CNWRA

NOPAL I PETROGRAPHY

+10 LEVEL

NORTH-SOUTH TRAVERSE

PENA BLANCA, CHIHUAHUA, MEXICO

308 - - - Q200405270005

Supplemental Material, Technical Activity Supporting Documentation: Experimental Data for Nopal I Petrography +10 Level North-South Traverse Pena Blanca, Chihuahua, Mexico (01/04/1993 through 01/20/1993)

NOPAL I PETROGRAPHY

JP

Sample No. NOPI-ECP-22.5/10.4-TS1

Description of matrix and alteration:
Very fine to cryptocrystalline intergrowth of quartz/feldspar. Granoblastic texture. In plane light remnant volcanic (eutaxitic) texture are observed. Much of the feldspar in the matrix is replaced by kaolinite. Quartz has sutured boundaries + undulose extinction

Description of phenocrysts/lithoclasts and alteration:
Quartz, feldspar, VRFs, Fe±Ti oxides. Quartz is relatively unaltered, feldspars completely replaced by kaolinite
zircons, sphene. Iron oxides - magnetite, exolution lamellae of hematite after ilmenite

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:
Kaolinite + quartz + uranyl silicates (uranophane) XRD. Quartz filling consists of fine crystalline (coarser than matrix), sutured grains with undulose extinction. Some crystals are euhedral with overgrowths.
Uranophane generally intergrown with kaolinite and is thus very fine crystalline, however occasionally a fracture will contain somewhat coarser uranophane without kaolinite

Degree of kaolinization: none slight moderate extreme

Degree of hematitization:

Description of mineralization: Uranophane occurs in fractures intergrown with kaolinite generally. Uranophane without kaolinite in fractures is less common. Uranophane rarely occurs in matrix but when it does it is intergrown with kaolinite. — along fractures

Uranium minerals	% of rock	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	~1%	very fine, equant with kaolinite fine, equant to prismatic without kaolinite	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Orange brown material coats matrix clay in some areas.

Other minerals

Fractures with equant to prismatic clear uranophane do not crosscut kaolinite replaced phenocrysts.
Fracture → kaolinite replacement → uranophane emplacement.

NOPAL I PETROGRAPHY

Sample No. NOP1-ECP-22.5/10.4-TS2

Description of matrix and alteration:
Very fine to crypto crystalline intergrowth of qtz/feld. Granoblastic. In plane light, remnant volcanic (eutaxitic) textures are observed. Much of feldspar matrix replaced by kaolinite. Quartz has sutured boundaries & undulose extinction

Description of phenocrysts/lithoclasts and alteration:
Quartz, feldspar, VRFs, Fe ± Ti oxides + zircons and sphene.
Same as TS1.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:
Same as TS1 + some occurrence of medium crystalline prismatic uranophane crystals in ~~[illegible]~~ fracture open space. appears to be late. In addition what appear to be pyrite crystals replaced by hematite ~~+ opal.~~

Degree of kaolinization: none slight moderate extreme
Degree of hematitization 0 - ~~[illegible]~~ along fractures

Description of mineralization: Same as TS1 + some occurrence of medium prismatic clusters of uranophane in open space.

Uranium minerals	% of rock	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	~1%	same as TS1 + medium prismatic crystals	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Orange brown and red material coats matrix + fracture filling clays in some areas. Orange brown areas are associated with uranophane generally. Iron oxide appear to replace pyrite in some fractures, these areas have higher concentrations of iron oxides.

Other minerals
~~Opal appears in some fractures as a replacement of pyrite after hematite~~. Its glass

5P

NOPAL I PETROGRAPHY

Sample No. 22.8/10.8-TS1

Description of matrix and alteration:
Silicified - very fine to cryptocrystalline quartz with sutured boundaries + undulose extinction. In plane light remnant volcanic texture are observed but are not common; most have been obliterated. Feldspar in matrix is completely gone diag replaced by kaolinite. Iron oxides are common and occurs as discrete patches in matrix with kaolinite + goethite ~~uranophane~~.

Description of phenocrysts/lithoclasts and alteration:
Feldspars replaced by kaolinite, quartz is relatively unaltered, magnetite + ilmenite showing replacement by hematite + some exolute lamellae.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Kaolinite is most abundant and is often intergrown with iron oxides and goethite? ~~uranophane~~. Iron oxides occur as amorphous coats or discrete crystals. Quartz - fine to medium crystalline with undulose extinction, sutured boundaries, and overgrowths. Occurs in fractures with clay + iron oxides. Uranophane is generally intergrown with clay + microcrystalline. Ghosts of pyrite replaced by iron oxide occur in fractures.

Degree of kaolinization: none slight moderate extreme

Degree of hematization: 0 - ~~mostly clay fracture~~ matrix + fracture

Description of mineralization: Iron oxides are most abundant occurring as amorphous coats or discrete crystals in fractures + in matrix. Uranophane is microcrystalline + intergrown with clay + iron oxides in fractures + matrix.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	1%		
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 30% Hematite coats clays or occurs as discrete crystals - often botyodial or colloform ~~texture~~ in fractures. Magnetite & ilmenite

Other minerals

JP

NOPAL I PETROGRAPHY

Sample No. 22.8/10.8-TS2

Not as hematized as TS1

Description of matrix and alteration:

Silicified matrix of very fine to cryptocrystalline quartz with sutured boundaries and undulose extinction. Feldspar in groundmass replaced by kaolinite. In place light volcanic textures have been completely destroyed. Matrix is relatively free of iron oxides except near fractures + voids filled by iron oxides where iron oxides infiltrate into matrix.

Description of phenocrysts/lithoclasts and alteration:

Feldspar completely replaced by kaolinite, quartz shows some corrosion along grain boundaries, some ilmenite/magnetite. Fracture cutting iron oxides crosscut phenocrysts.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Iron oxides are most abundant. Along with intergrown clay - reflected light

Degree of kaolinization: none slight moderate extreme

Degree of hematization

- mostly along fractures

Description of mineralization:

Iron oxides along fractures + adjacent matrix. Acicular clusters of uranophane observed in one fracture.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	<1%	fine crystalline/acicular	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides: 10% Occurs as amorphous coatings on clays + quartz and as discrete crystals (reflected light). Crystals are often intergrown - hematite/magnetite. Have similar texture to granular uraninite. Would be very worthwhile to SEM to see if uraninite is present.

Other minerals

JP

NOPAL I PETROGRAPHY

Sample No. 22.25/11.45 - TS1

Description of matrix and alteration:

Very fine to cryptocrystalline. quartz/feldspar. Feldspars mostly replaced by kaolinite but not totally. In plane light ~~[illegible]~~ volcanic texture of matrix is preserved. Eutaxitic texture. Quartz crystals have undulose extinction + sutured boundaries. Some quartz has fibrous ~~type texture~~ where it has replaced shards.

Description of phenocrysts/lithoclasts and alteration:

Feldspars completely replaced by kaolinite. quartz shows some corrosion along boundaries, Magnetite/ilmenite being replaced by hematite. Zircons.

Degree of fracturing or brecciation: none (slight) moderate extreme

Description of fracture-filling material:

Large fracture is filled by kaolinite + uranophane. Kaolinite infiltrates into matrix from the fracture.

Degree of kaolinization: none slight moderate (extreme)

Degree of hematitization: 0

Description of mineralization:

Uranophane occurs as fine to medium equigranular to acicular crystals intergrown with kaolinite in a large fracture or open void. No uranium minerals in matrix

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	~2%	fine to medium/acicular equigranular	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides: Very minor associated with clay.

Other minerals

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NOPAL I PETROGRAPHY

Sample No. 22.6/11.9 - TS1

Description of matrix and alteration:

Very fine to cryptocrystalline quartz impregnated by iron oxides. Iron oxides occur as discrete crystal masses in matrix. Quartz has undulose extinction + sutured boundaries - silicified. Feldspars replaced by kaolinite

Description of phenocrysts/lithoclasts and alteration:

Feldspars replaced by kaolinite + often coated with amorphous iron oxides. Corroded quartz. Magnetite-titanium, exsolution lamellae + replacement textures are common

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Kaolinite often coated with amorphous iron oxides (hematite). Cryptocrystalline hematite/magnetite intergrown. Uranophane often iron oxides as prismatic or acicular crystal masses.

Degree of kaolinization: none slight moderate extreme

Degree of hematization - matrix + fracture

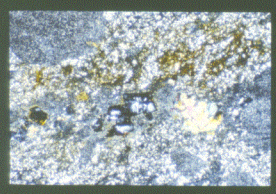
Description of mineralization:

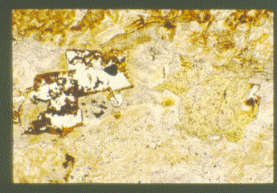
Iron oxides are most abundant occurring as amorphous coating and as cryptocrystalline masses in both matrix + fracture. Uranophane often iron oxides in fracture. Uranophane or possibly some other uranyl mineral intergrown with clay in fracture + matrix.

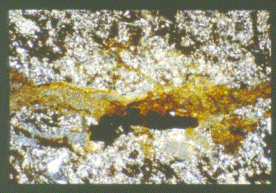
Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	5%	very fine/equant intergrown with kaolinite medium to coarse/prismatic often iron oxides in fracture	
Soddyite			
Weeksite/ Boltwoodite			
Others			

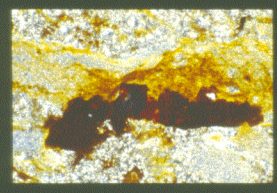
Iron oxides	50%	As amorphous coatings on kaolinite in fracture + replacing feldspars + as cryptocrystalline masses in matrix + fracture. Often have iron oxides intergrown - hematite/magnetite.
Other minerals		

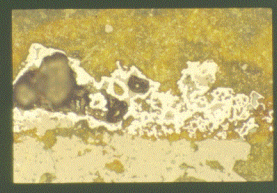
JP

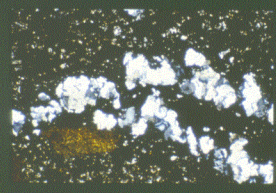


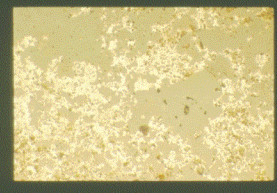


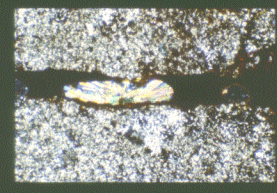


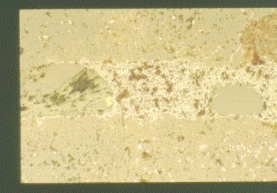


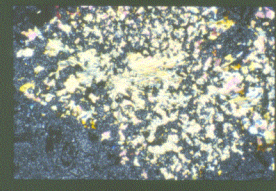


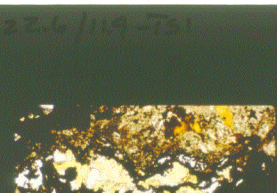


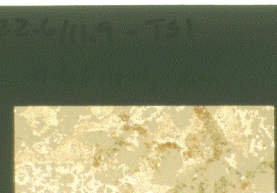


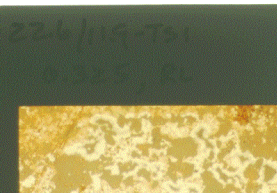












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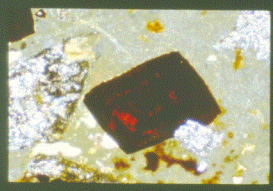
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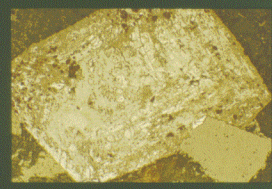
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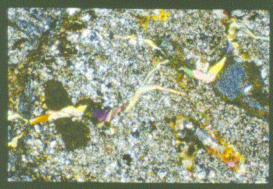
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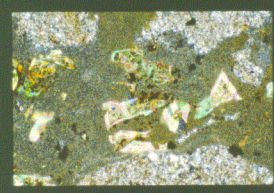
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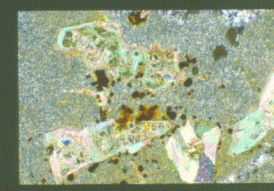
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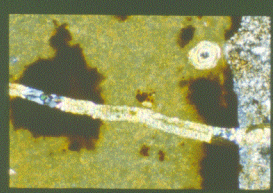
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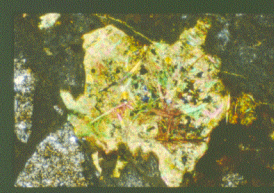
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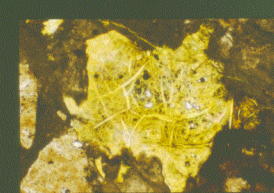
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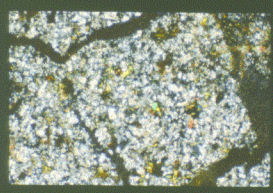
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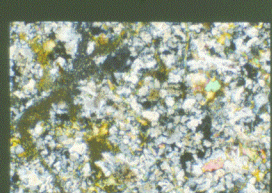

22.5/12.4-T31

NOPAL I PETROGRAPHY

Sample No. 22.5/12.4-TS2

Description of matrix and alteration; Matrix contains fine pyrite

~~Very~~ fine to cryptocrystalline quartz, silicified, sutured boundaries between quartz crystals. Feldspar in matrix have been dissolved + replaced by quartz or kaolinite. Original volcanic texture of tuff destroyed during silicification. Matrix contains some clay & uranyl silicates totally. Iron oxides are sometimes associated with clay + uranyl silicates.

Description of phenocrysts/lithoclasts and alteration:

Feldspar replaced by kaolinite &/or uranyl silicate. Some replaced feldspars are iron oxide rich.

Quartz has undergone some corrosion + replacement by clay

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Kaolinite predominates. Iron oxides are present locally - often as pyrite replacements. Uranyl silicates are abundant and are either intergrown with kaolinite or as coarser open space fillings.

Degree of kaolinization: none slight moderate extreme

Degree of hydration

Description of mineralization: - mostly in fractures. pyrite replacements followed by uranophane.

Uranyl silicates occur in fractures + in matrix. XRD - indicate both beta + alpha uranophane. Replace pyrite in some fractures. Pseudomorphic replacement of pyrite by uranyl silicate (along grain boundaries.)

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	15%	very fine, equant intergrown with clay fine prismatic crystals in fractures - both	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 10% generally concentrated in ~~fr~~ some fractures. Replace pyrite in fractures.

Other minerals

JP

NOPAL I PETROGRAPHY

Sample No. 22.5/12.4-TS1

Description of matrix and alteration: Fine to cryptocrystalline quartz-silicification. Quartz in matrix has sutured boundaries. Matrix feldspar replaced by quartz + kaolinite. Volcanic textures destroyed. Matrix contains some disseminated pyrite/iron oxides. Clay + mafic silicates are common in matrix.

Description of phenocrysts/lithoclasts and alteration: Feldspar replaced by kaolinite ± mafic silicates. Quartz has undergone corrosion at boundaries + replacement by clay ± mafic silicates. Replaced phenocrysts are often rim oxide rich. Ilmenite with zircons.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Kaolinite, pyrite intergrown with kaolinite have undergone varying degrees of oxidation. Pyrite replaced by iron oxides + mafic silicates. Replaced pyrite + ilmenite. Have baroque textures due to rhythmic replacement by mafic silicates. Later fractures cut across kaolinite filled fractures + are either open or filled by mafic silicates.

Degree of kaolinization: none slight moderate extreme

Degree of hematite

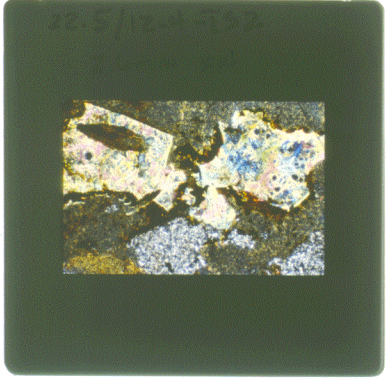
Description of mineralization: Mafic silicates are either fine and intergrown with clay or relatively coarse were they replaced pyrite + feldspar or precipitate in open fractures.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	~20%	fine equant - intergrown coarse equant to tabular + acicular	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides ~ 10% pyrite replacement by hematite/goethite
Cryptalline + amorphous.

Other minerals

JP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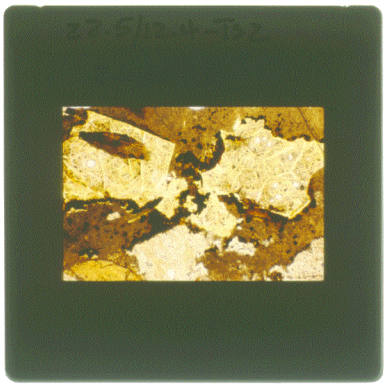
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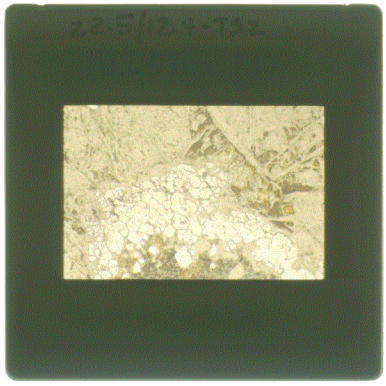
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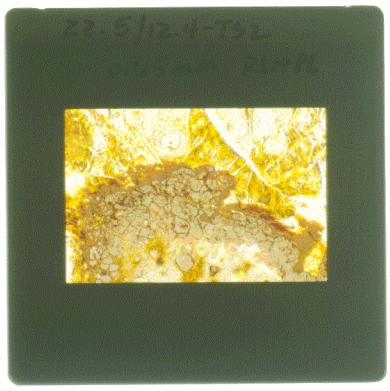
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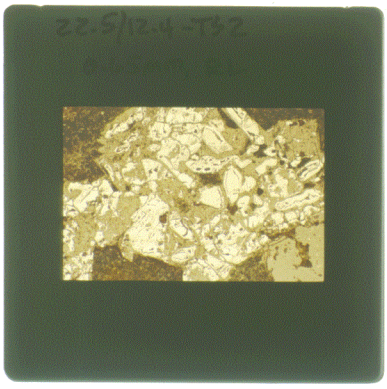
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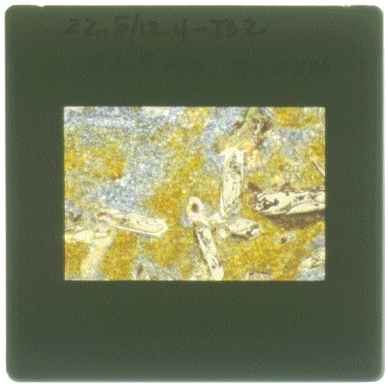
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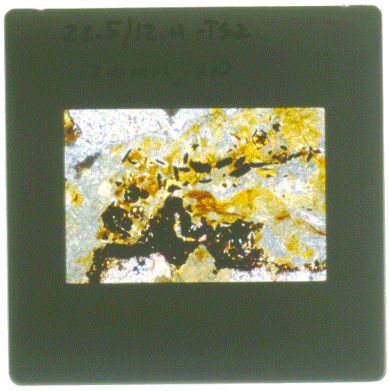
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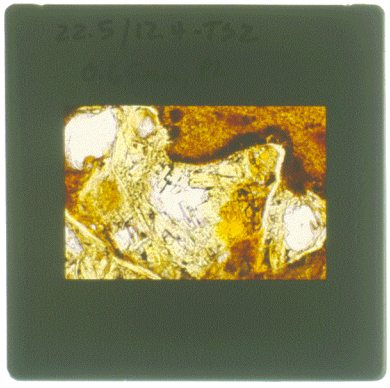
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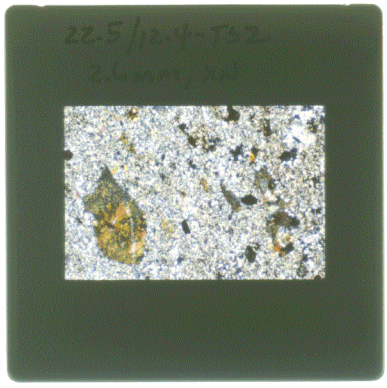
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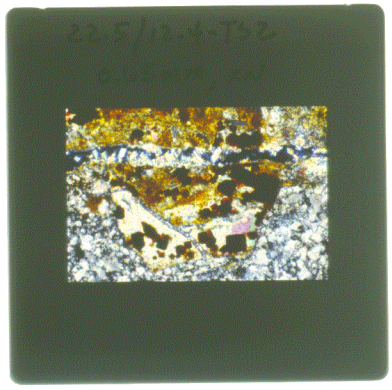
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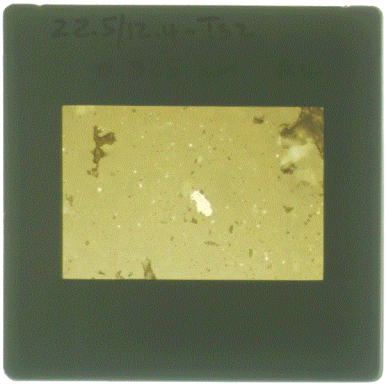
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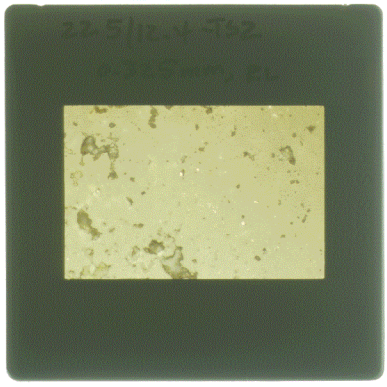
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35MM SLIDES

NOPAL I PETROGRAPHY

Sample No. 22.8/12.95-TS1

Description of matrix and alteration:

Very fine to cryptocrystalline quartz, silicified. Feldspar in matrix replaced by kaolinite. In plane light volcanic texture often are preserved. Some iron oxides coat clays in matrix. cryptoxtline pyrite throughout matrix

Description of phenocrysts/lithoclasts and alteration: gray reflective mineral in matrix - fine crystalline UO_2 or magnetite.

Feldspar completely replaced by kaolinite. Quartz corroded at boundaries. VRFs replaced by kaolinite. Magnetite/ilmenite

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Kaolinite is predominant fracture filling material. Salt + pepper chert? in fractures + replacing feldspars in matrix. Iron oxides coat clay in fractures sometimes. Uranyl silicates.

Degree of kaolinization: none slight moderate extreme

~~Degree of hematization~~

Description of mineralization:

Uranyl silicates - probably uranophane - occur in some small fractures and in matrix intergrown with clay + iron oxides.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	<1%	very fine/equant intergrown with clay fine/acicular to prismatic in fractures.	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 5% Intergrown with clays.

Other minerals

JP

NOPAL I PETROGRAPHY

Sample No. 22.8/1255-TS2

Description of matrix and alteration:
Very fine to cryptocrystalline silicified quartz. In plane light, volcanic textures almost completely destroyed. Iron oxides and uranophane have infiltrated the matrix, especially adjacent to ~~fracture~~ mineralized fractures. Kaolinite replaces feldspar in matrix.

Description of phenocrysts/lithoclasts and alteration:
Feldspars completely replaced by kaolinite. Quartz with corroded boundaries. Corroded titano-magnetites going to hematite.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:
Clay (kaolinite) with iron oxides as amorphous coatings followed by uranophane. Some fractures appear to have contained pyrite that has been replaced by iron oxides.

Degree of kaolinization: none slight moderate extreme

Description of mineralization:
Iron oxides occur mostly as coatings on clay. In both fractures + matrix. Uranophane is intergrown with clay in highly oxidized zones but also occurs as prismatic to acicular crystal masses in fracture open space.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	10%	Very fine/equant when intergrown with clay. Fine to medium/prismatic-acicular in fracture open space.	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 30% Occurs mostly as coatings on clays in fractures + matrix.

Other minerals

JP

NOPAL I PETROGRAPHY

Sample No. 22.6/13.6-TS1

Description of matrix and alteration:

Very fine to crypto crystalline quartz. Matrix has undergone extreme infiltration by iron oxides hematite and limonite. Glassy texture shows up well in plane light especially in hematized areas.

Description of phenocrysts/lithoclasts and alteration:

Feldspars replaced by kaolinite and often rimmed by hematite. Quartz corroded at boundaries.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Clay (kaolinite) is most abundant. Quartz as euhedral crystals with undulose ~~extinct~~ & sutured boundaries. Jarosite is intergrown with clay in limonitic iron oxide zones.

Degree of kaolinization: none slight moderate extreme

Description of mineralization:

Iron oxides occur as amorphous coatings. Some areas highly hematized (red) while other areas are limonitic (orange). Jarosite occurs with limonite

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 50% Hematite + limonite as coatings

Other minerals Jarosite is abundant 20% and is confined to limonitic areas. Consists of very fine equant crystal masses or intergrown with clay.

JP

NOPAL I PETROGRAPHY

Sample No. 22.1/14.65 TS1

Description of matrix and alteration:

Very fine to cryptoxtline intergrowth of qtz & feldspars along fractures. Iron oxide staining evident. Remnant volcanic text. in PL. XRD indicates feldspars in matrix have been dissolved

Description of phenocrysts/lithoclasts and alteration:

Almost all phenocrysts have been replaced by kaolinite. Some semi-euhedral quartz grains that have been corroded @ the boundaries. Ilminite phenocrysts embedded w/ zircons are also found

Degree of fracturing or brecciation: none slight moderate (extreme)

Description of fracture-filling material:

Kaolinite is predominate with iron oxides also present to a lesser degree. Fine crystalline uranyl silicates are often intergrown with kaolinite & associated iron oxide. Also relatively coarse acicular uranyl silicates occur in fractures.

Degree of kaolinization: none slight moderate (extreme)

Degree of hematization 0

Description of mineralization:

Hematization along fractures and surrounding grains
Uranyl silicates found in fractures in vugs

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	<3%	~~Bladed and~~	
Soddyite		acicular and closely assoc. w/ iron oxides and along fracture	
Weeksite/ Boltwoodite			
Others			

Iron oxides - hematite

Other minerals - Ilminite embedded with zircons

PGM

NOPAL I PETROGRAPHY

Sample No. 22.1 | 14.05 TSZ

Description of matrix and alteration: The matrix is granophyric with coarse grained quartz filling vugs and some fractures. Phenocrysts replaced by kaolinite. Large equant grains of ilminite being replaced by iron oxides.

Description of phenocrysts/lithoclasts and alteration: ~~Most~~ all feldspar phenocrysts have been ~~The matrix is granophyric~~ replaced by kaolinite. ~~the~~ Quartz phenocrysts show corrosion at boundries.

Degree of fracturing or brecciation: none slight moderate extreme

~~Degree of hematization~~

Description of fracture-filling material: fractures filled with kaolinite and in some places lined with iron oxides, large pyrite replaced by iron oxides and quartz. Some acicular uranyl silicates

Degree of kaolinization: none slight moderate extreme

Degree of hematization

Description of mineralization:

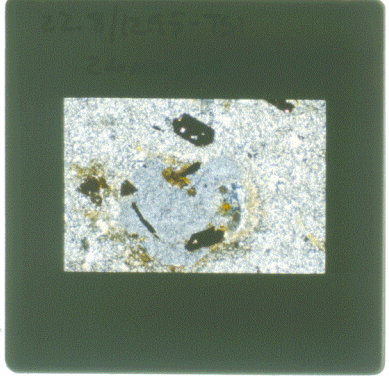
Fine crystalline uranyl silicate appear intergrown with kaolinite in iron oxide rich fractures. Minor acicular uranophane occur in some fractures

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	< 1 %	fine equant + acicular crystals	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Ilminite and hematite

Other minerals

PGh | JP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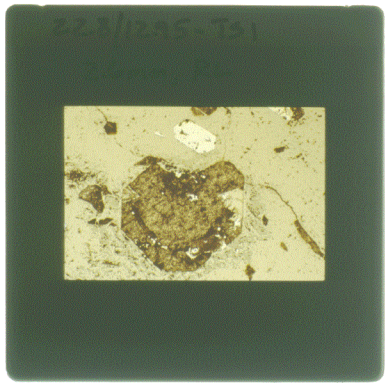
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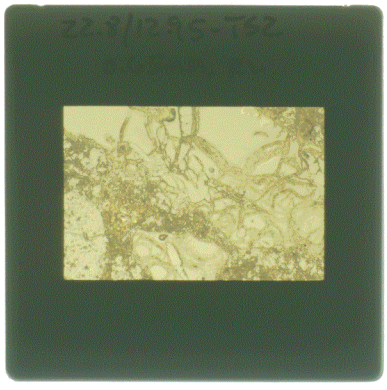
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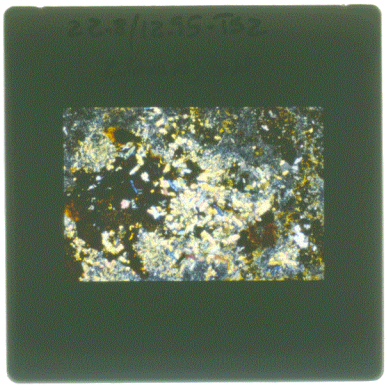
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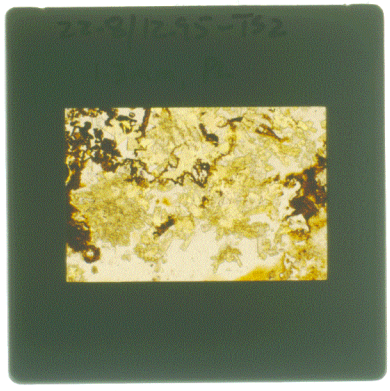
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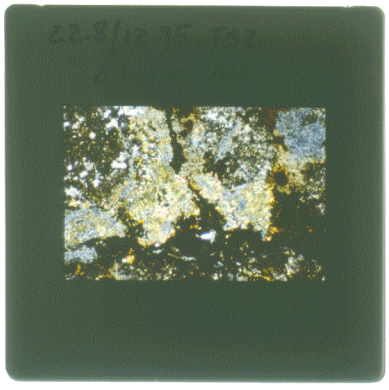
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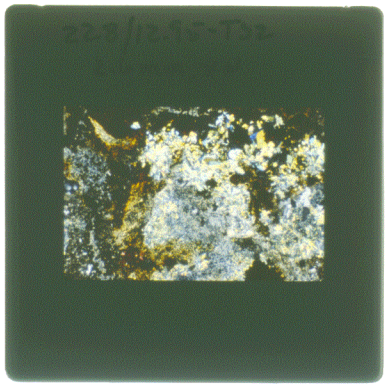
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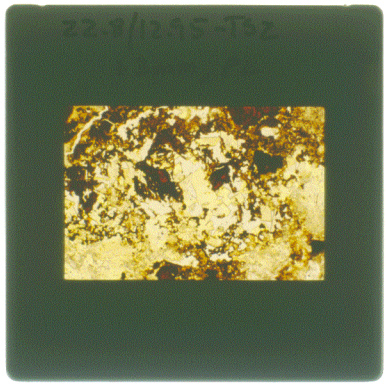
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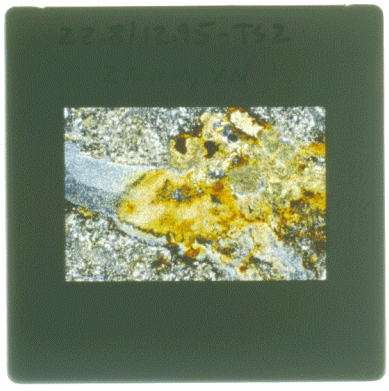
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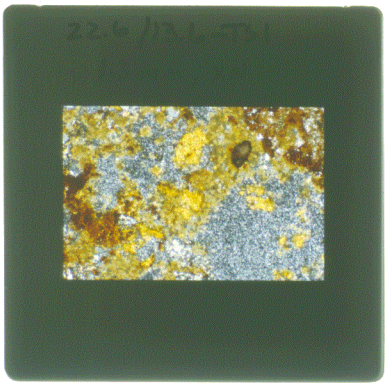
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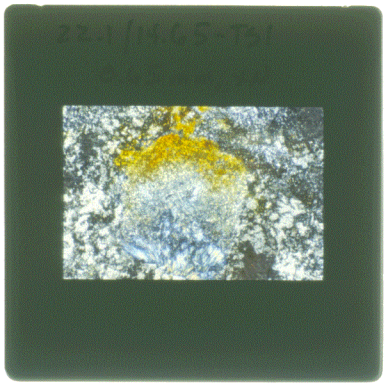
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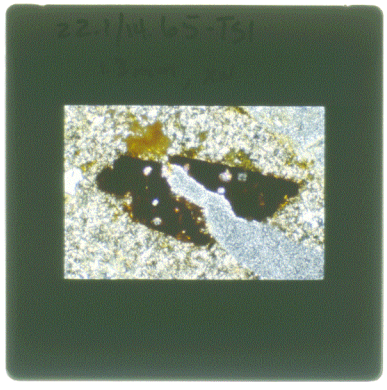
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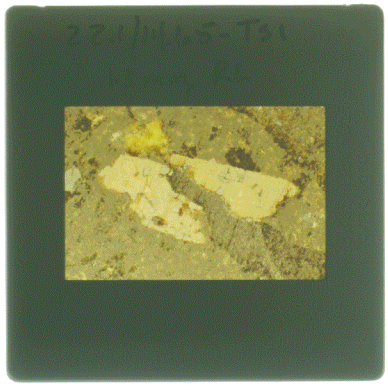
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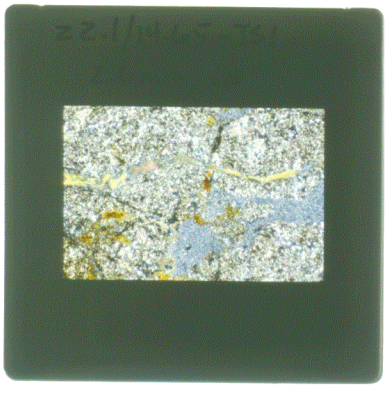
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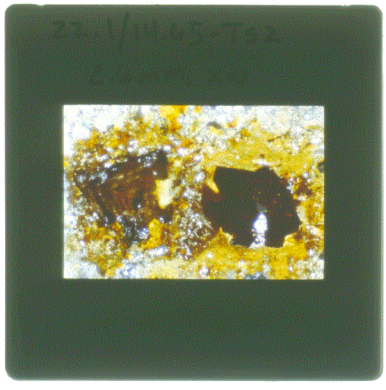
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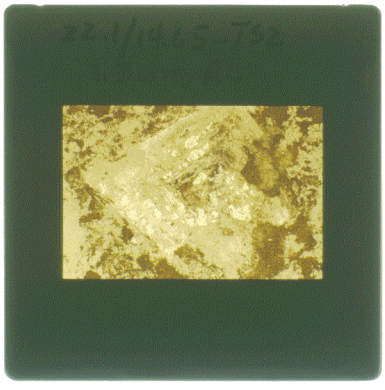
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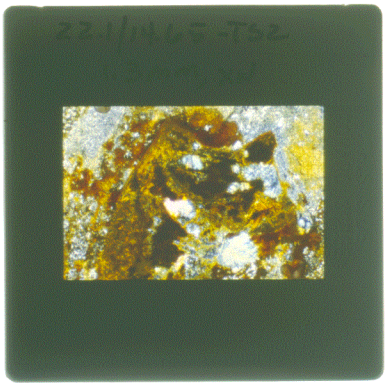
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NOPAL I PETROGRAPHY

Sample No. 22.35/15.3-751

Description of matrix and alteration: Very fine to cryptocrystalline intergrowths of quartz & feldspar. Volcanic texture is not preserved. Iron oxide staining throughout. Cryptocrystalline iron oxide throughout matrix (seen in RL) Coarse grained quartz and chert is found filling some areas. Kaolinite in textures w/ uranophane is also found

Description of phenocrysts/lithoclasts and alteration: Most phenocrysts have been replaced by kaolinite. Corroded quartz, illmite w/ zircon is also found

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Fractures are small - iron oxide staining follows fractures, but they are filled with uranophane in some places.

Degree of kaolinization: none slight moderate extreme

Degree of hematization

Description of mineralization: Uranophane found in fractures and intergrown with kaolinite in matrix

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	5%	cryptocrystalline	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.35/15.3 - TS2

Description of matrix and alteration: Very fine to cryptocrystalline quartz & feldspar. In some places kaolinite and uranophane intergrowths are in matrix - especially near fractures/brecciated area. Cryptoxtilline Fe oxide in matrix

Description of phenocrysts/lithoclasts and alteration: Most have been replaced by Kaolinite, Ilminite w/ zircon & empayed quartz.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Replaced pyrite lining some fractures. ~~Ilminite w/ zircon & empayed quartz~~ and kaolinite uranophane intergrowth found in fracture.

Degree of kaolinization: none slight moderate extreme

Degree of hematization

Description of mineralization: Uranophane found an intergrowth with kaolinite

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	3%	Intergrown w/kaolinite	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Amorphous & crystalline hematite & or goethite

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.6/15.85 - TS1

Description of matrix and alteration: Very fine to cryptoxtline intergrowths of quartz ~~& feldspar~~. In one area it has spherulitically devitrified. Most phenocrysts have been replaced by kaolinite or coarse grained quartz. Volcanic texture sometimes preserved (PL, Flow)

Description of phenocrysts/lithoclasts and alteration: Phenocryst have been replaced by kaolinite. Quartz phenocrysts show corrosion along borders. Some phenocrysts of kaolinite are being replaced by coarse grain quartz as are vugs and some fractures. Ilminite w/ zirons also present

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Filled mostly with kaolinite and iron oxides. Uranophane and uranophane intergrown with clay is also present. Coarse euhedral uranophane in open space follows hematite. Pyrites ~~in matrix~~ in fracture replaced by iron oxide.

Degree of kaolinization: none slight moderate extreme

Degree of hematization 0

Description of mineralization:

Amorphous + crystalline iron oxides mostly ~~along~~ in fractures. Uranophane occurs in fractures either as acicular crystal masses in open space. Some uranophane is intergrown with kaolinite.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	10%	Mostly acicular uranophane in filling vugs and fractures	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides hematite & magnetite or goethite - both amorphous + crystalline.

Other minerals Ilminite with zircons, some ilminite has been completely replaced

NOPAL I PETROGRAPHY

Sample No. 22.6/15.85 TSZ

Description of matrix and alteration: Matrix has a granophyric texture with coarse grained quartz filling in areas. Fine grain to cryptocrystline iron oxide throughout matrix. In plane light remnant volcanic ~~texture~~ is preserved; ~~eutaxitic texture~~.

Description of phenocrysts/lithoclasts and alteration: Feldspar has been replaced by kaolinite. About 10% quartz phenocrysts remain and all show corrosion of boundaries. Phenocrysts of alminite with zircon embedded in them are also present.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Most are filled with iron oxides the iron oxide also surrounds some phenocrysts.

Degree of kaolinization: none slight moderate extreme

Degree of hematization

Description of mineralization:

Amorphous iron oxides

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	[illegible]	[illegible]	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Hematite-amorphous

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.5/16.55-TS1

Description of matrix and alteration: Cryptocrystalline quartz/minor feldspar (XRD) In plane light some volcanic texture is preserved. Matrix is hematized - locally very heavy hematization. Feldspar in matrix replaced by kaolinite. Very fine pyrite + iron oxide throughout.

Description of phenocrysts/lithoclasts and alteration:
Feldspars replaced by kaolinite. Corroded quartz. Ilmenites with zircon. Magnetite replaced by hematite.

Degree of fracturing or brecciation: none (slight) moderate extreme

Description of fracture-filling material:
Kaolinite with amorphous hematite + some minor crystalline iron oxides. Acicular uranophane after kaolinite + iron oxides.

Degree of kaolinization: none slight moderate (extreme)
Degree of hematization

Description of mineralization:
Acicular uranophane in late fracture.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane	~3%	Acicular	
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides Amorphous hematite.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.25/17.15-TS1

Description of matrix and alteration: Cryptocrystalline quartz/feldspar. Kaolinite replaces some feldspar. Fine pyrite + iron oxides throughout. Hematite (amorphous) occurs locally but is not abundant. Volcanic textures seen in plane light.

Description of phenocrysts/lithoclasts and alteration: Feldspar replaced by kaolinite. Quartz - ~~[illegible]~~ generally unaltered. Ilmenite with leucoxene. Iron oxides occur as a cavity or replaced feldspar. Some feldspar not completely replaced.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

—

Degree of kaolinization: none slight moderate extreme

Degree of hematite

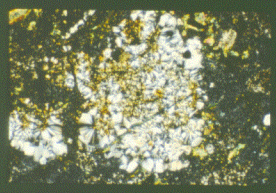
Description of mineralization:

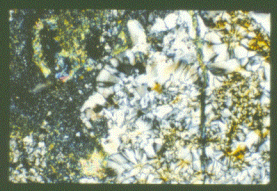
No U minerals

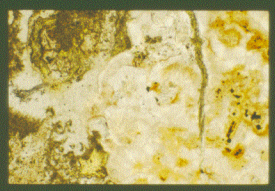
Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

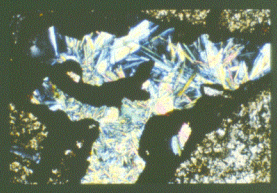
Iron oxides - 5% amorphous iron oxides.

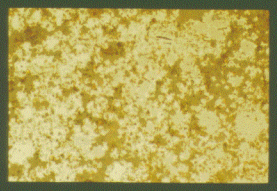
Other minerals

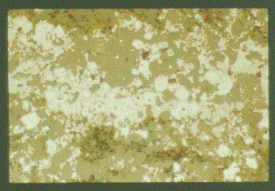


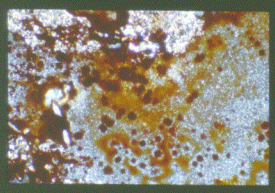


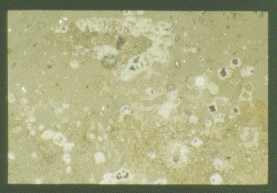


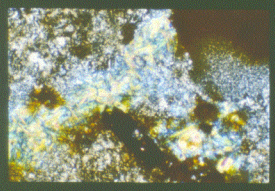


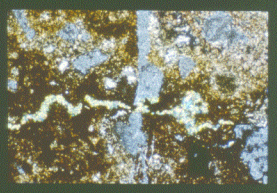


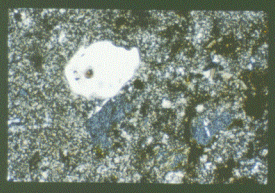


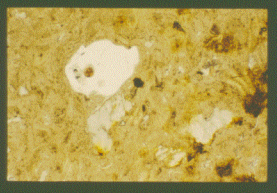


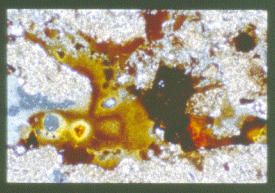












35MM SLIDES

NOPAL I PETROGRAPHY

Sample No. 22.85/17.85-T31

Description of matrix and alteration: Fine crystalline quartz/feldspar. Volcanic textures remain (PL). Pyrite + iron oxides disseminated throughout.

Description of phenocrysts/lithoclasts and alteration: Feldspar replaced by Kaolinite + some fine hematite coating. Some feldspar not completely replaced. Ilmenite with zircons.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

—

Degree of kaolinization: none slight moderate extreme

Degree of hematite

Description of mineralization:

No U minerals.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides – amorphous hematite 5%

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.3/18.3 -TS1

Description of matrix and alteration: Same as 22.85/17.85

Description of phenocrysts/lithoclasts and alteration:

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

Degree of kaolinization: none slight moderate extreme

Description of mineralization:

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			
Iron oxides			
Other minerals			

NOPAL I PETROGRAPHY

Sample No. 22.65/18.85-TS1

Description of matrix and alteration: Fine quartz / feldspar matrix. Slightly hematized. Very fine pyrite + iron oxides disseminated throughout. Volcanic texture preserved.

Description of phenocrysts/lithoclasts and alteration: Feldspar replaced by kaolinite. Quartz-unaltered. Ilmenite and iron oxides. Iron oxides (amorphous) in kaolinized feldspar.

Degree of fracturing or brecciation: none slight (moderate) extreme

Description of fracture-filling material:
Kaolinite that is heavily hematized locally. Hematite in fractures may be caused by pyrite dissolution.

Degree of kaolinization: none slight moderate (extreme)
Degree of hematization

Description of mineralization:
Mostly amorphous iron oxides

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 15% - amorphous hematite.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.85/20.1 - TS1

Description of matrix and alteration: quartz/feldspar matrix. Iron oxides evident in XN and RL throughout matrix. Relict volcanic texture can be seen in plane light. Coarse grained quartz filling in vugs.

Description of phenocrysts/lithoclasts and alteration: Most feldspars have been replaced by kaolinite, most have an iron oxide outline. Pyrite within phenocrysts has since oxidized and has left a reaction rim. Some quartz with corroded borders. Zircons found not only w/ ilmenite

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Fractures have been heavily hematized. Pyrite has been replaced by iron oxides all along the fracture. Some secondary quartz, alkali feldspar xtlization

Degree of kaolinization: none slight moderate extreme

Degree of hematization

Description of mineralization:

NO uranium minerals. Kaolinization of phenocrysts, & fractures, hematization of fractures and matrix

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides hematite ? either magnetite or goethite

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.85 / 20.85 - TS1

Description of matrix and alteration: Very fine quartz / feldspar matrix. Chalcedony is seen in some areas. Iron oxide is found throughout matrix. Relic volcanic texture can be seen, but has mostly been destroyed. Coarse grained quartz & chalcedony fill in vugs

Description of phenocrysts/lithoclasts and alteration: Most phenocrysts have been replaced by kaolinite. <1% ilminite, quartz an VRFs. Iron oxide coating on many kaolinite phenocrysts. Quartz phenocrysts are corroded.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: The few fractures present are filled with kaolinite and/or iron oxides

Degree of kaolinization: none slight moderate extreme

Degree of hematization 0

Description of mineralization:

no uranium minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			
Iron oxides			
Other minerals			

NOPAL I PETROGRAPHY

Sample No. 22.4/21.4 - TS1

Description of matrix and alteration: Cryptocrystalline quartz / feldspar ? iron oxides predominate. Calcedony has filled in some voids, as has coarse grained quartz.

Description of phenocrysts/lithoclasts and alteration: Most have been replaced by kaolinite, a few have been replaced by coarse grained quartz. ≈ 3% ilmenite w/zircon

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Iron oxides and replaced pyrite fill the fractures

Degree of kaolinization: none slight moderate extreme

Degree of hematitization

Description of mineralization:

No Uranium minerals present.

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			
Iron oxides			
Other minerals			

NOPAL I PETROGRAPHY

Sample No. 22.7/21.8 -TS1

Description of matrix and alteration: Quartz, feldspar and cryptoxtline iron oxides predominate. Calcedony is found filling void & vugs. Coarse grained quartz has also filled in vugs.

Description of phenocrysts/lithoclasts and alteration:
Kaolinite has replaced all feldspars. a few quartz phenocrysts are found, they are fairly euhedral. Ilminite with zircon embedded in it is also found

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Kaolinite fills most of the fractures. Iron oxide fills some of the smaller cracks.

Degree of kaolinization: none slight moderate extreme
Degree of hematization
Description of mineralization:

no uranium minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.6/22.4 — TS1

Description of matrix and alteration: Cryptocrystalline quartz/feldspar. In PL volcanic/glassy textures are still present. Matrix is only slightly hematized.

Description of phenocrysts/lithoclasts and alteration:
Feldspar are totally to partially replaced by kaolinite. Replaced phenocrysts tend to be rimmed by amorphous iron oxides which coats kaolinite. Quartz is ~~septo~~ relatively unaltered. (Free iron oxides disseminated throughout matrix)

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:
Kaolinite + iron oxide

Degree of kaolinization: none slight moderate extreme
Degree of iron oxidation

Description of mineralization:
No U minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides ~5% - amorphous, rims replaced phenocrysts.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.7/23.0 - T51

Description of matrix and alteration: Cryptocrystalline quartz/feldspar with amorphous iron oxides. In plane light volcanic texture remain. Hematite of matrix varies - near fracture very hematitic.

Description of phenocrysts/lithoclasts and alteration: Feldspars are partially to totally replaced by kaolinite and are rimmed by hematite. Quartz is relatively fresh. Iron oxides + ilmenite phenocrysts.

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material: Kaolinite that is strongly hematized. Iron oxides in fractures are often crystalline.

Degree of kaolinization: none slight moderate extreme
Degree of hematite

Description of mineralization:

No U minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 40% - amorphous + crystalline. In matrix + fractures.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.7/23.0-TS2

Description of matrix and alteration: Same as 22.7/23.0-TS1

Description of phenocrysts/lithoclasts and alteration:

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:
Hematite in fracture is often followed by quartz with sutured boundaries.

Degree of kaolinization: none slight moderate extreme

Description of mineralization:

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 55% amorphous + crystalline.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.8/23.755-T51

Description of matrix and alteration: Cryptocrystalline quartz/feldspar. Matrix is iron oxide rich near fractures. Not hematitic away from fractures. Hematite in matrix is amorphous + intergrown with clay. Volcanic textures visible.

Description of phenocrysts/lithoclasts and alteration: Totally to partially replaced feldspars. Quartz unaltered. Magnetite.

Degree of fracturing or brecciation: none slight (moderate) extreme

Description of fracture-filling material: Iron oxides intergrown with Kaolinite. Some iron oxides are crystalline.

Degree of kaolinization: none slight moderate (extreme)

Degree of hematite

Description of mineralization:

No U minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides 35% along + in fractures.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.5/24.6 -TS1

Description of matrix and alteration: Cryptocrystalline qtz/feldspar with some iron oxides. Volcanic texture visible under PL.

Description of phenocrysts/lithoclasts and alteration: Partially to totally replaced feldspars, quartz, magnetite. Replaced phenocrysts rimmed by iron oxides

Degree of fracturing or brecciation: none slight moderate extreme

Description of fracture-filling material:

—

Degree of kaolinization: none slight moderate extreme

Degree of hematite

Description of mineralization:

No U minerals

Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			

Iron oxides ~5% amorphous iron oxides intergrown with clay.

Other minerals

NOPAL I PETROGRAPHY

Sample No. 22.7/25.25-TS1

Description of matrix and alteration: Same as previous sample.

Description of phenocrysts/lithoclasts and alteration:

Hematite replaced magnetite.

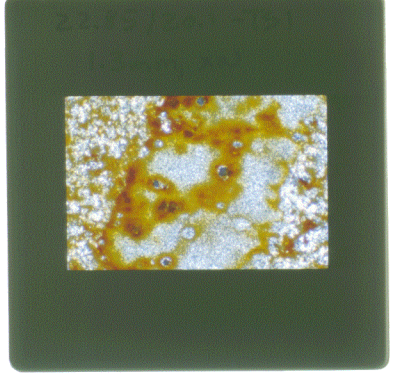
Degree of fracturing or brecciation: none slight moderate extreme

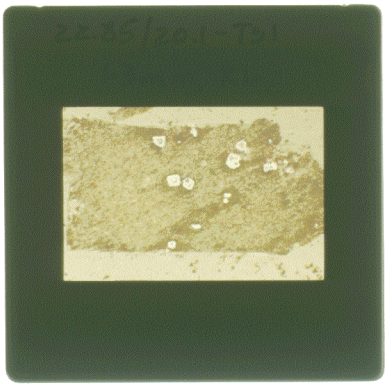
Description of fracture-filling material:

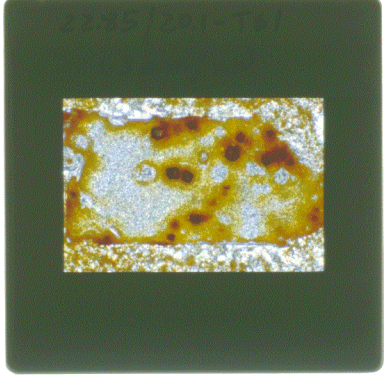
Degree of kaolinization: none slight moderate extreme

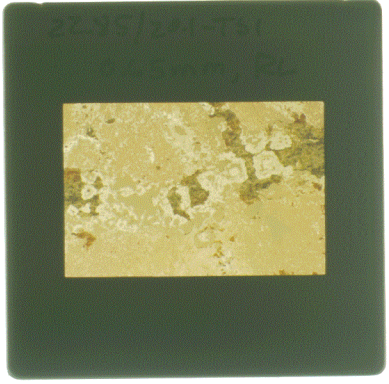
Description of mineralization:

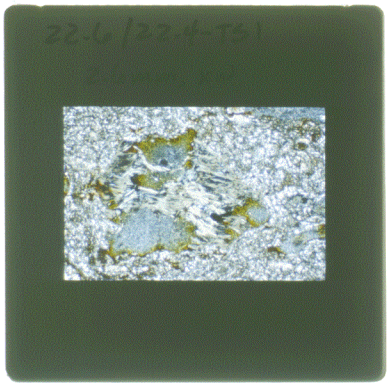
Uranium minerals	%	crystal size/habit	remarks
Uraninite			
Schoepite			
Ianthinite			
Uranophane			
Soddyite			
Weeksite/ Boltwoodite			
Others			
Iron oxides			
Other minerals			

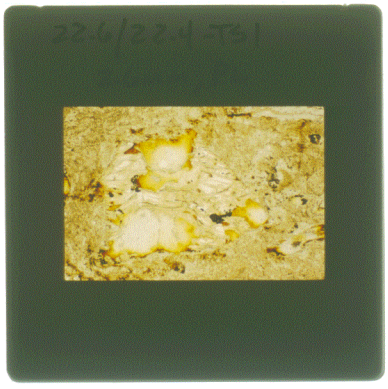


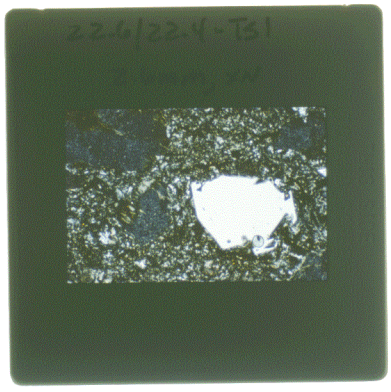


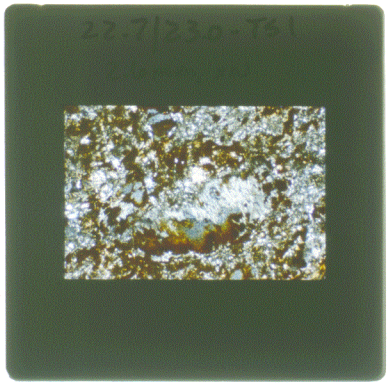


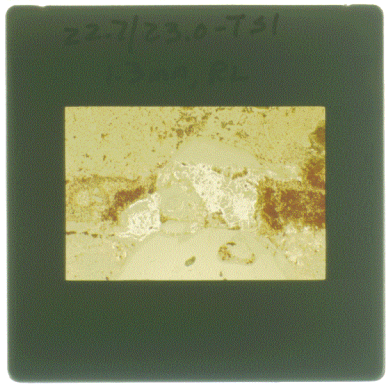


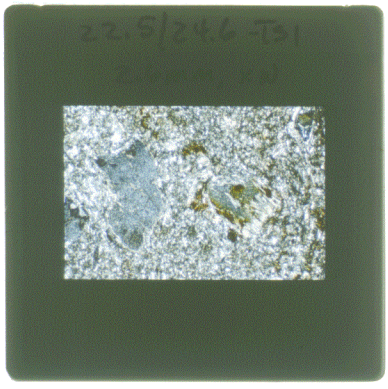


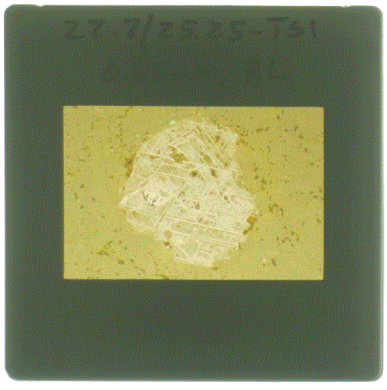












35MM SLIDES

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/4/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 200

Photo No.	Sample No. and description	Obj.	FOV	Light
	NOPI-ECP-22.5/10.4-TS2			
1	Open space or fracture filled by kaolinite. Also contains late manophene and what appear to be pyrite crystals that are dissolved or replaced. Also orange-brown iron oxides as coatings (amorphous) and in open space produced by pyrite dissolution.	5X	2.6mm	XN
2	Same area as #1. Shows dissolved pyrite followed by iron oxides and manophene.	10X	1.3mm	PL
	22.8/10.8 - TS1			
3	Iron oxide rich tuff with kaolinite filled fracture. Kaolinite is intergrown with iron oxides, manophane?, and pyrite replaced by hematite.	5X	2.6mm	XN
4	Closeup of #3. Shows pyrite crystals replaced by iron oxides	10X	1.3mm	XN
5	Closeup of #4. Shows colloform texture of iron oxides.	20X	0.65mm	RL

N/S traverse

PHOTOGRAPHY

Photographer: Microscope:

Type of photography: Camera:

Date: Film:

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.8/10.8-TS1			
6	Highly hematized tuff with relatively coarse sutured quartz and altered feldspar phenocrysts	5x	2.6mm	XN
7	Closeup of #6 showing crystalline iron oxides in matrix of tuff	20x	0.65mm	RL
	22.8/10.8-TS2			
8	Cluster of uranophane in hematized fracture	10x	1.3mm	XN
9	Closeup of #8 showing crystalline iron oxides with similar habit to granular uraninite.	20x	0.65mm	RL
	22.25/11.45-TS1			
10	Uranophane with kaolinite in large fracture or open void	5x	2.6mm	XN
	22.6/11.9-TS1			
11	Prismatic uranophane in fracture after iron oxides	5x	2.6mm	XN
12	Same as #11 but under plane light. Shows iron oxides followed by uranophane	5x	2.6mm	PL

PHOTOGRAPHY

Photographer: Microscope:

Type of photography: Camera:

Date: Film:

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.6/11.9-TS1			
13	Matrix iron oxides - some with colloform textures	20x	0.65mm	RL
14	Closeup of #13 showing colloform iron oxides. White - hematite. Gray - goethite or magnetite.	40x	0.325	RL
	22.5/12.4-TS2			
15	Apparently large pyrites replaced by uranyl silicates with weird textures. Smaller pyrites rim replaced crystal + those pyrites are replaced by iron oxides. All this occurs in kaolinite rich fracture. Kaolinite is integrown with uranyl silicates	5x	2.6mm	XN
16	Same as 15 but under plane light. Shows stage textures in replaced pyrite.	5x	2.6mm	PL
17	Shows replacement of pyrite by iron oxides (gray = ~~hematite~~ magnetite, white = hematite)	20x	0.65mm	RL
18	Same as #17 but shows that weird textures is result of rhythmic replacement of pyrite along grain boundaries	20x	0.65mm	RL+PL

PHOTOGRAPHY

Photographer: Microscope:

Type of photography: Camera:

Date: Film:

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.5/12.4-TS2			
19	Cluster of pyrite replaced ~~along grain boundaries~~ by iron oxides	20x	0.65mm	RL
20	Beta-marcasite overgrowing iron oxide that has replaced ilmenite?	20x	0.65mm	RL+XN
21	Fracture cutting kaolinite, pyrite, amorphous hematite, and ~~pyrite~~ ilmenite. Mangl silicates are replacing + overgrowing pyrite + ilmenite. Iron oxides replace pyrite + ilmenite.	5x	2.6mm	XN
22	Beta marcasite (prismatic crystals) growing in open void created by pyrite dissolution. Iron oxides present (amorphous).	20x	0.65mm	RL
23	Kaolinite and mangl silicates intergrown replacing feldspar phenocryst + feldspar in matrix	5x	2.6mm	XN
24	Fracture cutting prismatic beta marcasite. Kaolinite + pyrite fill fracture. Pyrite replaced by iron oxides. Possibly a phenocryst being replaced by marcasite at bottom of photo.	20x	0.65mm	XN

PHOTOGRAPHY

Photographer: JP + PH

Type of photography: TS

Date: 1/5/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 200

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.5/12.4-TS2			
1	Pyrite + possibly menanite (gray) within silicified breccia fragment	40x	0.325mm	RL
2	Pyrite surrounded by uraninite (?)	40x	0.325mm	RL
	22.8/12.95-TS1			
3	Kaolinite replaced felspar phenocryst with ilmenite and zircon	5x	2.6mm	XN
4	Same as 3 but in Reflected light. Notice ilmenite being replaced by iron oxide	5x	2.6mm	RL
	22.8/12.95 TS2			
5	Iron oxide ~~coating~~ concentrically coating grains	20x	0.65mm	XN
6	Same as #5 except in Reflected light	20x	0.65	RL

PHOTOGRAPHY

Photographer: JP & PN

Microscope: Nikon

Type of photography: TS

Camera: Nikon

Date: 1/5/93

Film: Ektachrome 200

Photo No.	Sample No. and description	Obj.	FOV	Light
	22-8/12.95-TS2			
7	Beta monophane intergrown with kaolinite + amorphous iron oxide in a large fracture	5x	2.6mm	XN
8	Closeup of beta-monophane in #7. Shows prismatic habit	10x	1.3mm	PL
9	Silicified breccia fragments cemented by kaolinite intergrown with mafic silicates (monophane). Amorphous hematite occurs throughout	5x	2.6mm	XN
10	Relatively coarse beta monophane intergrown with iron oxides + kaolinite in fracture in brecciated ore. Notice ghosts of pyrite replaced by hematite.	5x	2.6mm	XN
11.	Closeup of beta-monophane in #10. Prismatic habit of beta.	10x	1.3mm	PL
12	Fracture containing kaolinite with iron oxides + mafic silicates in silicified breccia	5x	2.6mm	XN

PHOTOGRAPHY

Photographer: JP & Pafn

Microscope: Nikon

Type of photography: TS

Camera: Nikon

Date: 1/5/93

Film: Ektachrome 200

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.6/13.6 TS1			
13	- Jarosite shown intergrown with clay, and replacing a phenocryst.	X10	1.3mm	XN
	22.1/14.65 TS1			
14	Acicular uranyl silicate filling a vug	X20	0.65mm	XN
15	Ilminite phenocryst cut by kaolinite fracture. Ilminite usually associated with zircon as seen here	X10	1.3mm	XN
16	Same as 15-	X10	1.3mm	RL
17.	Uranyl silicate filled vein	X5	2.6mm	XN
	~~22.1/14.65 TS2~~ 22.6/15.85 TS1			
18.	Spherulitic divitrification of matrix with uranophane ~~filling~~ in fracture and surrounding area	X5	2.6mm	XN

PHOTOGRAPHY

Photographer: Pgh

Microscope: Nikon

Type of photography: TS

Camera: Nikon

Date: 1/5/93

Film: Ektachrome 200

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.6/15.85 TS1			
19.	Close up of #18. Showing uranyl silicate filled fracture.	X10	1.3mm	XN
20	Plane light of #18. Note Spherulitic texture	X10	1.3mm	PL
1/6/93	22.6/15.85 TS1			
21	Uranophane filling in fracture or vug lined with iron oxides	x10	1.3mm	XN
1/7/93	22.1/14.65-TS2			
22	Oxidized pyrites in fracture, note zoning and later quartz infilling	5x	2.6mm	XN
23	Closeup of #22 shows replacement of pyrite by hematite (white) + magnetite (gray).	10x	1.3mm	RL
24	Hematized pyrite with uranyl silicates in dissolved open spaces.	10x	1.3mm	XN

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/7/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 100

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.6/15.85-TS1			
1	Breccia containing fractures filled by kaolinite, iron oxides, + mafic silicates	5X	2.6mm	XN
2	Iron oxides - hematite (white), goethite or magnetite (gray). Intergrown in a fracture with kaolinite + quartz.	40	0.325	RL
3	Iron oxides that appear to replace pyrite crystals in a fracture with quartz + kaolinite. White (hematite), gray (goethite or magnetite).	40X	0.325	RL
4	Fracture containing kaolinite, replaced pyrite and monazite.	10X	1.3mm	XN
5	Closeup of #4 showing replaced pyrite. Gray is either goethite/magnetite + white is hematite.	20X	0.625	RL
	22.5/16.55-TS1			
6	Acicular monazite along with kaolinite + iron oxides in a fracture. Also shows an ilmenite crystal.	10X	1.3mm	XN
7	Late fracture with acicular monazite cutting a kaolinite filled fracture	5X	2.6mm	XN

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/7/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 100

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.25/17.15-TS1			
8	Kaolinized Tuff - Feldspar phenocrysts replaced by matrix feldspars remain. Phenocrysts in fine qtz/fld matrix	5x	2.6mm	XN
9	Same as #8 but in PL showing volcanic texture of matrix	5x	2.6mm	PL
	22.65/18.85-TS1			
10	Hematized fracture outside pipe. Hematite may result from dissolution of pyrite.	5x	2.6mm	XN
	22.85/20.1 - TS1			
11.	Kaolinized phenocrysts with pyrite reaction rims	10x	1.3mm	XN
12.	Reflected Light shot of another Kaolinized phenocrysts. There are reaction rims around the pyrite	10x	1.3mm	RL
13.	Same as 12 w XN	10x	1.33	XN
14.	Pyrite replaced by Iron oxides filling fracture	20x	0.65mm	RL

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/14/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 100

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.5/12.4-TS1			
15	Large pyrite that formed with kaolinite in fracture of a breccia. Pyrite has been replaced by iron oxides.	5x	2.6mm	XN
16	Closeup of replaced pyrite by hematite-white + probably goethite-gray.	10x	1.3mm	RL
17	Late fracture filled with vanyl silicate cutting a feldspar that has been replaced by kaolinite.	5x	2.6mm	XN
18	Baroque vanyl silicate in a fracture filled by kaolinite.	5x	2.6mm	XN
19	Closeup of #18 showing presence of pyrites that are partially hematized. Baroque texture apparently forms by replacement of pyrites by vanyl silicate	10x	1.3mm	XN
20	Late fracture containing B-uranophane cutting into kaolinite filled fracture	10x	1.3mm	XN

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/14/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 100

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.5/12.4 -TS1			
21	Baroque manganese silicate in kaolinite filled fracture. Notice euhedral pyrite.	5x	2.6mm	XN
22	Plane light photo of #21	5x	2.6mm	PL
23	Shows manganese silicates in matrix - filling open pores + intergrown with kaolinite	5x	2.6mm	XN
24	Closeup of #23	10x	1.3mm	XN

PHOTOGRAPHY

Photographer: JP

Type of photography: TS

Date: 1/14/93

Microscope: Nikon

Camera: Nikon

Film: Ektachrome 100

Photo No.	Sample No. and description	Obj.	FOV	Light
	22.6/22.4-TS1			
1	Partially replaced feldspar phenocryst. Amorphous iron oxides coats kaolinite	5x	2.6mm	xN
2	Same as #1 under plane light	5x	2.6mm	PL
3	Quartz + partially replaced feldspar phenocrysts with some iron oxides in a qtz/feld matrix.	5x	2.6mm	xN
	22.7/23.0-TS1			
4	Partially replaced feldspar in strongly hematized tuff.	5x	2.6mm	xN
5	Strongly hematized fracture cutting a quartz phenocryst. Notice late quartz following hematite.	5x	2.6mm	xN
6	Closeup of #5 shows crystalline nature of some of the iron oxides.	10x	1.3mm	RL
	22.5/24.6-TS1			
7	Partially replaced feldspar in qtz/feld matrix. Some iron oxide	5x	2.6mm	xN
	22.7/25.25-TS1			
8	Hematite replacing magnetite	20x	0.65mm	RL