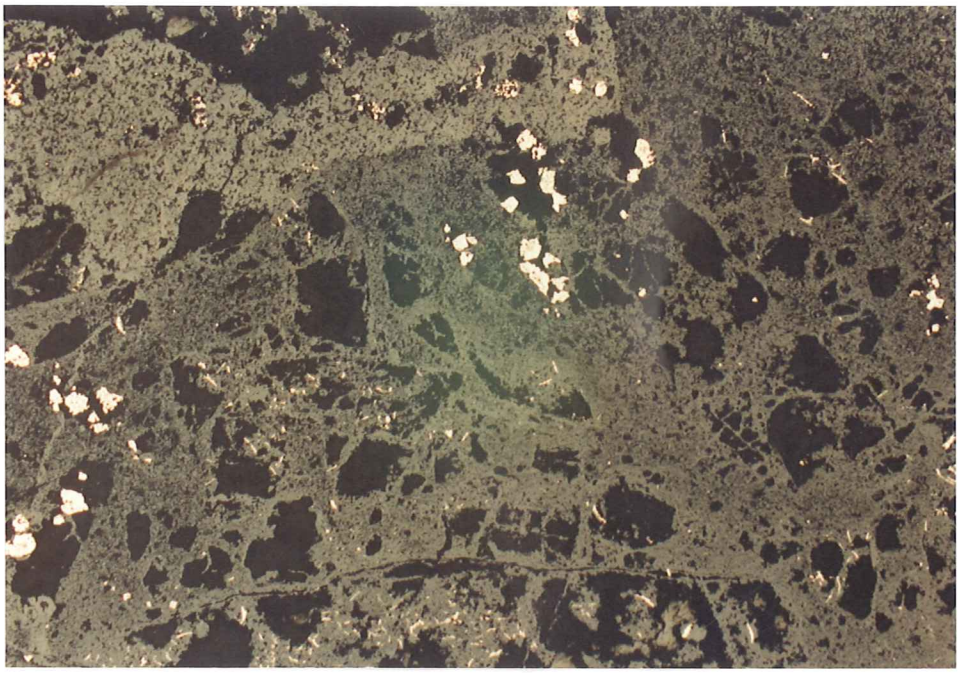

Figure 10. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Disseminated pyrite and fine, skeletal pyrite/marcasite in the tuffaceous volcanic host and matrix quartz. RL; 1cm on the photo= 0.532mm.

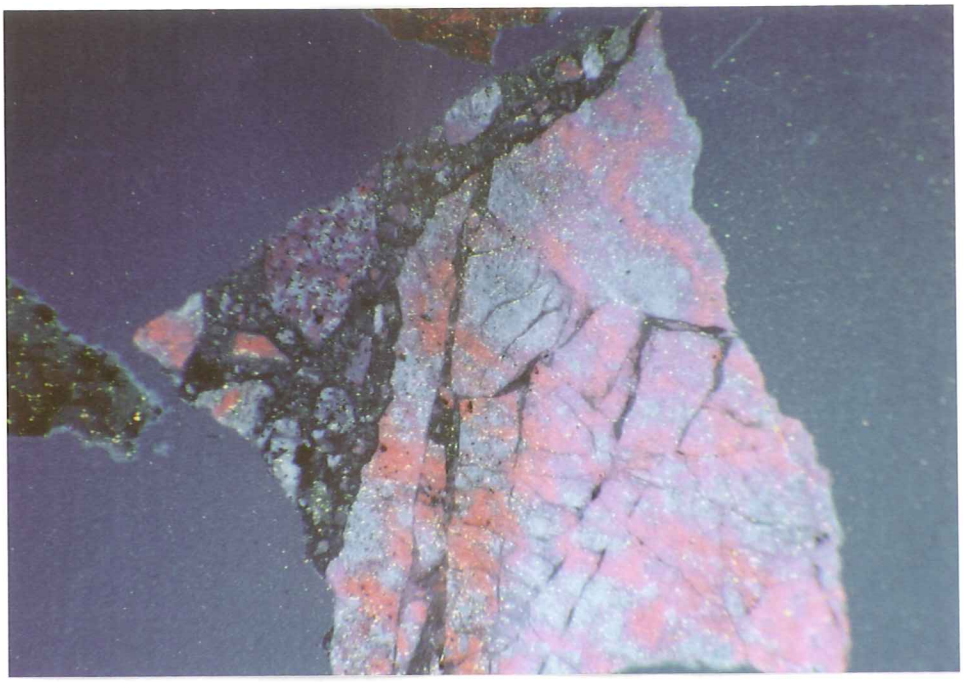

Figure 11a. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. The host lithology is devitrified, strongly welded tuff. Patchy zones with blue and red CL most likely represent different stages in the devitrification process (see text for description and explanation. CL; 1cm on the photo= 1.111mm.

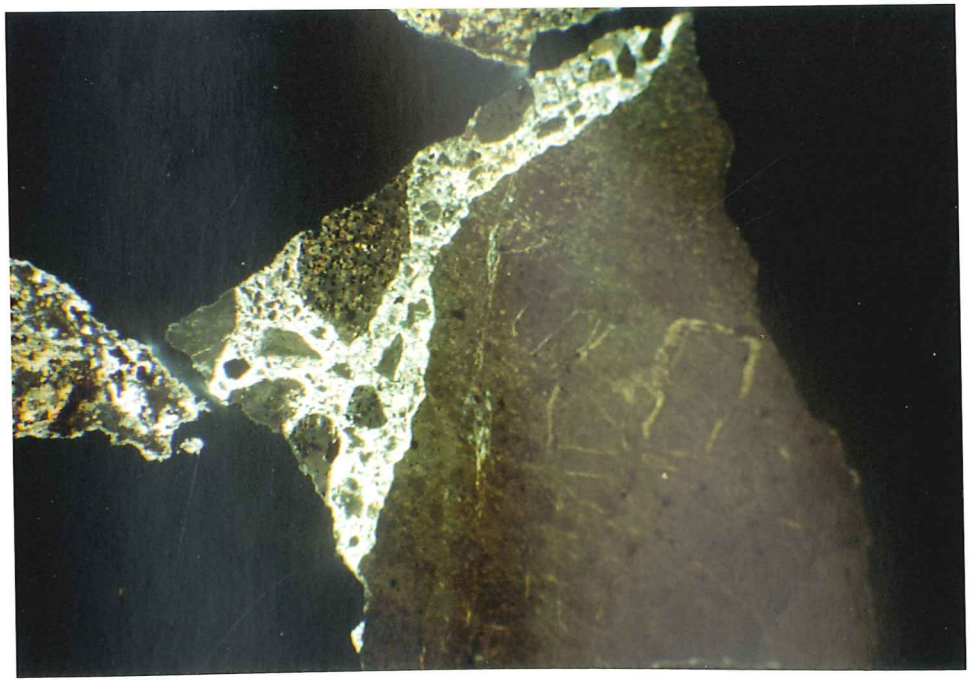

Figure 11b. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Same view and scale as figure 11a. TLX; 1cm on the photo= 1.111mm.

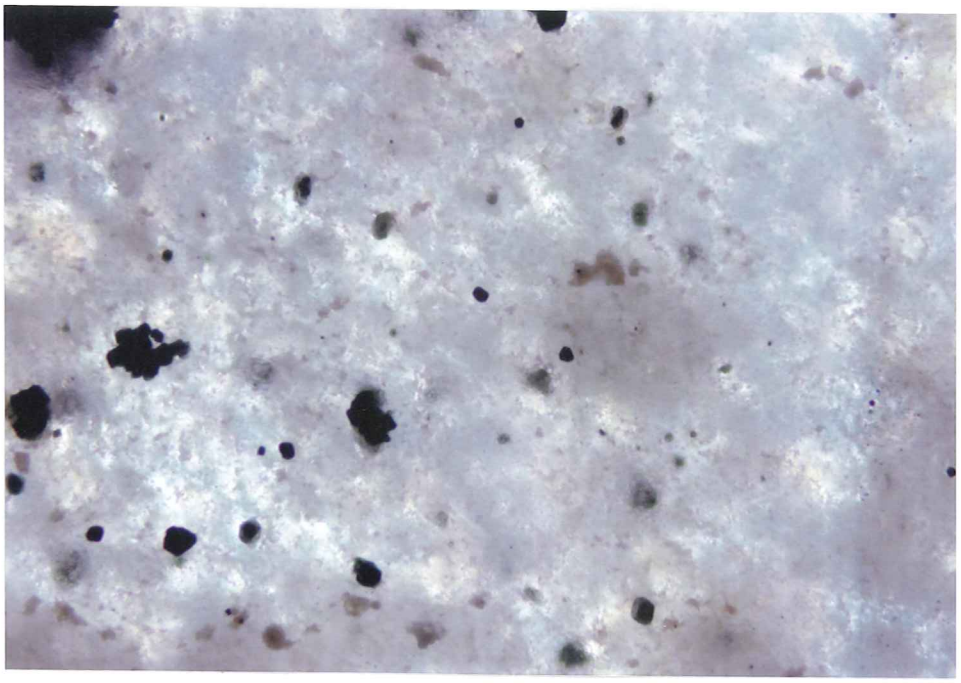

Figure 12a. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Close-up of red CL zone in the devitrified tuff. Relict brown glass with poikilitic quartz-alkali feldspar devitrification patches. TLX; 1cm on the photo= 0.053mm.

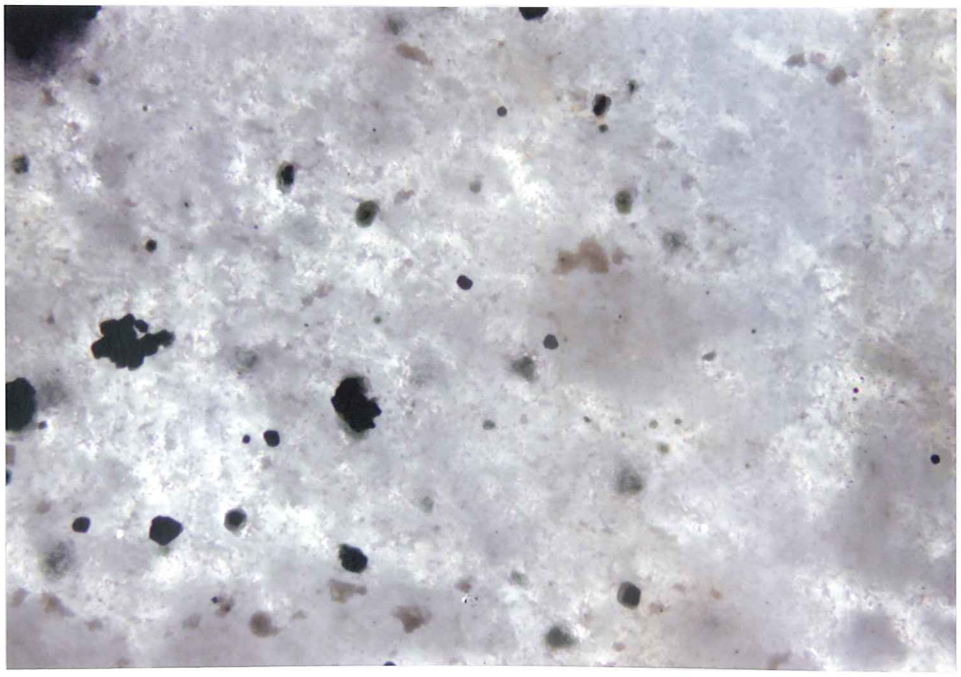

Figure 12b. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Same view and scale as Figure 12a. TLP; 1cm on the photo= 0.053mm

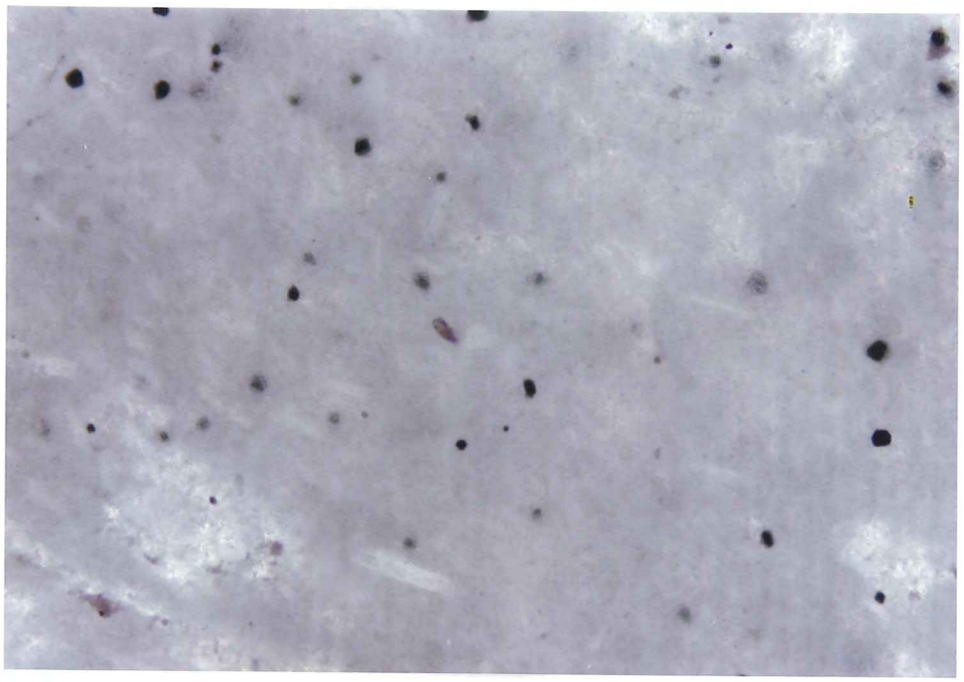

Figure 13. Sample RS4948, 1585. Quartz matrix hydrothermal breccia/vein breccia. Close-up of blue CL zone. Brown glass is more abundant than in red CL zone. Alkali feldspar microlites are noticeable, but quartz is nota well-developed component of the devitrification assemblage.

Sample 494-810

Sample 494-810 is a selected RVC drill chip. Under the hand lens the chip appears to be a quartz matrix hydrothermal breccia. It consist of angular fragments of white microcrystalline quartz dispersed in a gray microcrystalline matrix with about 2% very fine disseminated pyrite.

In thin section sample 494-810 is interpreted as a piece of glassy pyroclastic volcanic rock, perhaps a densely welded vitrophyre with very sparse pyrogenic crystals, that has been invaded by a quartz breccia vein. The pyroclastic host is moderately well-stratified, and the stratification is imparted by an interpreted relict eutaxitic texture. The vitrophyre consists of grayish brown glass and its devitrification products. It shows variable intensity of devitrification. The more densely welded fiamme(?) have a higher proportion of glass, while the matrix has glass, microcrystalline quartz, and alkali feldspar crystallites. Disseminated opaques are more abundant in the glassier parts of the host. The sparsely distributed pyrogenic crystals appear to have included feldspar and biotite. The feldspar laths are euhedral and reach about 0.8mm in length. Abundance is less than 0.1 %, and the crystals are completely pseudomorphed by microcrystalline quartz and clay/sericite. Former pyrogenic biotites are completely altered to sericite/clay pseudomorphs to 0.1mm in length.

The devitrification has a micropoikilitic texture in which microscopic patches of quartz poikilitically enclose alkali feldspar microlites. The micropoikilitic patches are generally on the order of 0.1mm in diameter, and are interpreted to result from initial high-temperature devitrification of the densely welded glass. The proportion of quartz in the patches appears to be higher in the more densely welded relict fiamme. Some of the alkali feldspar microlites have minor clay/sericite alteration.

The quartz vein breccia occurs at the edge of the chip. It consists of saccharoidal polycrystalline quartz with individual crystals up to 0.2mm in diameter. Average quartz crystal size is on the order of 0.03mm in diameter. Minor wisps of very fine clay occur along the vein margin and along quartz crystal boundaries. The polycrystalline vein or breccia matrix contains disaggregated angular to subangular fragments of the devitrified pyroclastic host. The longest fragment may have spalled from the vein wall and is about 8mm in length. The coarsest quartz crystals occur along the vein wall and, discontinuously, along fragment margins. Some of the fragments have an unusual patchy silicification similar to that noted in sample RS4948/1585. Texturally these silicification patches, which average about 0.1mm in diameter, are similar to the patches of poikilitic devitrification, but they lack accompanying alkali feldspar. The fragments dispersed in the vein contain minor disseminated opaques, as does the vein quartz.

RL: The hydrothermal breccia contains about 2-3% disseminated pyrite. The pyrite occurs as subhedral to anhedral crystals to 0.45mm diameter. Most of the diseminated pyrite is on the order of 0.03 - 0.05mm in diameter. Morphology is grossly cubic or irregularly equant (formerly pyritohedron). The larger crystals have somewhat corroded cores.

CL: The hydrothermal quartz matrix is non-luminescent. Within the tuffaceous volcanic host are crudely alternating bands with redCL and light blue CL, respectively, similar to the zones of patchy red and light blue CL described for sample RS4948, 1585. These zones are interpreted to result from different stages of devitrification. The zones of red CL

have better developed poikilitic devitrification, in which alkali feldspar microlites are poikilitically encased by fine quartz patches and relict glass is less abundant. The zones of light blue CL contain alkali feldspar microlites, but glass is more abundant, and quartz crystallization is not as well developed. A less likely explanation is that the unusual CL patterns may result from hydrothermal alteration accompanying brecciation and quartz deposition.

Representative photomicrographs from sample 494-810 are shown in Figures 14 - 18.

Conclusions on the presence of adularia

Detailed examination under the polarizing microscope and Luminoscope did not reveal the presence of adularia in any of the samples examined for this study. Material identified as adularia in the hand specimens (chips) of samples RS4948, 1585 and 494-810 is probably altered and disaggregated fragmental volcanic rock. Cathodoluminescence examination of the two samples revealed unusual patchy to banded zones with red CL or light blue CL. These zones probably reflect different stages of the devitrification process. The areas with red CL appear to have reasonably well-developed micropoikilitic devitrification texture in which feldspar microlites are encased in fine quartz patches and relict glass is subordinate. The light blue CL zones consist predominantly of alkali feldspar microlites and glass, and quartz crystallization is not well-developed. It may also be possible that the red and light blue CL relationships are due to an unusual alteration associated with the quartz matrix breccia formation. this possibility is deemed unlikely, however.

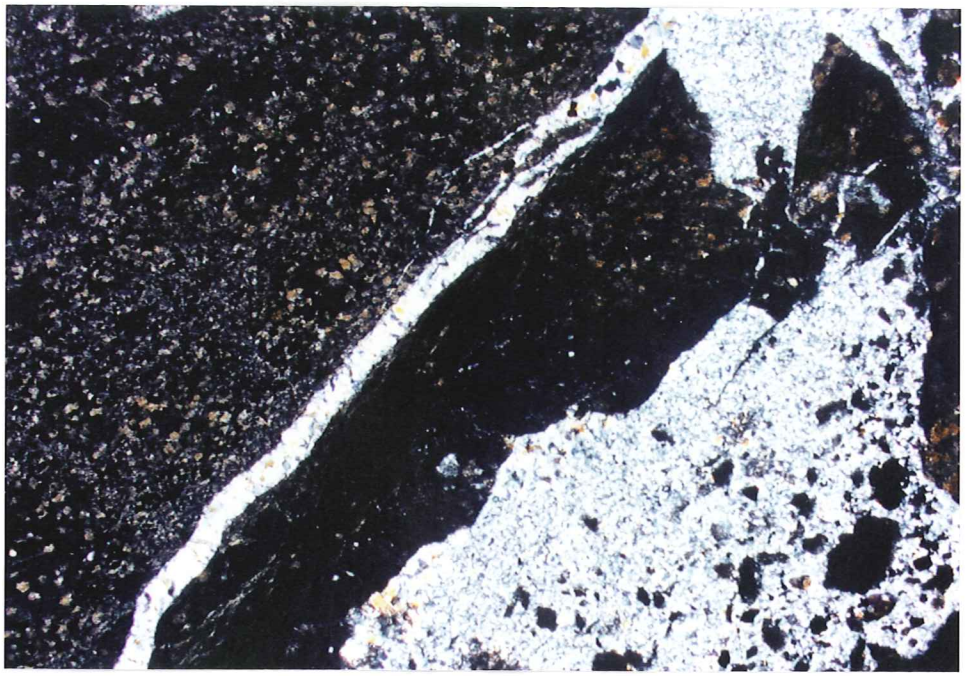

Figure 14a. Sample 494-810/quartz matrix vein breccia. Partly silicified vitrophyre invaded by a quartz matrix breccia vein. The fine, polycrystalline quartz in the breccia matrix contains abundant disaggregated volcanic fragments similar to the host. TLX; 1cm on the photo= 0.532mm.

Figure 14b. Sample 494-810/quartz matrix vein breccia. Same view and scale as Figure 14a. Note relict eutaxitic texture in upper left photo quadrant. TLP; 1cm on the photo= 0.532mm.

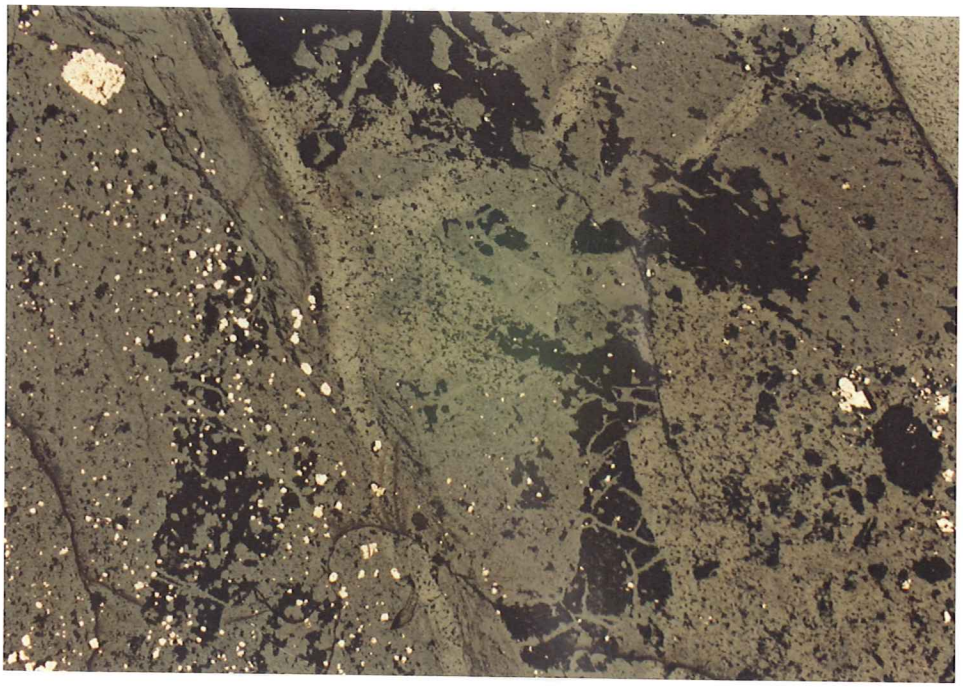

Figure 15. Sample 494-810/quartz matrix vein breccia. Disseminated pyrite is concentrated in the host vitrophyre. RL; 1cm on the photo= 0.532mm.

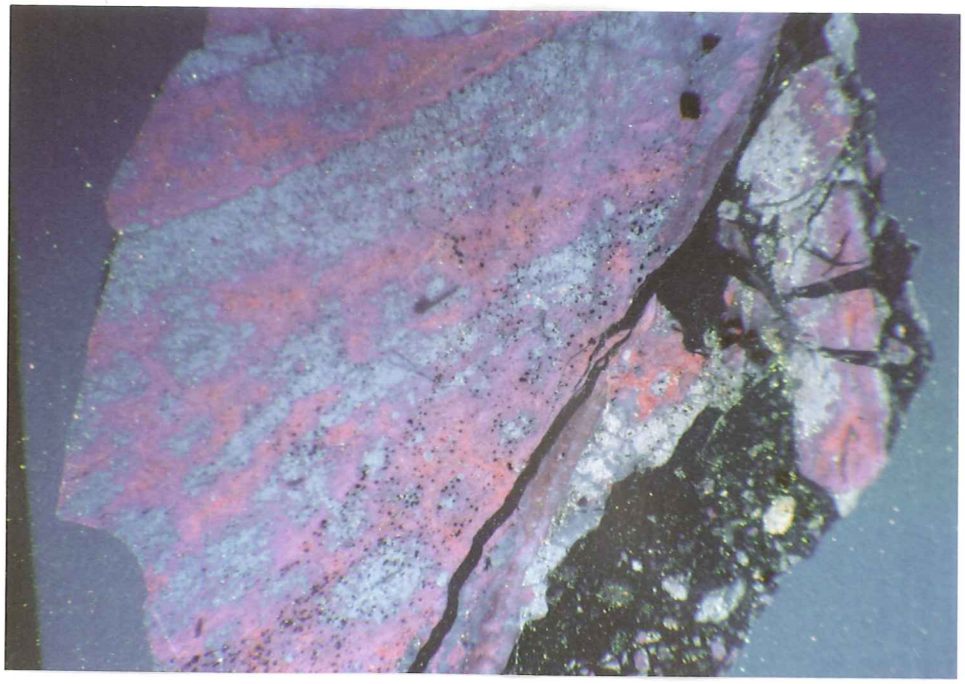

Figure 16a. Sample 494-810/quartz matrix vein breccia. Banded zones of alternating red and light blue CL most probably reflect different devitrification stages. See text for explanation. CL; 1cm on the photo= 1.163mm.

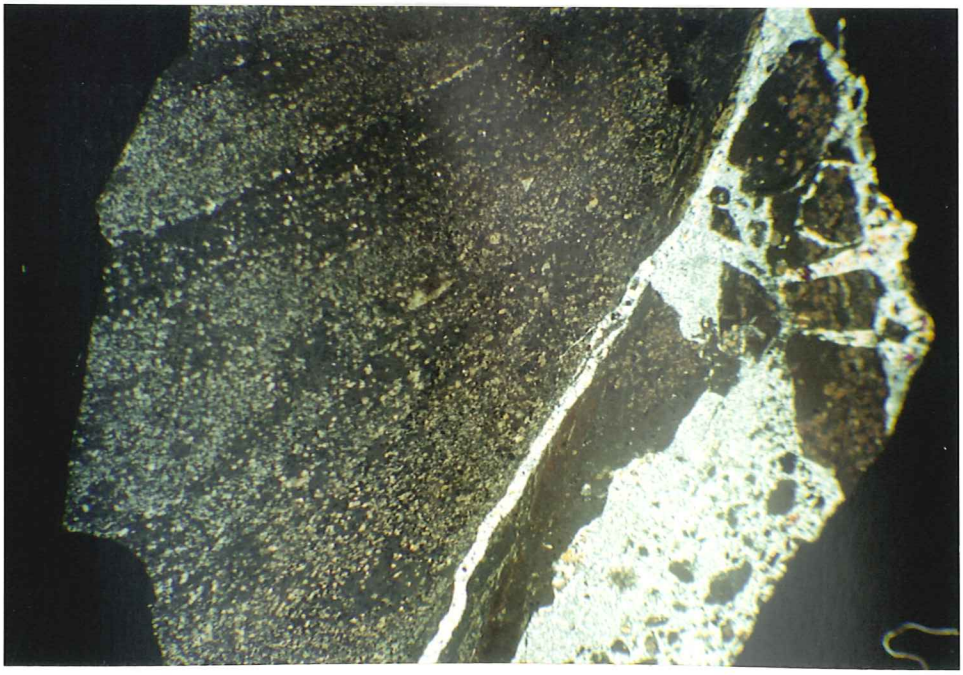

Figure 16b. Sample 494-810/quartz matrix vein breccia. Same view and scale as Figure 16a. Note interpreted eutaxitic texture in the host vitrophyre. TLX; 1cm on the photo= 1.163mm.

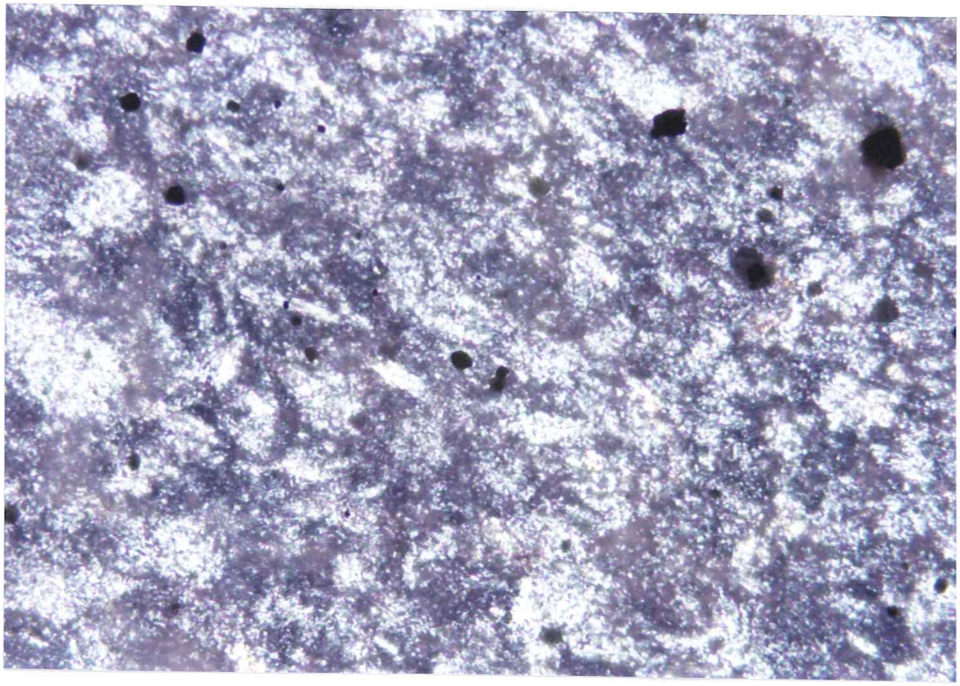

Figure 17a. Sample 494-810/quartz matrix vein breccia. A close-up view of one of the zones with red CL. Poikilitic devitrification is well-developed with fine microlites of alkali feldspar encased in fine quartz patches. Relict grayish brown glass is present, as well. TLX; 1cm on the photo= 0.053mm.

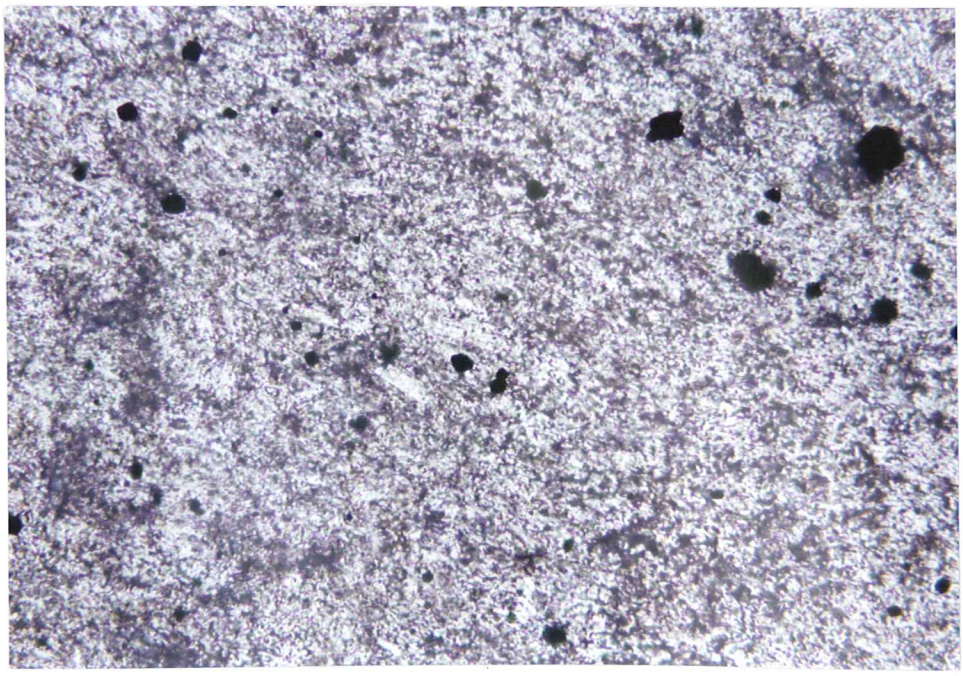

Figure 17b. Sample 494-810/quartz matrix vein breccia. Same view and scale as figure 17a. TLP; 1cm on the photo= 0.053mm.

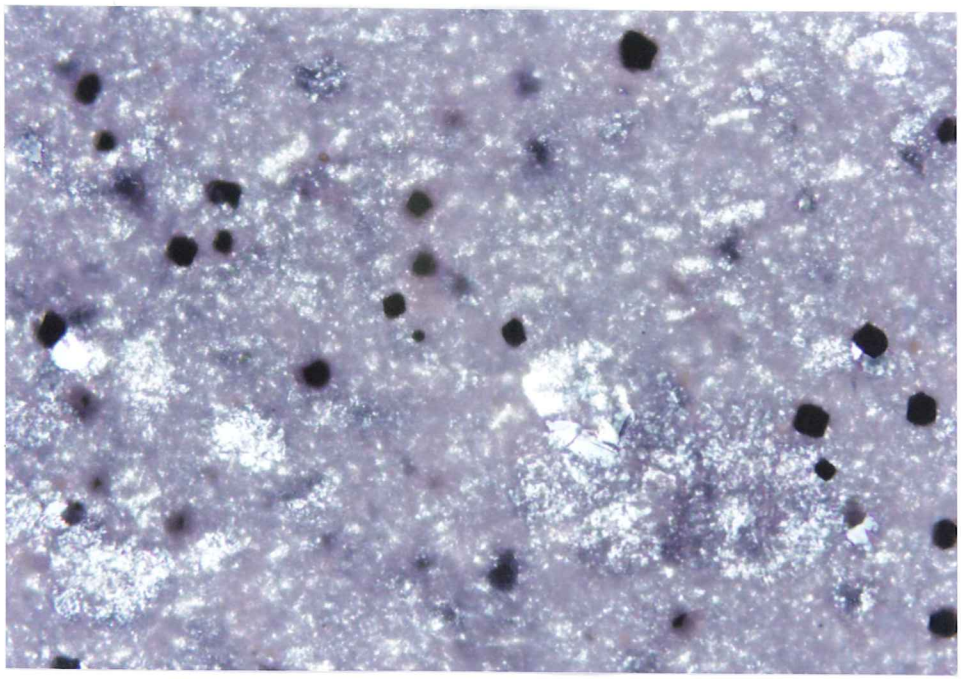

Figure 18a. Sample 494-810/quartz matrix vein breccia. Close-up view of one of the areas with light blue CL. Alkali feldspar microlites and relict grayish brown glass are relatively abundant, but the fine quartz patches have not materialized to the extent visible in the red CL patches. TLX; 1cm on the photo= 0.053mm.

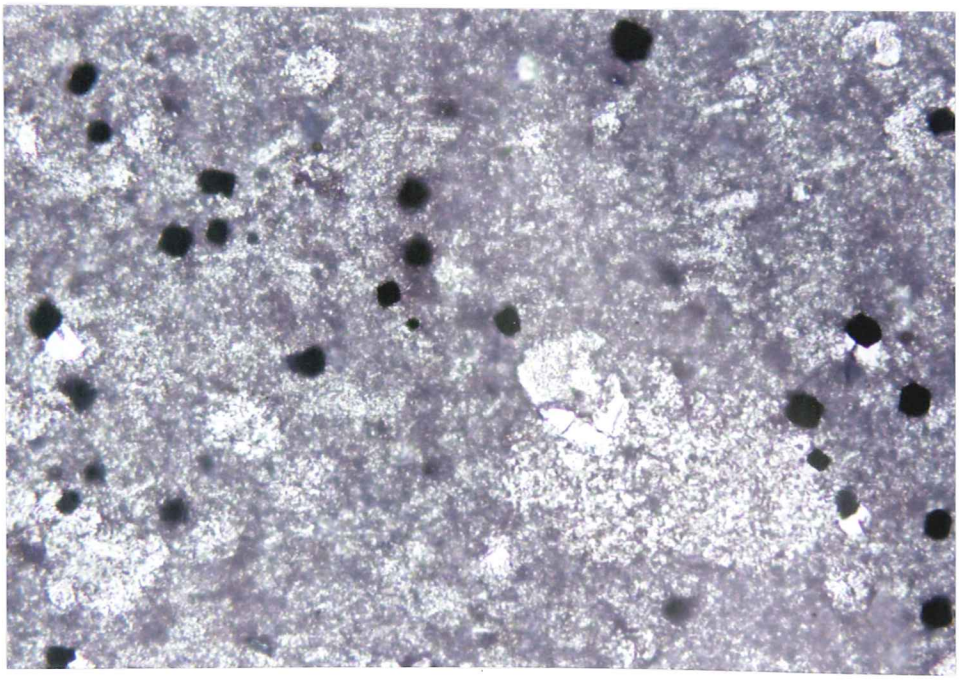

Figure 18b. Sample 494-810/quartz matrix vein breccia. Same view and scale as Figure 18a. TLP; 1cm on the photo= 0.053mm. TLP; 1cm on the photo= 0.053mm.

Sample Green

Sample Green is a selected RVC drill chip. Megascopically it appears to be a dark reddish brown felsitic lithology with several percent scattered mm-scale plagioclase laths and quartz phenocrysts. It is cut by a dark, narrow, irregular veinlet of magnetite, and there appears to be disseminated magnetite, as well. Present also are several narrow veinlets of a dark green mineral phase. These veinlets are sub-parallel to the main magnetite veinlet.

In thin section the sample is interpreted to be a sparsely porphyritic lava that contains scattered pseudomorphed phenocrysts and microphenocrysts of feldspar, mafics, and magnetite in a fine-grained, hyalopilitic groundmass of alkali feldspar laths, interstitial, partly devitrified brown glass, and sparsely disseminated fine magnetite. The sample is probably latitic or dacitic in composition. It is cut by several narrow veinlets. One of the veinlets is irregular, somewhat undulatory, and up to 1mm in width. It is composed of magnetite and its oxidation products, and minor quartz. The other veinlets contain primarily an unidentified green, somewhat pleochroic mineral phase and minor quartz. The green mineral phase also pseudomorphs the mafic phenocryst phases.

Phenocrysts and microphenocrysts make up 2-3% of the sample. About 60% of the phenocrysts in this particular sample are interpreted to be mafic phases pseudomorphed by the emerald green phase and calcite. The former mafic crystals are subhedral to anhedral and reach 0.85mm in diameter. Some show evidence of hexagonal morphology, and the protocrysts were probably biotite. The green mineral shows a strong emerald green color that is weakly pleochroic to yellowish green in some orientations. Several possibilities regarding the identity of this phase include celadonite [K(Mg, Fe2+)(Fe3+, Al)Si4O10 (OH2)], or perhaps a copper oxide or carbonate mineral. The feldspar pseudomorphs form euhedral to subhedral, tabular crystals to 1.7mm in length. They are completely altered to a cloudy assemblage of clay, calcite, microcrystalline quartz, and, in some examples, the unidentified green phase. Several feldspar pseudomorphs form a glomerophyric mass in one part of the sample.

The groundmass is a fine-grained mesh of alkali feldspar (sodic plagioclase) laths with interstitial brown glass partly devitrified to a faintly birefringent assemblage of cryptocrystalline quartz and alkali feldspar. Present also are disseminations of fine magnetite and it oxidation products.

The largest vein is irregular, undulatory, and up to 1mm in width. It shows crude banding with magnetite and goethite. The other veinlets are sub-parallel to the magnetite veinlet. They are very narrow (maximum width of 0.15mm) and birfurcating, and are composed dominantly of the unidentified green phase, plus minor quartz.

RL: Opaque phases constitute about 2-3% of the sample. The sample is cut by an irregular, crudely banded and disrupted magnetite veinlet to 1mm in width. The magnetite is altered to goethite along the vein margins, resulting in a banded texture. Magnetite occurs also as fine disseminations, some of which are partly to completely altered to goethite. The magnetite is present as subhedral to anhedral, crudely cubic crystals to 0.05mm in diameter.

CL: The body of the chip has light blue CL (alkali feldspar; Ti4+ activation). The disseminated calcite has orange CL. Calcite occurs primarily as part of the assemblage that pseudomorphs the phenocryst phases (biotite? and plagioclase).

Representative photomicrographs from sample Green appear in Figures 19 - 23.

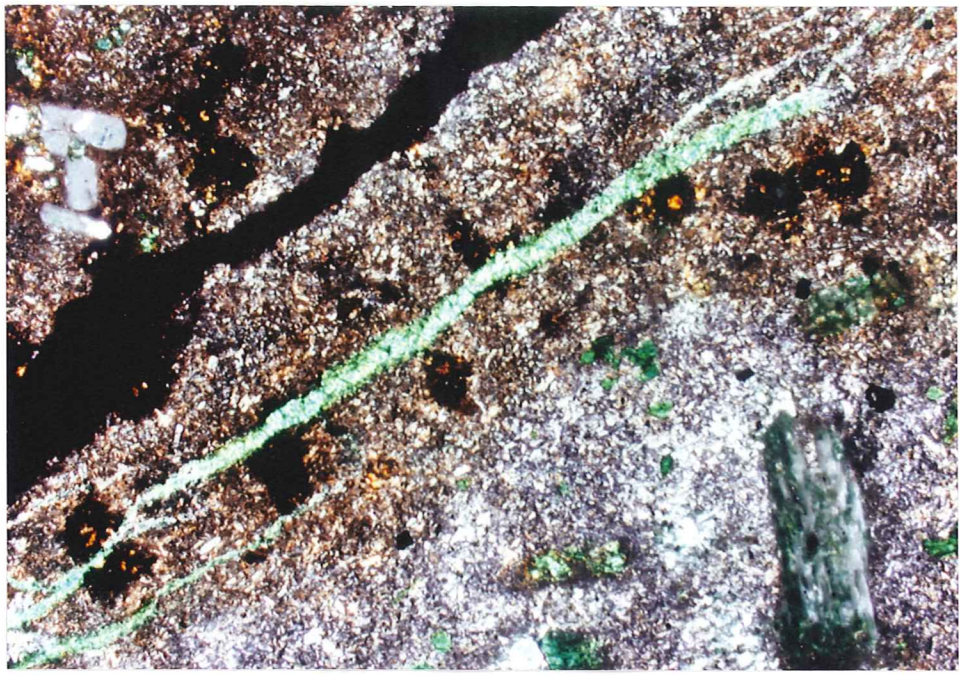

Figure 19a. Sample Green/dacitic or latitic lava. Veinlets of magnetite and an unidentified green phase (celadonite?) cut the lava, which has a hyalopilitic texture with phenocrysts of plagioclase pseudomorphed by an assemblage of clay, calcite, microcrystalline quartz, and, in some examples, the unidentified green phase. Mafic phenocrysts (biotite) are pseudomorphed by the celadonite (?) and calcite. TLX; 1cm on the photo= 0.532mm.

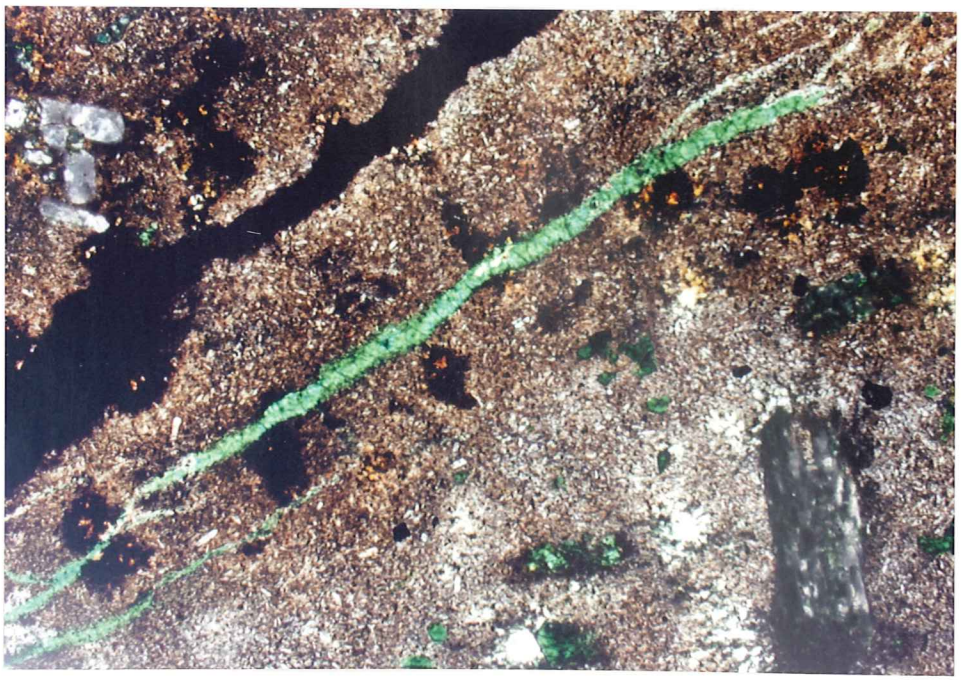

Figure 19b. Sample Green/dacitic or latitic lava. Same view and scale as Figure 19a. TLP; 1cm on the photo= 0.532mm.

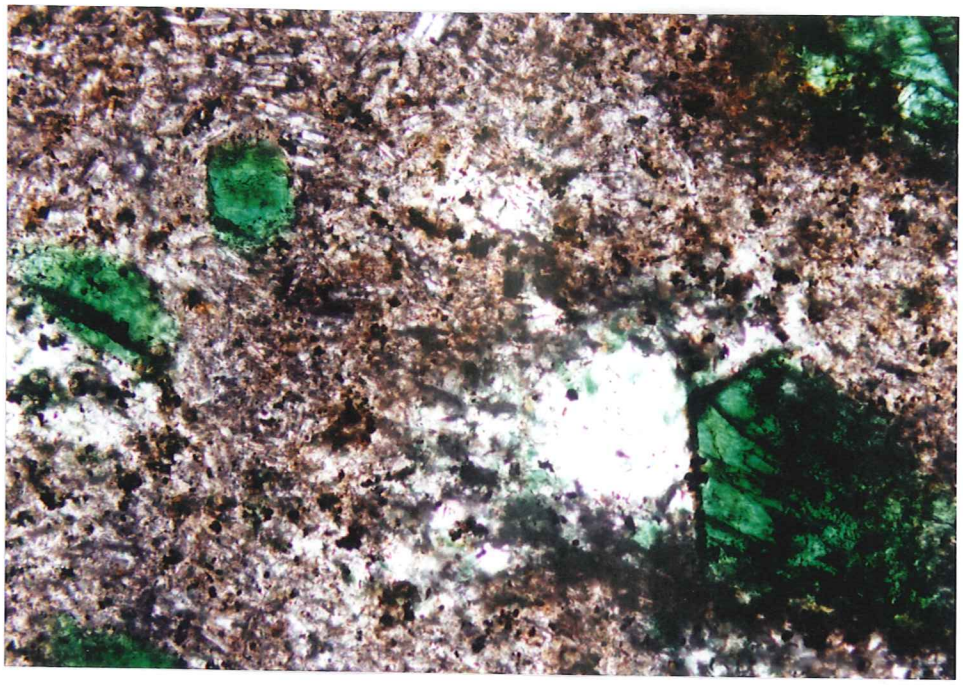

Figure 20a. Sample Green/dacitic or latitic lava. Mafic phenocrysts pseudomorphed by the unidentified green phase (celadonite?). Note the partial hexagonal morphology of some of the pseudomorphed mafic phases. TLX; 1cm on the photo= 0.106mm.

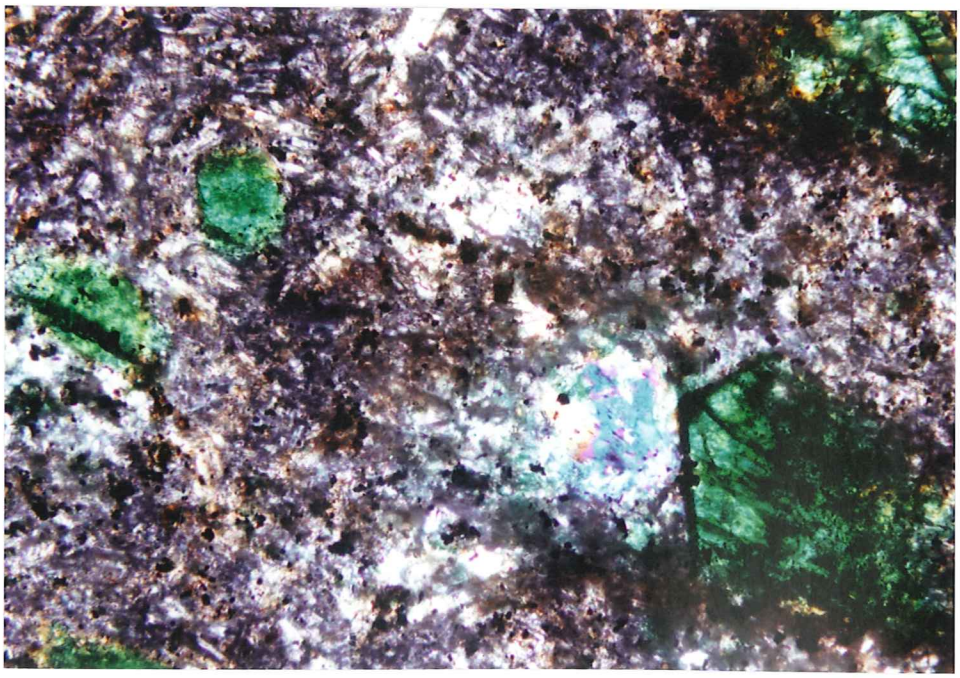

Figure 20b. Sample Green/dacitic or latitic lava. Same view and scale as Figure 20a. TLP; 1cm on the photo= 0.106mm.

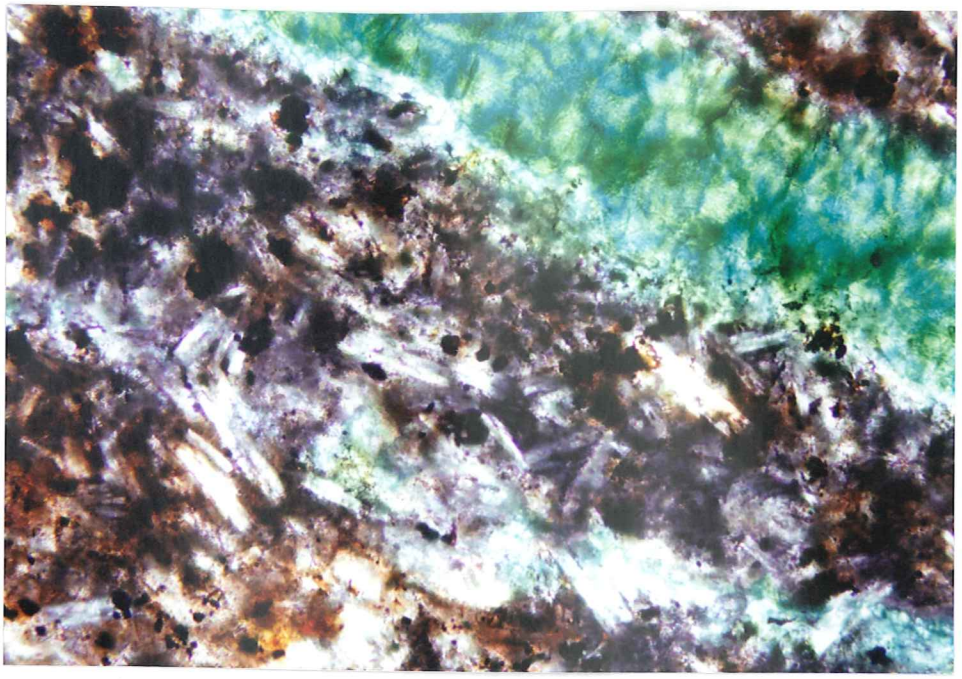

Figure 21a. Sample Green/dacitic or latitic lava. Hyalopilitic groundmass texture with fine laths of alkali feldspar, brown glass, and disseminated magnetite. The emerald green mineral phase in the veinlets may be celadonite, or perhaps even a copper oxide or carbonate mineral. TLX; 1cm on the photo= 0.053mm.

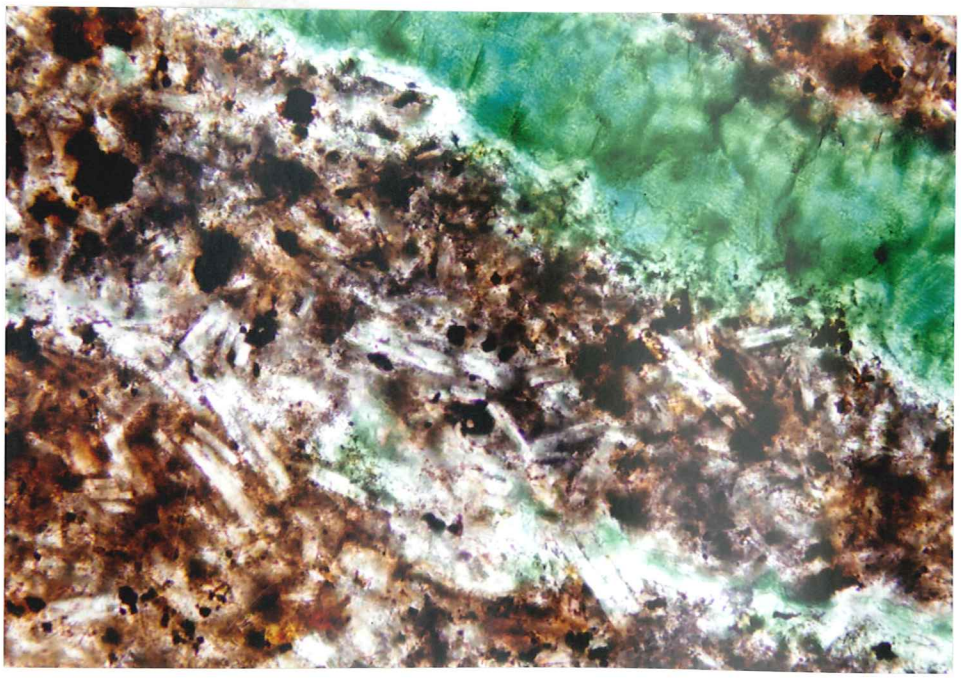

Figure 21b. Sample Green/dacitic or latitic lava. Same view and scale as Figure 21a. TLP; 1cm on the photo= 0.053mm.

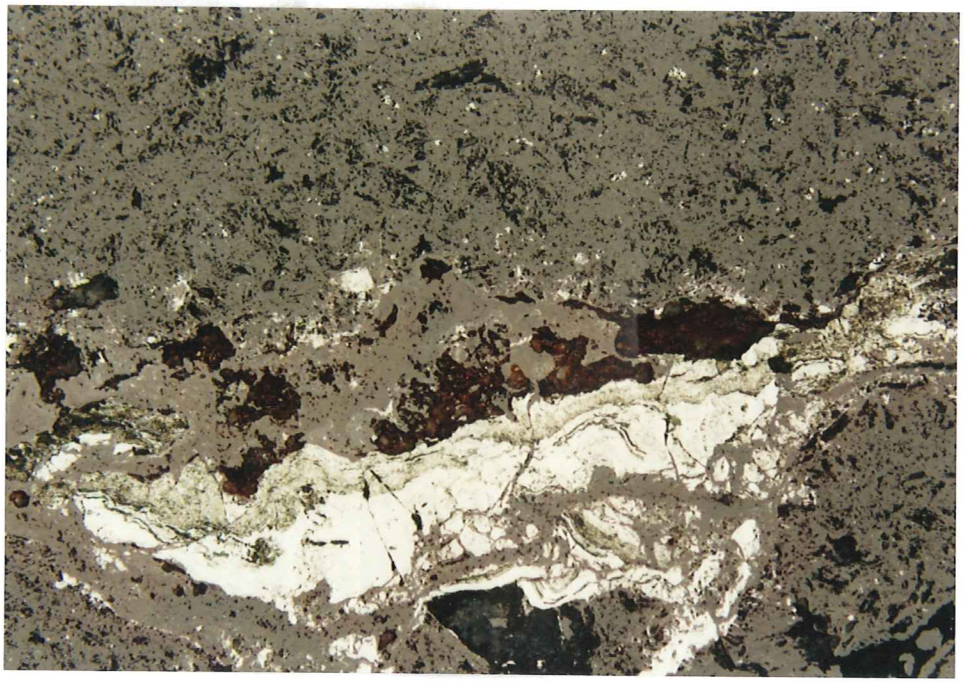

Figure 22. Sample Green/dacitic or latitic lava. Magnetite vein with goethite margins imparting a crude banding. Fine magnetite occurs also as disseminations in the lava. RL; 1cm on the photo= 0.106mm.

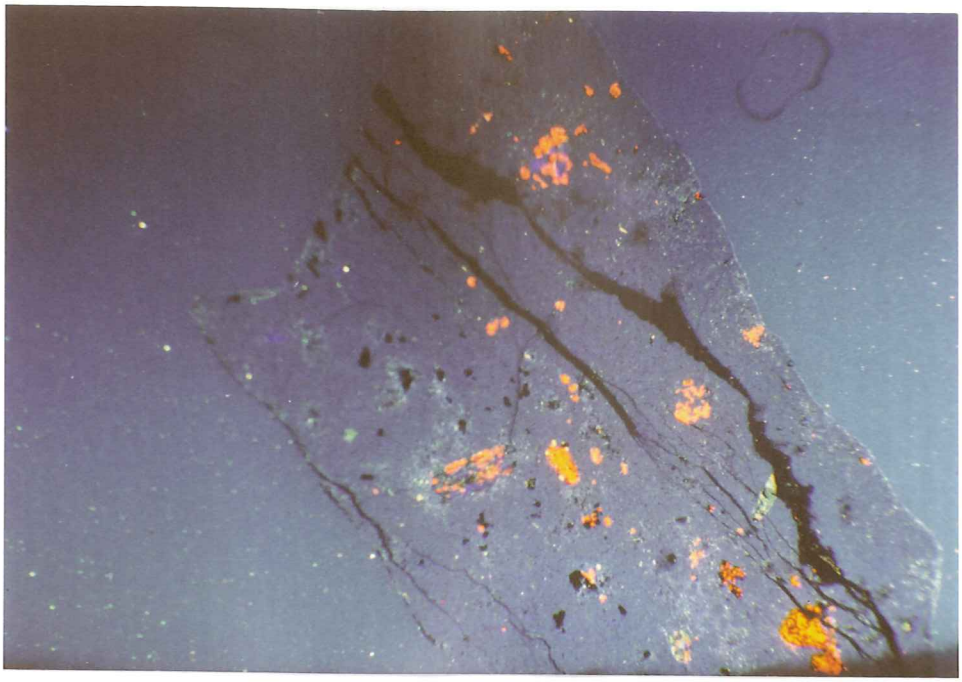

Figure 23a. Sample Green/dacitic or latitic lava. The groundmass has light blue CL, probably owing to Ti4+ activation in the alkali feldspar laths. Calcite (bright orange CL; Mn2+ activation) partly pseudomorphs feldspar and some mafic phenocrysts. The glomerocrystic plagioclase shows partial alteration to clay with dull royal blue CL (near upper edge center of photo). CL; 1cm on the photo= 1.484mm.

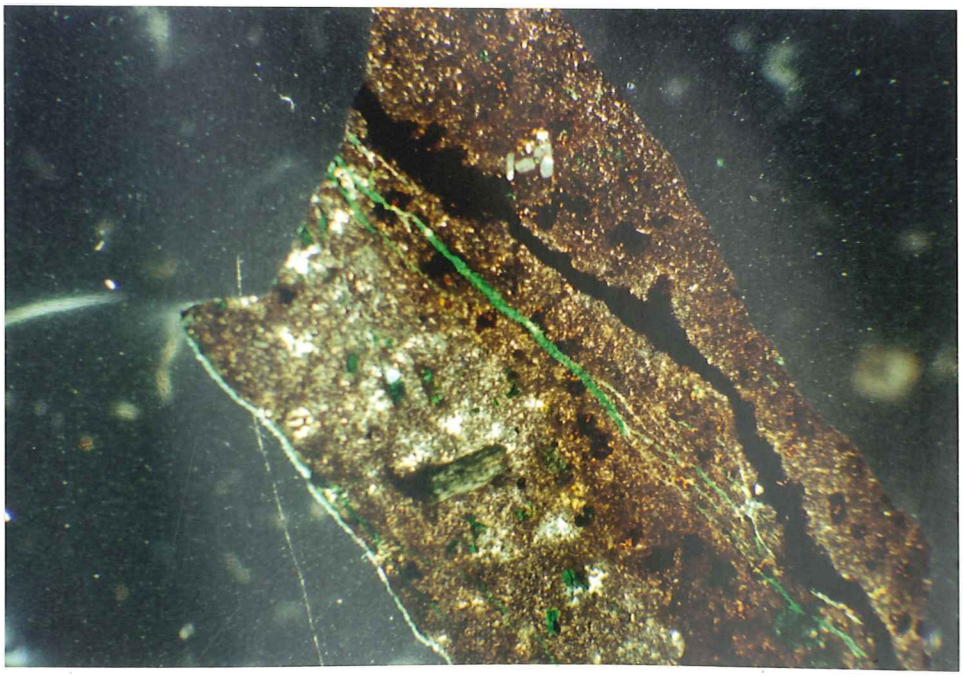

Figure 23b. Sample Green/dacitic or latitic lava. Same view and scale as Figure 23a. TLX; 1cm on the photo= 1.484mm.