URBD 40404 GEOLOGY
PETROGRAPHY & ORE MICROSCOPY: RE-5,
SCHURER & FUCHS, 7/89

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Schurer & Fuchs

1555 Ridgeview Drive, #8
Reno, Nevada 89509
(702) 825-3306

July 13, 1989

Mr. Craig Nelson
Lac Minerals (U.S.A.), Inc.
1475 Greg Street
Sparks, Nevada 89431

Dear Craig:

The following is a cost estimate for recommended X-ray diffraction (XRD) work on six samples from drill hole RE-5. This includes two samples from among the additional samples that you mentioned that come fron deeper drill intervals. The main objectives of the XRD analyses are to identify the clay minerals and to confirm the presence of (secondary) K-feldspar in the deeper samples. We recommend using either assay pulps or unwashed rejects, as they would be more representative of the sample intervals and could contain more clay than the screened drill chips, thereby perhaps eliminating the necessity for making clay separates.

XRD analyses (dry & glycolated samples):	
6 samples @ $150/sample	$ 900.
Copying & splicing of XRD patterns	40.
Subtotal	$ 940.

Additional XRD work on clay upgrades (if necessary):

Clay separation	240.
XRD analyses (dry & glycolated samples):	
6 samples @ $100/sample	600.
Subtotal	840.
Total	$1780.

This is a cost estimate and not a firm quote. Estimated turn-around time for this work is late September.

Sincerely,

Vickie Schurer

Victoria Schurer

PETROGRAPHY & ORE MICROSCOPY OF ADDITIONAL SAMPLES FROM DRILL HOLE RE-5, ROSEBUD PROJECT

Prepared for: Mr. Bob Bennett
Lac Minerals (U.S.A.), Inc.
1395 Greg Street, Suite 107
Sparks, Nevada 89431

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1555 Ridgeview Drive, #8
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October 1989

SAMPLE LIST

RE-5-540-545 (combined transmitted & reflected light)

RE-5-560-565 (combined transmitted & reflected light)

RE-5-570-575 (transmitted light only)

RE-5-595-600 (combined transmitted & reflected light)

RE-5-680-685 (transmitted light only)

RE-5-765-770 (transmitted light only)

RE-5-540-545 Polished Thin Section Description

Rock Classification: Altered Igneous (Volcanic or Hypabyssal) Rock

Alteration: Silicic>propylitic>argillic

Hand Specimen: Screened and washed drill cuttings from 540'-545' interval of drill hole RE-5

Assays: 0.381 opt Au, 8.73 opt Ag

Transparent Minerals:

Feldspar: 70-75%; turbid; clay alteration common along cleavage surfaces; twinned plagioclase forms very sparse subhedral to euhedral grains and microphenocrysts 50-200 microns in length, minor propylitic alteration

Quartz: 12-16%, ubiquitous; alteration product, usually turbid with scattered irregular patches of clear quartz; also as occasional drusy veinlets (open-space filling); occasional (micro- to cryptocrystalline) chalcedonic drill chips; one silicified chip displays relict trachytic texture

Carbonate: 4-5%; sparse small patchy alteration and occasional veinlets; sometimes occurs with anatase; sparse monomineralic drill chips

Chlorite: 3-5%(?) overall, difficult to estimate; variable distribution; small alteration patches $\pm$ carbonate; sometimes forms relict prismatic grains (altered pyroxene?); intermixed (and subordinate to) clay in places; abundant in a few intensely chloritized drill chips

Clay: <3% (difficult to estimate); alteration product along cleavage surfaces in feldspar; also with quartz in altered phenocrysts; clay-rich fragments constitute 3-5% of the sample, one such drill chip containing brecciated clay fragments in quartz cement, foliated

Jarosite: Trace; cryptocrystalline; in one monomineralic drill chip

Zircon: Trace; 22-micron prismatic-rectangular grain; prismatic and subhedral-skeletal grains, very fine-grained

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Bright Green Chlorite/Clay?: Trace; in silicified drill chips

Opaque Minerals:

Pyrite (FeS_2): 1.5-2.5%; disseminated cubes and rare pyritohedrons in altered host rock and local fine-grained aggregates (in one drill chip); grain size range = 4-165 microns (long dimension)

Anatase (TiO_2): 0.25-0.5%; disseminated grains and aggregates in gangue; square outlines not uncommon; typical size of individual grains $\leq$12 microns (long dimension), typical size of aggregates <25 microns; rare stringer-like aggregates 60 and 160 microns in length; rarely intergrown with pyrite

Marcasite (FeS_2): 0.1-0.2%, local; intergrown with cubic pyrite in relict (replaced) prismatic grains (1.08 to 1.2 mm in length) in carbonate; zebra-like lamellae (twinning?); one pure 0.3-mm marcasite grain attached to clay fragment

Galena (PbS): Trace; irregular 10-micron inclusion in pyrite; 12-micron rectangular grain sandwiched between two pyrite grains; no silver or selenium was detected in galena grains analyzed by SEM

Sphalerite ((Zn,Fe)S): Trace; three dark gray irregular inclusions, $\leq$14 microns (long dimension), in pyrite; two other grains, 75 and 85 microns in size, found elsewhere; no silver was detected in the one grain analyzed by SEM

Rutile (TiO_2): Trace; one 35-micron subhedral grain in gangue

Note: No gold was found

Summary

The sample consists of partly silicified igneous (volcanic or hypabyssal) rock fragments. Silicification is more intense than either propylitic or argillic alteration overall, but the latter two types of alteration are predominant in a few drill chips. The patchy nature of the silicification may indicate an original porous texture in the protolith. Sparse micro-veinlets mineralogically indistinct from the altered host rock are also present.

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Opaque minerals, which constitute about 3% of the sample in the section, consist of pyrite, subordinate anatase and marcasite, and trace amounts of sphalerite, rutile, and galena. Marcasite is locally intergrown with pyrite where the two minerals appear to have simultaneously replaced two larger grains of a former unknown prismatic-shaped mineral. No gold was found. Potential silver-bearing minerals (i.e. galena, sphalerite, and pyrite) are too low in abundance to account for the high silver assay. Furthermore, no silver was detected in the galena grains analyzed by SEM.

Microscopist: Victoria Schurer

RE-5-560-565 Polished Thin Section Description

Rock Classification: Altered Igneous Rock (Volcanic or Hypabyssal)

Alteration: Silicic>propylitic>argillic

Hand Specimen: Screened and washed drill cuttings from 560'-565' interval of drill hole RE-5

Assays: 0.079 opt Au, 14.40 opt Ag

Transparent Minerals:

Feldspar: 83-85%; includes K-feldspar and plagioclase; feldspar typically turbid with patchy silicification and sparse quartz veinlets; scattered zoned euhedral to subhedral grains and microphenocrysts 0.1 to 0.6 mm in length, partly altered to chlorite or to carbonate; one rare bent phenocryst; plagioclase grains analyzed by SEM were found to be highly sodic

Quartz: 7-10%; largely secondary; irregular patches and sparse veinlets; occasional drill chip composed of silicified rock with turbid quartz; occasional chalcedonic quartz

Clay: 2-3%; ubiquitous in groundmass along cleavage in feldspar; often brown; also forms sparse irregular microveinlets; occasionally sericitic and colorless; kaolinitic clay identified by SEM in one quartz veinlet

Chlorite: 2%; altered mafic grains (occasionally with clay/sericite); occasionally interstitial in quartz patches or intermixed with clay in groundmass; abundant in one chip; also with vein quartz

Carbonate: 0.5-1% overall; small disseminated patches and local grains; occasional irregular microveinlets (one with sparse euhedral (drusy) quartz crystals on margins); local veinlets in one silicified drill chip

Zircon: <0.25%; local aggregates; grain size ≤50 microns (long dimension), except for one euhedral 100-micron grain

Apatite: Trace; one prismatic grain 150 microns in length

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Opaque Minerals:

Pyrite (FeS_2): 0.5-1%; cubic and occasional pyritohedral habits; general grain size range = 15-125 microns (long dimension), maximum size = 210 microns

Anatase (TiO_2): <0.25%; common grain size ≤20 microns (long dimension)

Marcasite (FeS_2): Minor; local rhombohedral/bladed grains and aggregates

Galena (PbS): Minor; anhedral with the exception of two subhedral-octahedral 18-micron grains; found in gangue or as small inclusions in pyrite; grain size ≤18 microns; no silver or selenium was detected in grains analyzed by SEM

Chalcopyrite ($CuFeS_2$): Trace; euhedral and amoeboid; two grains in gangue, and one grain largely enclosed by sphalerite; grain size = 4-12 microns (long dimension)

Sphalerite ((Zn,Fe)S): Trace; anhedral; one inclusion in pyrite, one grain intergrown with pyrite, and one grain with a chalcopyrite inclusion; grain size range = 7-125 microns (long dimension)

Hematite(?) (Fe_2O_3): Trace; two grains of possible hematite in carbonate; anisotropic, red internal reflections; grain sizes = 12 and 14 microns

Note: No gold was found

Summary

The sample consists of a fine-grained igneous rock (volcanic or hypabyssal) that has undergone patchy silicification and a lesser degree of propylitic (chlorite-carbonate) and clay alteration. The patchy nature of the silicification may reflect original porous texture of the protolith. Also present are sparse microveinlets which appear to be mineralogically indistinct from the altered host rock. Highly sodic plagioclase grains detected by SEM analysis may be indicative of albitization. Further study is recommended.

Opaque minerals constitute 1-1.5% of the sample and consist of pyrite, subordinate anatase, and minor local marcasite.

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Trace amounts of chalcopyrite, galena, and sphalerite are also present. No gold was found. The potential silver-bearing sulfides present (i.e. galena, sphalerite, and pyrite) are too sparse to account for the high silver assay. No silver was detected in galena grains analyzed by SEM.

Microscopist: Victoria Schurer

RE-5-570-575 Thin Section Description

Rock Classification: Altered Volcanic or Hypabyssal Rock

Alteration: Silicic>propylitic>argillic

Hand Specimen: Screened and washed drill cuttings from 570'-575' interval of drill hole RE-5

Assays: 0.149 opt Au, 2.49 opt Ag

Thin Section (half K-stained):

Feldspar: 75-80%; K-feldspar and plagioclase; subhedral and lesser euhedral forms; some zoning; clay alteration along cleavage surfaces, and some carbonate alteration; grain size of coarser grains and microphenocrysts = 50-300 microns (long dimension)

Quartz: 10-15%; irregular (mono- and polycrystalline) patches; sparse pure quartz drill chips (silicified rock)

Carbonate: 3% overall; small disseminated patches and rare veining

Clay: <3%, ubiquitous; alteration of feldspars, particularly along cleavage surfaces; occasional fracture-veinlets

Chlorite: 1-2%; abundant in groundmass of a few drill chips; alteration (± iron oxide) of mafic grains and occasionally of feldspar microphenocrysts

Iron Oxide + Opaques: 4-5%; ubiquitous; hematitic; iron oxide is oxidation product of coarser opaque patches (probable altered mafic grains) ± chlorite/clay; also as cubic, granular, and rare hexagonal disseminations and aggregates generally ≤25 microns in size

Zircon: Trace

Summary

The sample is comprised of a fine-grained volcanic or hypabyssal rock that has undergone silicification and less intense propylitization (carbonate-chlorite). Low-level clay alteration is pervasive. Fine-grained disseminated opaque grains are ubiquitous, and coarser hematitic patches occur in altered mafic grains. Also present are irregular discontinuous

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(K-stained) microveinlets which appear to be similar mineralogically to the surrounding host rock, and their relation to alteration is not clear.

Petrographer: Victoria Schurer

RE-5-595-600 Polished Thin Section Description

Rock Classification: Altered Volcanic or Hypabyssal Rock

Alteration: Silicic>propylitic>argillic

Hand Specimen: Screened and washed drill cuttings from 595'-600' interval of drill hole RE-5

Assays: 0.255 opt Au, 3.56 opt Ag

Transparent Minerals:

Feldspar: 83-85%; plagioclase and K-feldspar; usually anhedral to subhedral grains, with sparse euhedral to subhedral microphenocrysts 0.2-0.6 mm in length; grain boundaries in groundmass commonly ill-defined; clay alteration along cleavage surfaces; rare twinning; turbid in some drill chips

Quartz: 10-12%; scattered irregular patches; moderately abundant fluid inclusions; one chalcedonic chip cut by a carbonate veinlet

Clay: <2%; ubiquitous; alteration of feldspar (commonly along cleavage surfaces in groundmass grains); sparse small patches and occasional microveinlets (one with carbonate); colorless

Carbonate (includes Calcite): 0.75-1%; local vein material (with quartz); major alteration product of plagioclase microphenocrysts; occasionally botryoidal

Chlorite: 0.5-1%; forms sparse altered (pyroxene?) grains ± hematite; occasional veinlet with carbonate; strong green color

Zircon: <0.25%; prismatic and anhedral; forms patchy skeletal aggregates and local concentrations; grain size ≤40 microns (long dimension)

Opaque Minerals:

Magnetite (Fe_3O_4) + Ilmenite ($FeTiO_3$): 0.5-0.75% (2% in one drill chip); granular, octahedral, and lesser cubic disseminated grains in host rock; main opaque mineral in most drill chips; occasionally rimmed by hematite; typical size of coarser grains and aggregates = 15-50 microns (long dimension); SEM analysis of several grains indicates a range in titanium levels from non-titaniferous to titaniferous magnetite to ilmenite

Pyrite (FeS_2): <0.25%; sparse disseminated cubic grains present in only a few drill chips; common grain size <50 microns (long dimension), maximum size = 125 microns

Hematite (Fe_2O_3): <0.25%; narrow rims on magnetite; in fractures of chloritized mafic grains and in partly leached/altered grains

Galena (PbS): Minor; anhedral and occasional subhedral-cubic forms; found as inclusions in pyrite or grains attached to pyrite, or in quartz; also found partly or completely enclosed in sphalerite (in calcite); grain size range = 5-70 microns (long dimension); no silver or selenium was detected in grains analyzed by SEM

Anatase (TiO_2): Minor; disseminated grains often in local concentrations; typical grain size = 4-32 microns (long dimension)

Sphalerite ((Zn,Fe)S): Trace; 130-micron prismatic grain (in calcite-altered plagioclase phenocryst) enclosing or partly enclosing grains of galena; anhedral 6-micron inclusion (near a galena inclusion) in pyrite

Note: No gold was found

Summary

The sample consists of fine-grained volcanic or hypabyssal rock that has undergone patchy silicification and low-level propylitic (chlorite-carbonate) and clay alteration. The patchy occurrence of the quartz may reflect an original porous texture of the protolith. Local veining observed under plane-polarized transmitted light does not appear to consist of mineralogy that is significantly distinct from the host rock, other than an occasional increase in chlorite.

Opaque minerals comprise less than 1% of the rock and include magnetite-ilmenite, subordinate pyrite and hematite, and minor galena and anatase. Trace amounts of sphalerite are also present. Some magnetite grains have been partly altered to hematite on the rims. The pyrite content is much lower than that of the other two polished thin sections of this suite. Galena is associated with pyrite and, in one case, with sphalerite. No gold was found in the section.

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The presence of ilmenite along with titaniferous and non-titaniferous magnetite (detected by SEM) indicates an irregular distribution of titanium, which is a phenomenon more likely to occur in tuffs than in volcanic rocks.

Microscopist: Victoria Schurer

RE-5-680-685 Thin Section Description

Rock Classification: Altered Igneous (Volcanic or Hypabyssal) Rock

Alteration: Silicic>propylitic>clay

Hand Specimen: Screened and washed drill cuttings from 680'-685' interval of drill hole RE-5

Assays: 0.088 opt Au, 0.85 opt Ag

Thin Section (half K-stained):

Feldspar + Quartz: 92%

Feldspar: Partly silicified and propylitized (chlorite-carbonate), with minor clay alteration; some euhedral to subhedral laths 50 microns to 0.6 mm in length

Quartz: Patchy replacement in less altered rock, and rare discontinuous veinlets; abundant (and often turbid) in some intensely silicified rock chips

Chlorite: 3-5% overall; alteration of feldspar, often associated with carbonate; usually light green

Carbonate: 3-4%; anhedral; alteration of plagioclase, often with chlorite; local vein(?) material

Clay: <1%; feldspar alteration, particularly along cleavage surfaces; abundant and intergrown with quartz in one drill chip

Zircon: Trace; anhedral and prismatic; sparse skeletal aggregates

Opaques (includes Pyrite): ≤0.25%; cubic; maximum grain size = 280 microns (long dimension)

Summary

The sample consists of two types of altered igneous material: (1) intensely silicified and moderately chloritized rock, and (2) less intensely silicified volcanic or hypabyssal rock with moderate propylitic (chlorite-carbonate) and minor clay alteration. The second type of rock contains patchy quartz which may be indicative of an original porous texture in the protolith. Also present in this second rock type are sparse microveinlets that appear to be mineralogically indistinct from the altered host rock.

Petrographer: Victoria Schurer

RE-5-765-770A Thin Section Description

Rock Classification: Altered Volcanic ± Hypabyssal Rock

Alteration: Silicic>propylitic>argillic

Hand Specimen: Screened and washed drill cuttings from 765'-770' interval of drill hole RE-5

Assays: 0.021 opt Au, 0.24 opt Ag

Thin Section (1 of 2 half K-stained thin sections):

Quartz + Feldspar: 94%; quartz content in individual chips varies from 5% to 90%+; includes intensely silicified igneous rock with some relict trachytic texture and turbid quartz, and less intensely silicified feldspar-rich igneous rock (with patchy silicification); sparse quartz veinlets, some cross-cut by carbonate veinlets; sparse irregular veinlets of indistinct mineralogy in less silicified rock; liquid-dominant fluid inclusions common in patchy quartz

Carbonate: 2.5-3% overall; small alteration patches (locally abundant); pure carbonate veinlets common (some cutting across quartz veinlets); in altered mafic grains with iron oxide ± chlorite; also as major alteration product of plagioclase phenocrysts

Chlorite: 1%(?) overall; variable distribution; fine-grained alteration (± carbonate) of host rock; present in one carbonate veinlet; also found with carbonate and iron oxide in altered mafic grains; dull to bright green color, pleochroic

Clay: <1%; alteration of feldspar along cleavage surfaces; not usually present in intensely silicified drill chps; sparse veinlets present in second section made from this sample

Iron Oxide + Opaques: 0.5-1%; includes hematite; fine-grained disseminated granular, cubic, and hexagonal grains commonly in the 4- to 14-micron size range; also in altered mafic grains with carbonate and chlorite

Zircon: Trace; semi-opaque patchy skeletal aggregate

(continued)

Summary

The sample contains altered igneous rock of two varieties: (1) intensely silicified rock with some relict trachytic texture, and (2) feldspar-rich rock with patchy silicification. The patchy nature of the quartz in the second rock type may represent relict porous texture of the protolith.

Propylitic alteration (carbonate-chlorite) is of variable intensity in both types of rock. Limited crosscutting relationships of carbonate and quartz veinlets suggest that propylitic alteration postdates silicification. Minor clay alteration has occurred in the less silicified rock. Irregular stockwork veining, which is not mineralogically distinct from the host rock, may be related to silicification or to an earlier alteration event.

Petrographer: Victoria Schurer

Rosebud

89-017/Lac
Rolls #1 & #2

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