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BC Geological Survey
Assessment Report
38241

Ministry of Energy, Mines & Petroleum Resources
Mining & Minerals Division
BC Geological Survey

Assessment Report
Title Page and Summary

TYPE OF REPORT [type of survey(s)]: Geological, geochemical, petrographic

TOTAL COST: 30,107.85

AUTHOR(S): John Bradford

SIGNATURE(S):

NOTICE OF WORK PERMIT NUMBER(S)/DATE(S): N/A

YEAR OF WORK: 2018

STATEMENT OF WORK - CASH PAYMENTS EVENT NUMBER(S)/DATE(S): 5735397 2019/MAR/25

PROPERTY NAME: Oxide Peak

CLAIM NAME(S) (on which the work was done): 1063012, 1063006

COMMODITIES SOUGHT: Cu, Au

MINERAL INVENTORY MINFILE NUMBER(S), IF KNOWN:

MINING DIVISION: Liard

NTS/BCGS: 094E/06, 094E/11; 094E045

LATITUDE: 57 ° 28 ' " **LONGITUDE:** 127 ° 05 ' " **(at centre of work)**

OWNER(S):
1) ArcWest Exploration, Inc.
2)

MAILING ADDRESS:
2300 - 1177 West Hastings Street Vancouver, BC V6E 2K3

OPERATOR(S) [who paid for the work]:
1) ArcWest Exploration, Inc.
2)

MAILING ADDRESS:
2300 - 1177 West Hastings Street Vancouver, BC V6E 2K3

PROPERTY GEOLOGY KEYWORDS (lithology, age, stratigraphy, structure, alteration, mineralization, size and attitude):
Hazelton Group, Toodoggone Formation, Takla Group, potassic, propylitic, QSP, porphyry, vein, magnetite, hematite, chalcopyrite, pyrite

REFERENCES TO PREVIOUS ASSESSMENT WORK AND ASSESSMENT REPORT NUMBERS: 5194, 8998, 14795, 15070, 18793, 27638, 34792, 36482

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TYPE OF WORK IN THIS REPORT	EXTENT OF WORK (IN METRIC UNITS)	ON WHICH CLAIMS	PROJECT COSTS APPORTIONED (incl. support)
GEOLOGICAL (scale, area)			
Ground, mapping	2 sq. km	1063006, 1063012	26107.85
Photo interpretation			
GEOPHYSICAL (line-kilometres)			
Ground			
Magnetic			
Electromagnetic			
Induced Polarization			
Radiometric			
Seismic			
Other			
Airborne			
GEOCHEMICAL (number of samples analysed for...)			
Soil			
Silt			
Rock	4	1063012	1500
Other			
DRILLING (total metres; number of holes, size)			
Core			
Non-core			
RELATED TECHNICAL			
Sampling/assaying			
Petrographic	6	1063006	2500
Mineralographic			
Metallurgic			
PROSPECTING (scale, area)			
PREPARATORY / PHYSICAL			
Line/grid (kilometres)			
Topographic/Photogrammetric (scale, area)			
Legal surveys (scale, area)			
Road, local access (kilometres)/trail			
Trench (metres)			
Underground dev. (metres)			
Other			
		TOTAL COST:	30107.85

Assessment Report

Geology, Rock Geochemistry and Petrographic Study of the Oxide Peak Property

Liard Mining Division

094E/06, 094E/11
094E045

615500mE 6372000mN UTM Z09 NAD83
57°29'N 127°05'W NAD83

For

ArcWest Exploration Inc.

By

John Bradford

April 2, 2019

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Geology, Rock Geochemistry, and Petrographic Study of the Oxide Peak Property

Introduction

The Oxide Peak Property was examined by the author and geologist Tyler Ruks over the course of two days on September 13 and 14, 2018. The primary focus of the work program was to re-examine two previously documented alteration and mineralized zones (Falcon and Oxide Creek) in order to document the style of mineralization and alteration and determine the area's prospectivity for porphyry copper-gold deposits. Representative rock samples were collected in four altered areas to document the presence and tenor of mineralization. In addition, petrographic work was conducted on a number of samples by Craig Leitch of Vancouver Petrographics in order to better characterize lithologies and alteration suites. All work including report writing was completed at a cost of $16624.44.

Location and Access

The Oxide Peak Property is located in the northern part of the Toodoggone district in northern B.C. on the north side of the Toodoggone River between McClair and Mulvaney Creeks (Figure 1). The property is located in NTS 094E/06 and 094E/11 centered near UTM 615500mE 6372000mN, 57°29'N 127°05'W. The property is helicopter access only, with the nearest road access to the old Baker and Lawyers mine sites, about 18-20 kilometers to the southwest. The nearest power line is about 55 kilometers to the south at the Kemess mine and mill site. An old mineral exploration camp is located at UTM 613833 E, 6372024 N on a small lake within the Gordonia Gulch valley.

Physiography, Climate and Vegetation

The Oxide Peak Property is located within the Metsantan Range, one of the Swannell Ranges of the Omineca Mountains. The property occupies an area of deeply incised, glaciated mountainous terrain with elevations extending from just below 1400 meters in the Belle Lakes area to almost 2200 meters at Mount Gordonia, near the center of the property.

Seasonal temperatures vary from -35°C in winter to over 30°C during the 4 months of summer. The mean daily temperatures for July and January are approximately 14° C and -15° C, respectively. Annual precipitation averages between 50 and 75 centimeters, with most during the winter months as snow cover of approximately 2 meters.

The area lies within the Spruce-Willow-Birch Biogeoclimatic Zone, with vegetation cover occurring in the main valleys, surrounding broad alpine areas. A variety of wildlife inhabits the area including black bears, grizzlies, wolves, fox, moose and caribou.

Claims and Ownership

The Oxide Peak Property consists of 4 contiguous claims which total 3359 hectares, as indicated in Table 1 and Figure 2. They are owned 100% by ArcWest Exploration, Inc., Vancouver, BC. (formerly Sojourn Exploration, Inc.)

Table 1: Claim Status

Title Number	Owner	Title Type	Issue Date	Good To Date	Status	Area (ha)
1063001	285428 (100%)	Mineral	2018/SEP/13	2020/AUG/30	GOOD	522.3651
1063006	285428 (100%)	Mineral	2018/SEP/13	2020/AUG/30	GOOD	1287.377
1063010	285428 (100%)	Mineral	2018/SEP/13	2020/AUG/30	GOOD	1061.369
1063012	285428 (100%)	Mineral	2018/SEP/13	2020/AUG/30	GOOD	487.6394
						3358.7511

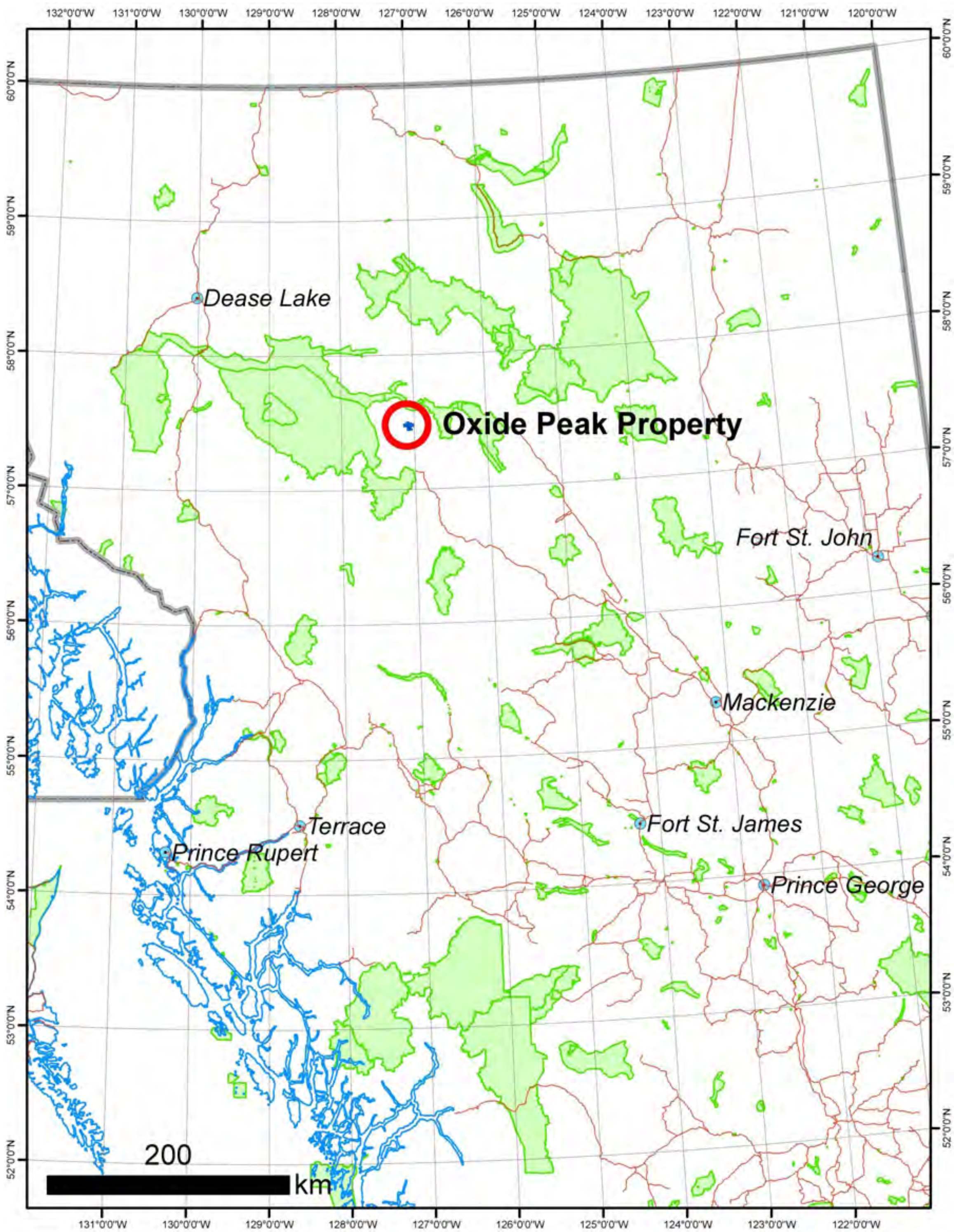

Figure 1: Location of the Oxide Peak Property.

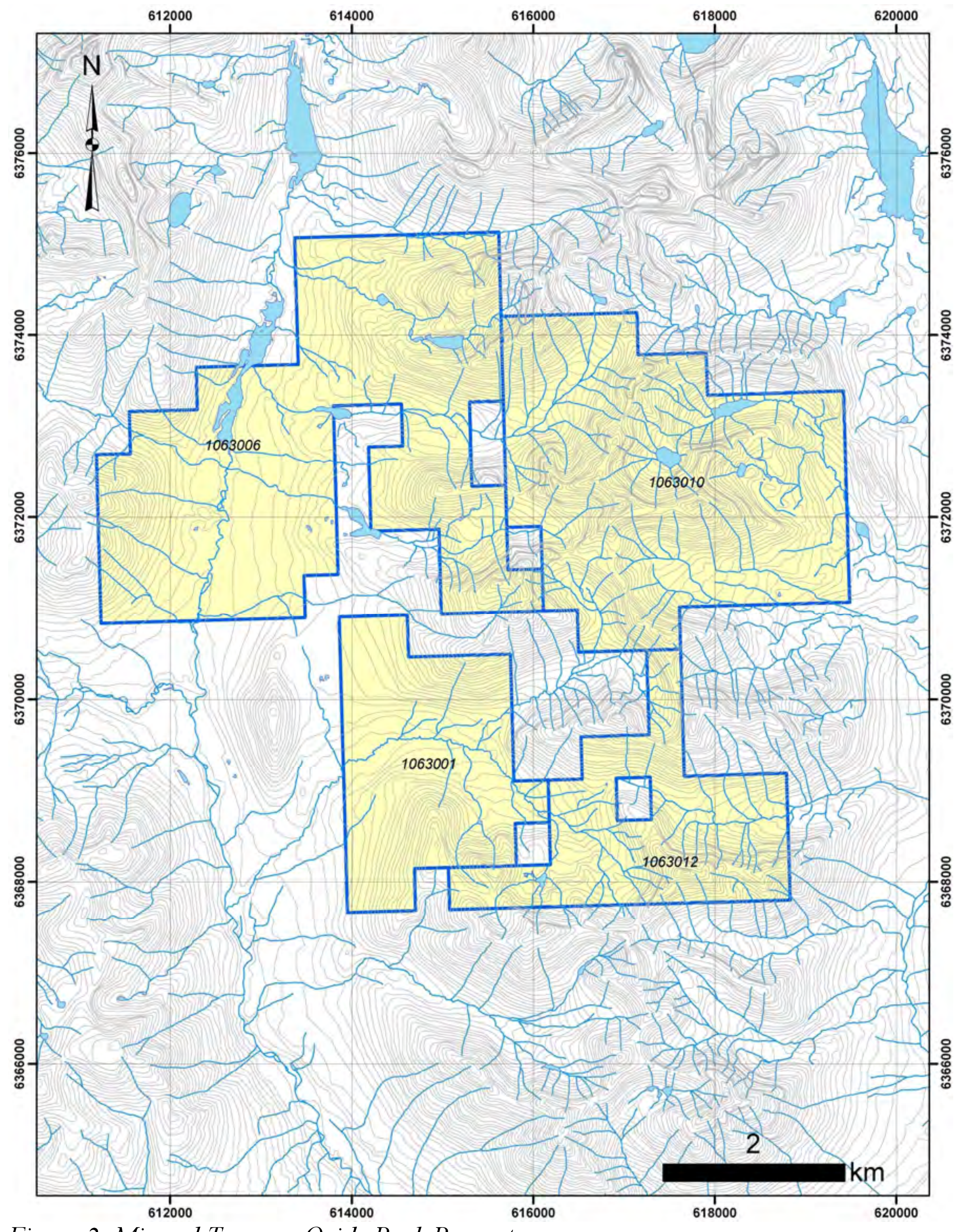

Figure 2: Mineral Tenures, Oxide Peak Property.

Exploration History

A brief summary of the exploration history of the Toodoggone district is presented in Diakow et al., 1993 (pp. 45-46). The earliest placer mining in the district in the mid-1920's took place in McClair Creek, just 5 kilometers south of the Oxide Peak property.

In 1970, a ground magnetometer survey was completed by Red Rock Mines in the central part of the property near Mount Gordonia, as a follow-up on the discovery of bornite and copper staining (McKelvie, 1970). In 1974, Union Miniere carried out geological mapping, soil sampling, and an EM survey in the eastern part of the property (Burgoyne, 1974). A variety of small geochemical (soil and rock) sampling programs were carried out north and south of Mount Gordonia in the 1980's (see References for assessment carried out on the Joanna and Magic claims). In addition, a 110 line-kilometer airborne magnetic survey was flown in 1986 (Woods, 1988). This survey outlined two large magnetic highs on the east side of Belle Creek valley.

In the western part of the property in 1980, SEREM carried out a program of geological mapping and soil and silt sampling around the Oxide Peak alteration zone (Crawford and Vulimiri, 1981). Additional mapping and sampling was carried out in 1986 (Yeager and Ikona, 1986) and 1988 (Lyman, 1988).

Stealth Minerals carried out the most extensive geochemical sampling program on the Gordonia and Oxide Peak areas in 2004 (Kuran and Barrios, 2005), collecting 628 rock samples, 30 soils, and 10 silt samples, as well as doing PIMA analyses of 274 rock samples. This program detailed widespread high Cu, Au, Ag and other base metal anomalies.

Seven Devils Exploration carried out a small prospecting and geochemical sampling program in 2016, collecting 26 rock samples, and assessing the prospectivity of the Oxide Peak, Gordonia, Tarn and Falcon zones for porphyry copper-gold deposits.

Regional Geology and Metallogeny

Regional geology of the Toodoggone River district was compiled in Diakow et al. (1985; Figure 3) and revised by Diakow (2006; Figure 4). The following general summary of the regional geology and metallogeny of the northern Toodoggone district is adapted from McBride and Leslie (2014).

> *The Toodoggone volcanic sequence, which appears to underlie most of the Oxide Peak Property, occurs in the northeastern part of the Intermontane tectonic belt, within the Stikine and northern Quesnel terranes. This lower Jurassic unit, comprising calcalkaline latite and dacite subaerial volcanic rocks of distinctive lithologies and comagmatic plutons, accounts for most of the island arc-forming Hazelton Group rocks exposed between the Finlay and Chukachida Rivers. Unconformably underlying this sequence is the late Triassic Takla Group, dominated by island arc basaltic to andesitic flows, tuffs and breccias with subordinate sedimentary clastics and limestone. The oldest rocks of the region, intensely deformed late Carboniferous to Permian Asitka Group volcanics and sedimentary rocks, are of limited extent, cropping out in uplifted blocks and around pluton margins as in the Baker mine area to the south. Continental clastic sediments of the Cretaceous Sustut Group unconformably cap the volcanic successions.*
>
> *Associated with an elongate, northwesterly trending, volcanic-tectonic structural development, the Toodoggone volcanics represent a voluminous accumulation of material over a 90 by 25 km. area within an asymmetric collapse feature in a continent-arc setting. Two eruptive cycles are recognized within the Toodoggone. The lower cycle is characterized by plateau forming dacitic ash-flow and air-fall tuffs interspersed with and followed by latite flows and lahars. Following an erosional event which partially unroofed previous co-magmatic plutons, the upper cycle proceeded with explosive dacite pyroclastic eruptions, culminating with voluminous ashflow tuff accumulations.*
>
> *A variety of mineral deposit types are related to the Toodoggone eruptive cycles and co-magmatic events (Diakow et al., 1991; Duuring et la., 2009). These include: gold- and silver-rich, low-sulphidation epithermal systems characterized by quartz veins, stockworks and breccias with associated adularia, sericite and calcite; high-sulphidation systems with associated fine-grained silica, alunite, barite and clay; and porphyry copper-gold systems within and marginal to early Jurassic plutons. The more common sericite-adularia type, is typified by the Lawyers and Shasta deposits. The acid sulphate deposits include the Ranch (BV/Al), Baker and Silver Pond prospects. The Kemess South mine and the Kemess North and Kemess East deposits, examples of copper - gold porphyry systems, are characterized by chalcopyrite, pyrite and minor molybdenite (+/- magnetite) occurring as disseminations and polyphase quartz stockworks.*

The most recent geological compilation by Diakow (2006) includes the eastern two-thirds of the Oxide Peak property east of McClair Creek and the Belle Lakes (Figure 4). North of the Toodoggone River the general sequence south to north is as follows:

- **McClair Pluton**: Early Jurassic quartz monzonite (Black Lake plutonic suite)

- **Late Triassic Takla Group**: includes basalt and andesite lava flows; typically fine to medium grained clinopyroxene-plagioclase porphyries and aphanitic lavas; typically massive and inherently difficult to subdivide (uTTa); also sandstone and siltstone; drab olive green, dominated by plagioclase and lesser pyroxene grains; bedded section between lava flows of unit uTTa (uTTs)

- **Early Jurassic Hazelton Group, Upper Toodoggone Formation**: includes conglomerate and sandstone dominated by fine grained basaltic detritus that is presumably derived in part from units TJv or uTTa; reworked polymict lapilli tuffs and breccias; heterolithic unit comprising diffusely layered very thick beds (TJs); also basalt and andesite lava flows characterized by crowded plagioclase 1mm long or less and relatively fresh pyroxene; minor pyroxene bearing sandstone interbeds (TJv); also dacite ash-flow tuff, light green to maroon, texturally variable including nonwelded, locally lithic rich, and thick (100-150m) welded columnar jointed zones; diagnostic accidental pyroclasts include pink, quartz-biotite dacite porphyry and biotite-hornblende quartz monzonite; rare cross-laminated ground surge tuff or layered fallout ash and fine lapilli tuff at the base (TG).

The gently to moderately north dipping Takla - Hazelton unconformity is mapped along the south flank of Mount Gordonia in the central part of the property. A U/Pb zircon age date of 194.7 + 0.4 Ma was obtained from a site about 0.5 kilometers southeast of the peak (Diakow, 2006).

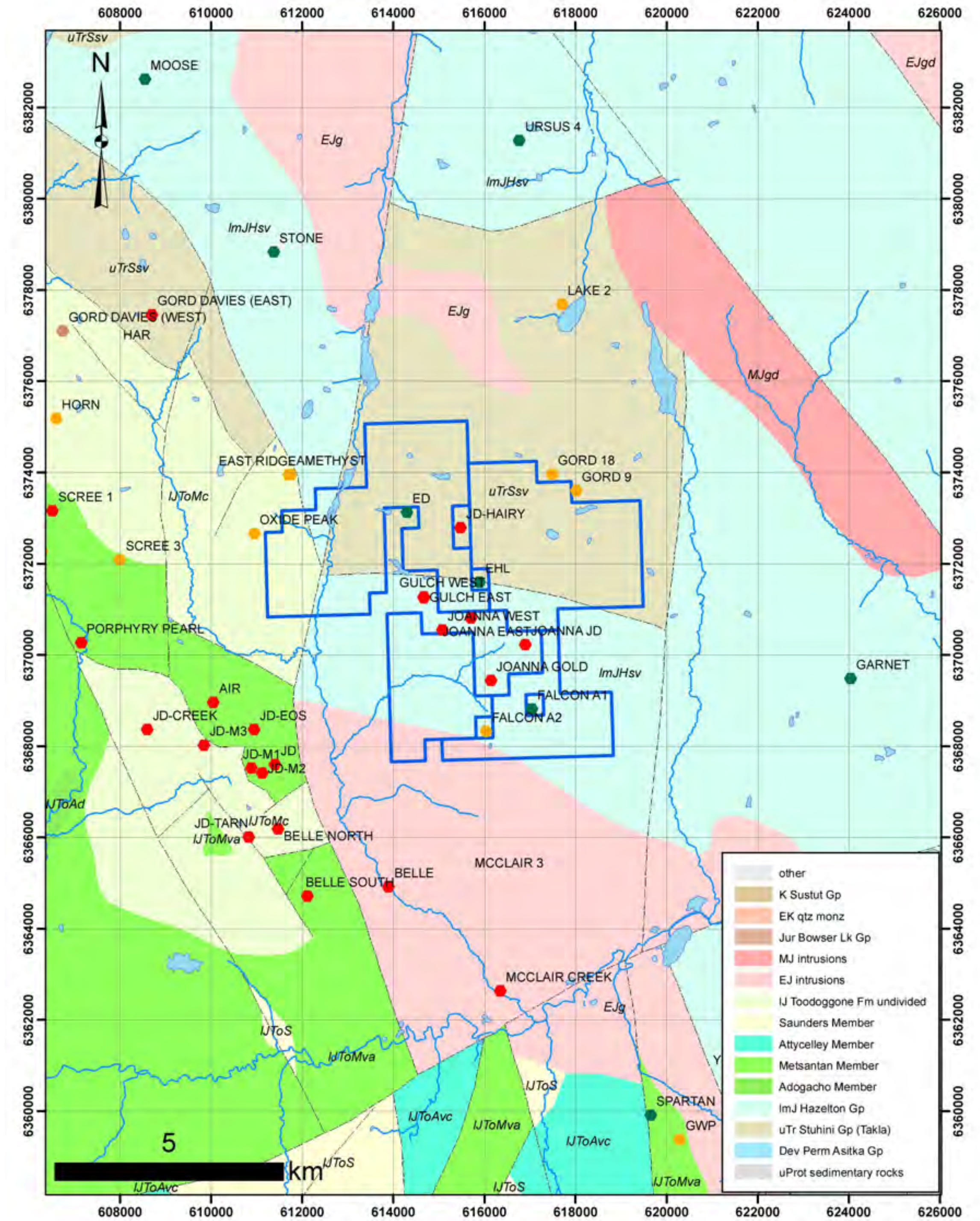

Figure 3: Regional geology and MINFILE occurrences, based on Diakow et al. (1985).

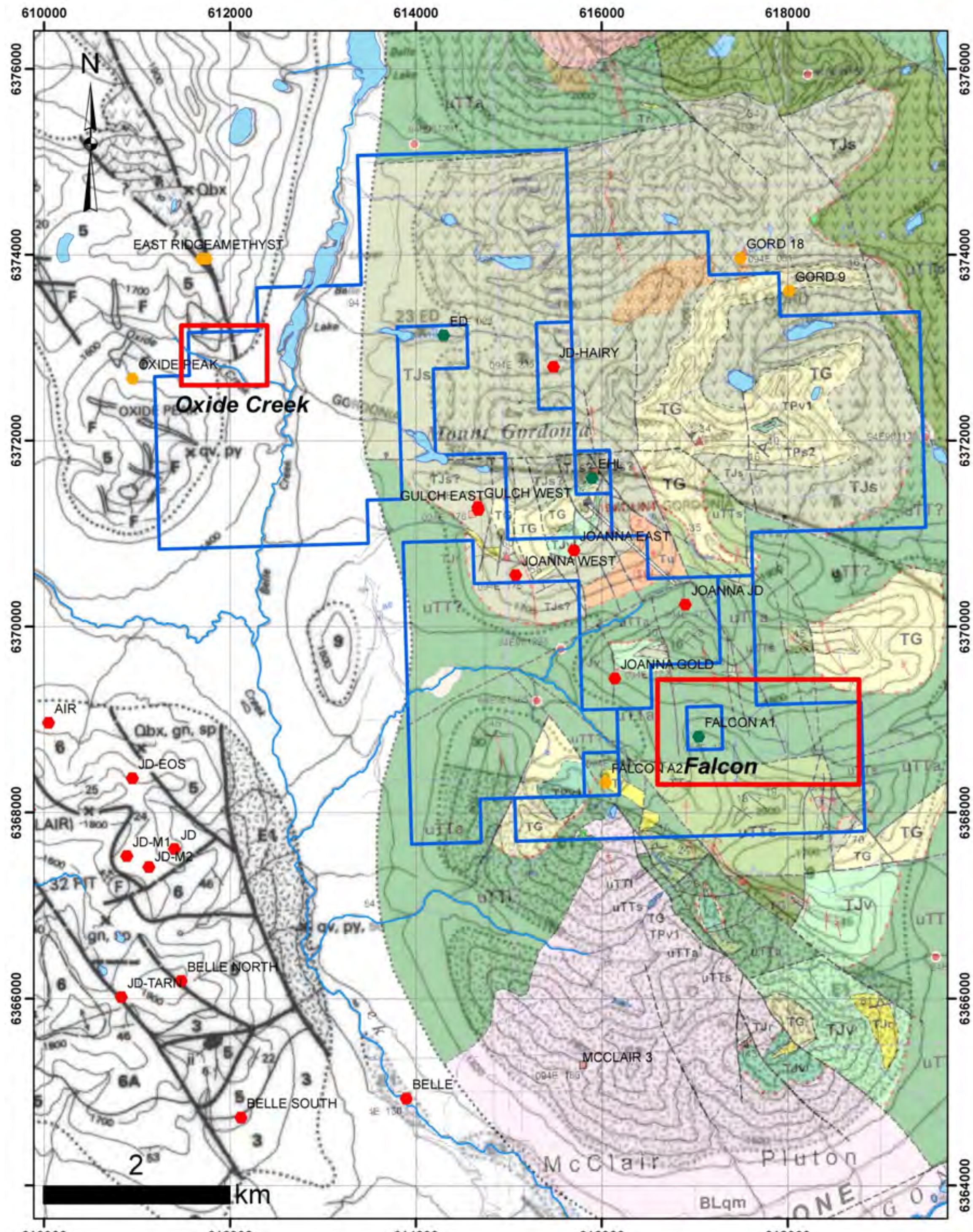

Figure 4: Detailed geology and areas investigated in 2018 (map legend on next page).

Units east of McClair Creek (Diakow, L.J. 2006)

BLqm - Early Jurassic McClair Pluton: quartz monzonite (Black Lake plutonic suite)

Tr - Dacite to rhyolite sills, locally flow laminated

Early Jurassic Hazelton Group, Upper Toodoggone Formation:

- **TG** - dacite ash-flow tuff, light green to maroon, texturally variable including nonwelded, locally lithic rich, and thick (100-150m) welded columnar jointed zones; diagnostic accidental pyroclasts include pink, quartz-biotite dacite porphyry and biotite-hornblende quartz monzonite; rare cross-laminated ground surge tuff or layered fallout ash and fine lapilli tuff at the base
- **TJr** - dacite to rhyolite lava flows; lenticular; commonly flow-laminated deposits
- **TJs** - conglomerate and sandstone dominated by fine grained basaltic detritus that is presumably derived in part from units TJv or uTTa; reworked polymict lapilli tuffs and breccias; heterolithic unit comprising diffusely layered very thick beds
- **TJv** - basalt and andesite lava flows characterized by crowded plagioclase 1mm long or less and relatively fresh pyroxene; minor pyroxene bearing sandstone interbeds

Late Triassic Takla Group (uTT):

- **uTTa** - basalt and andesite lava flows; typically fine to medium grained clinopyroxene-plagioclase porphyries and aphanitic lavas; typically massive and inherently difficult to subdivide
- **uTTs** - sandstone and siltstone; drab olive green, dominated by plagioclase and lesser pyroxene grains; bedded section between lava flows of unit uTTa

Units west of McClair Creek (Diakow, L.J., Panteleyev, A., and Schroeter, T.G. 1985)

Early Jurassic Hazelton Group, Upper Toodoggone Formation:

- **9** - undivided volcanic and sedimentary rocks
- **6** - Tuff Peak Formation: pale purple, grey and green biotite augite hornblende plagioclase porphyry flows, autobrecciated flows, minor sills and plugs, crystal and lapilli tuff
    - **6A** - conglomerate or lahar with graded and crosslaminated mudstone and sandstone interbedded; debris flows, lailli and crystal tuffs
- **5** - McClair Creek Formation: purple, grey, green crowded fine to medium grained plagioclase porphyritic flows, includes some lapilli tuff, breccia and minor epiclastic beds
- **3** - Lawyers-Metsantan quartzose andesite: green to grey quartzose pyroxene hornblende plagioclase porphyry flows and tuffs, with local flow breccia, lapilli tuff and rare welded tuff units

Tr - Late Triassic Takla Group: dark green augite porphyry basalt flows and breccias with lesser andesite and minor interbedded sediments

F - Feldspar porphyry, hornblende feldspar porphyry

E1 - Granodiorite, quartz diorite

Figure 4: Map legend.

Reconnaissance Geology, Alteration and Mineralization

Reconnaissance traverses were conducted in two separate areas, designated: (1) Oxide Creek, and (2) Falcon (Figure 4), where previous work in 2016 had indicated the presence of copper mineralization in a porphyry-type environment (Bradford and Ruks, 2016).

Areas traversed and generalized geological observations are shown in Figures 5-7, along with locations of rock samples.

Falcon

The Falcon area is located in a broad, open valley with tributary creeks descending to the east towards Mulvaney Creek, and to the west towards McClair Creek. The area is underlain by Takla Group sedimentary and volcanic rocks, although the Takla Group - Hazelton Group unconformity is mapped just west of as well as northeast of the area traversed in 2018 (Figure 4). At higher elevations, shallowly north to northeast dipping, strongly hornfelsed thin to medium bedded siltstone to fine grained sandstone comprises unit uTTS of Diakow (2006). This unit is in fault contact with andesitic volcanic rocks to the north (unit uTTa), which underlie the Falcon alteration zone. Both sedimentary and volcanic packages are intruded by a series of monzonite (feldspar-hornblende±biotite) porphyry and quartz-feldspar porphyry dykes. According to Diakow (2006), this area is strongly affected by north-south, east-west and northwest trending block faults (Figure 4).

The most intense alteration in the valley exposures of the Falcon zone consist of variable chlorite-sericite-pyrite (CSP) to locally intense quartz-sericite-pyrite (QSP), which is accompanied by abundant clear quartz and quartz-pyrite stringers and trace chalcopyrite. The width of CSP-QSP alteration is about 1.4 km, which is central to a broad (>2 km wide) zone dominated by epidote-chlorite. Sulfide veins and blebs with strong chalcopyrite mineralization (over 2% Cu) are seen locally as well. Altered outcrops comprise andesitic volcanics cut by feldspar-hornblende monzonite porphyry and QFP dykes.

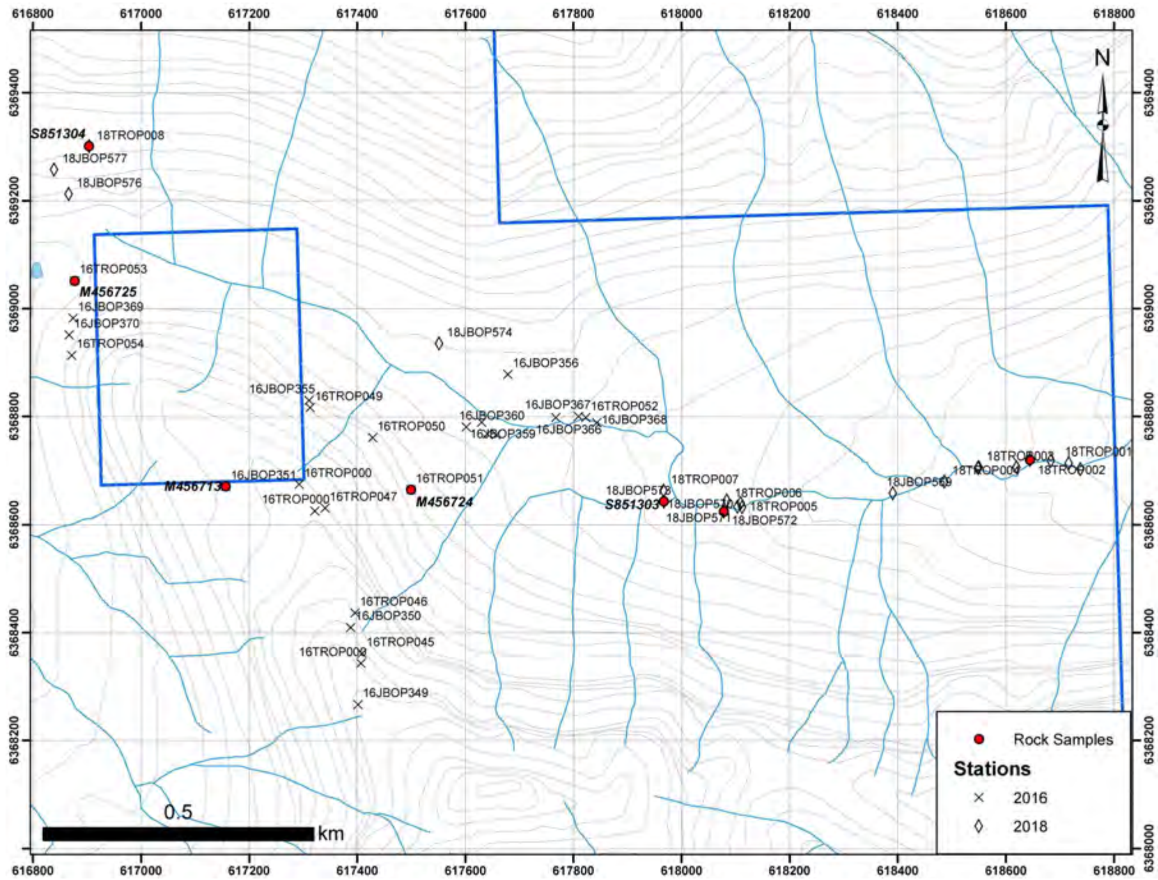

Figure 5: Falcon area stations and rock samples (2016 stations described in Bradford and Ruks, 2016)

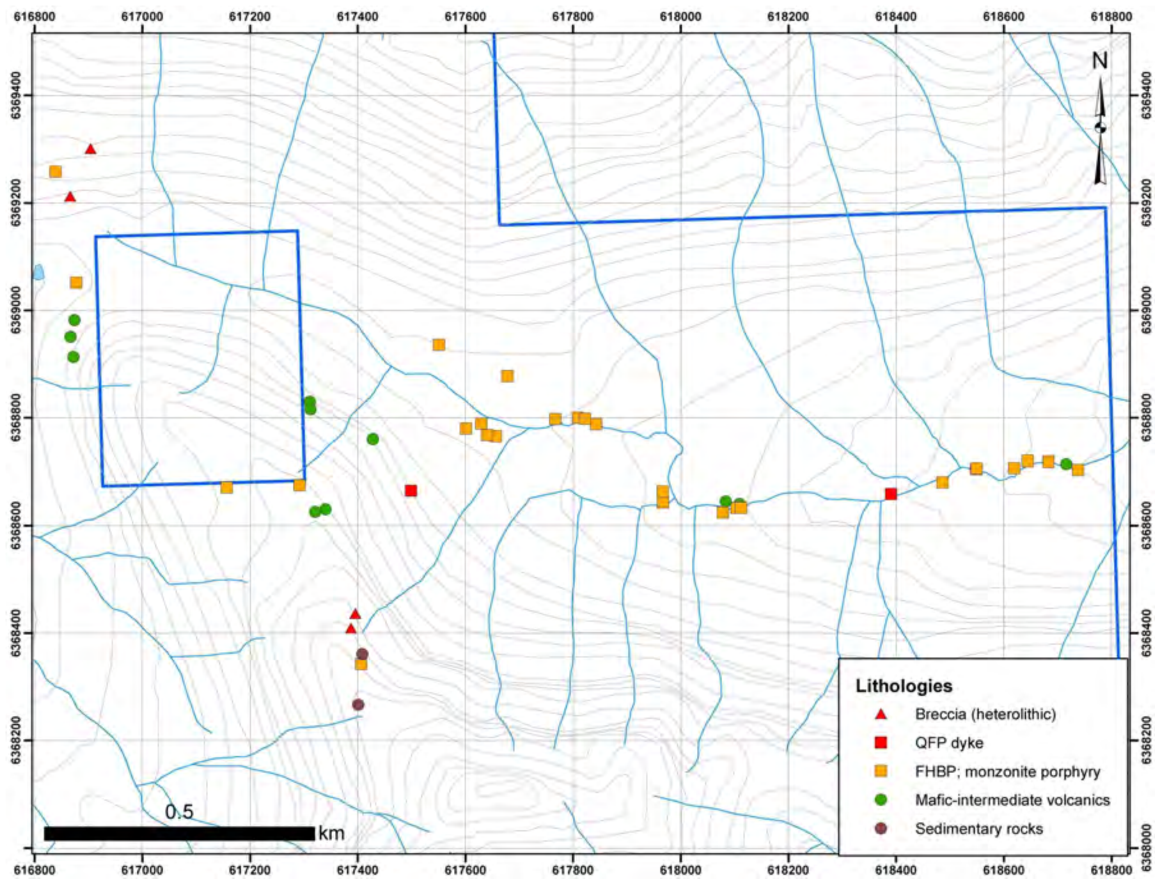

Figure 6: Falcon area lithologies

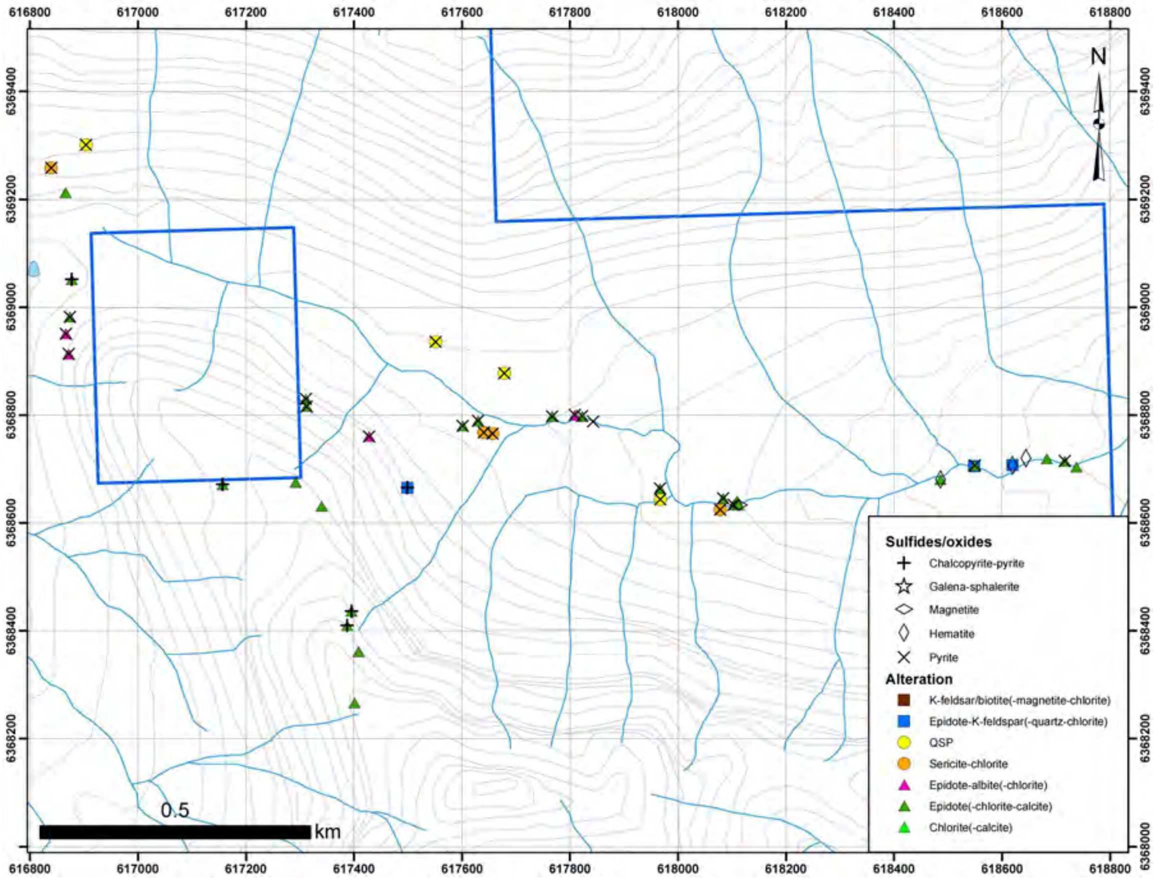

Figure 7: Falcon area alteration

The 2018 traverse extended the eastern limits of the alteration zone to the edge of the property about 1.3 km to the east of the area prospected in 2016, and also included examination of exposures on the north side of the valley. To the eastern edge of the property, alteration within the valley remains dominated by propylitic facies, mainly epidote-chlorite, but also including variable but significant calcite and pyrite. Although outcrops are mainly intermediate volcanics, crowded feldspar(-hornblende-biotite) porphyry (FHBP) dykes are also widespread.

Crowded feldspar porphyry (right) cutting epidote altered mafic to intermediate volcanics (left); station 18JBOP562.

Working inward (westward) from the eastern property boundary, the dominant epidote-chlorite alteration is first accompanied by quartz veins with epidote and hematite halos as well as hematite veins about 150m west of the claim boundary (station 18TROP002). Hematite veins occur mainly in FHBP dykes. About 100 meters west of the easternmost appearance of hematite veins, veins increase to stockwork intensity in places, and consist mainly of quartz, epidote and K-feldspar as well as hematite. About 250 meters west of the outermost hematite veining, the easternmost quartz-feldspar porphyry dyke was mapped (18JBOP569); these dykes appear to be a later phase than the feldspar-hornblende monzonite porphyry dykes.

About 530 m west of the outermost hematite, FHBP dykes containing a strong quartz-epidote±magnetite stockwork were mapped (18TROP005); these dykes coincide with the easternmost appearance of zones of intermittent QSP to CSP alteration. The QSP/CSP zones (e.g. 18JB572-3) tend to be controlled by dyke contacts and small scale faults, and are surrounded by broader zones of epidote-chlorite with widespread quartz-epidote±K-feldspar±magnetite veining.

Rusty chlorite-sericite-pyrite (CSP) alteration with quartz and pyrite veinlets adjacent to porphyry dyke, station 18JBOP572, sample S851302 (0.108 g/t Au).

Intense quartz-sericite-pyrite alteration with quartz and oxidized pyrite veinlets, station 18JBOP573, sample S851303 (over 7% S, but strongly depleted in Au, Cu and Zn).

Quartz-epidote stockwork; some veins have pink K-feldspar haloes; station 18TROP007 (adjacent to previous photo).

Gossanous exposures on the north side of the valley were also examined in 2018. Here intensely epidote-chlorite-pyrite altered volcanics are cut by breccia zones (hydrothermal-magmatic?) with variably altered (chlorite-epidote-pyrite to QSP) feldspar-phyric intrusive clasts within a QSP altered matrix. Clasts range from pebble to boulder size (+40 cm), and are subangular to subrounded. In places quartz veins cut the breccia matrix.


Intensely altered breccia, station 18TROP008.

Oxide Creek

The McClair Creek member of the Toodoggone Formation, consisting of a heterogeneous sequence of predominantly andesitic flows and tuffs, underlies the Oxide Peak area in the western part of the property. The volcanics are intruded by a number of porphyritic intrusive phases, including feldspar, hornblende, quartz and biotite phyric dykes. The distribution of dykes (unit F) is shown somewhat schematically, in Figure 4. Two traverses in this area in 2016 confirmed the presence of widespread advanced argillic and propylitic alteration in the volcanics and porphyry dykes at higher elevations near the ridgetop, and multiphase mineralized and unmineralized feldspar-hornblende (-quartz-biotite) porphyries along the creek valley.

In 2018 a more detailed examination was conducted of a mineralized zone on Oxide Creek where strong chlorite (possibly after secondary biotite)-magnetite-pyrite was previously identified. Chalcopyrite is present but not abundant in this outcrop, although pyrite stringers and disseminated pyrite are quite intensely developed.

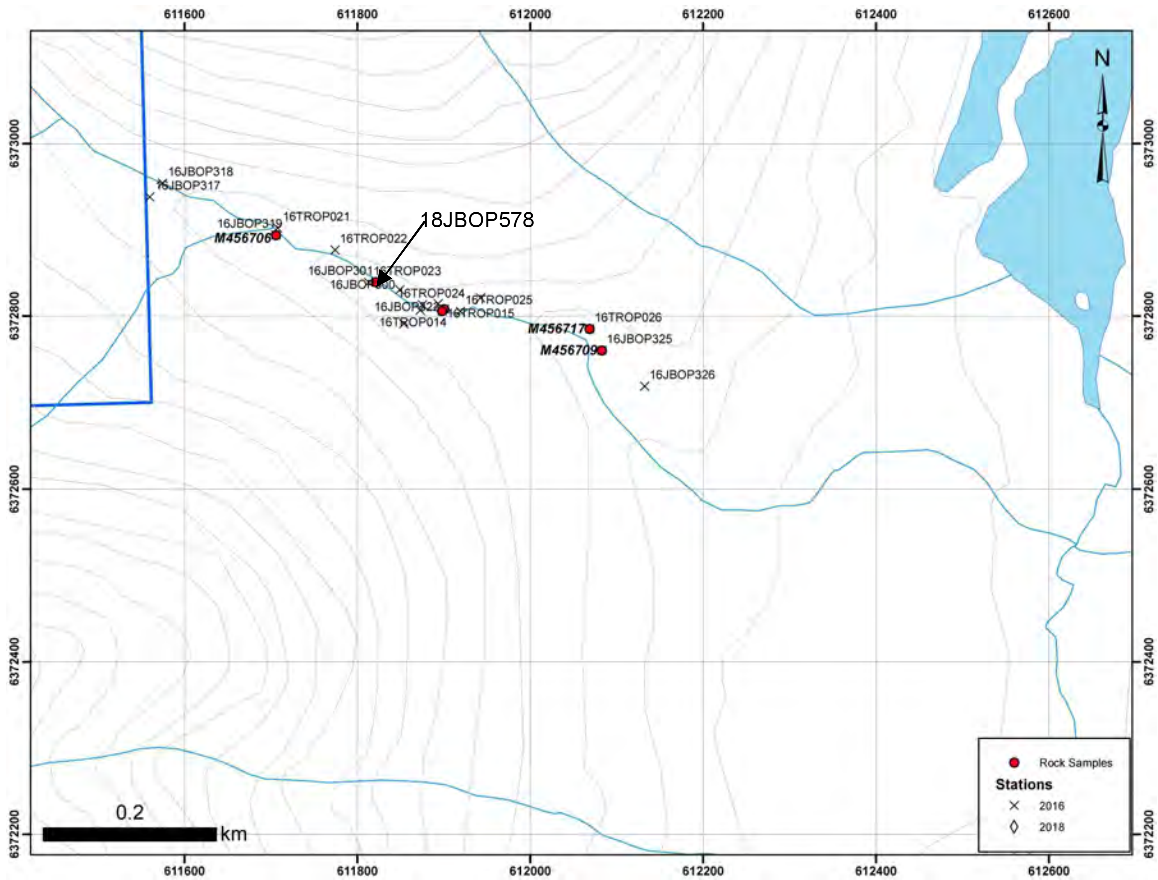

Figure 8: Oxide Creek area stations and rock samples (2016 stations described in Bradford and Ruks, 2016). Arrow points to mineralized zone in creek.

The mineralized zone (16JBOP301/16TROP023/18JBOP578) is about 30 meters across and consists of highly fractured, rusty weathering, variably brecciated dacite porphyry, with a strong late chlorite-pyrite overprint. The rock is strongly magnetic with early secondary magnetite ± biotite ± chalcopyrite veinlets. Quartz-pyrite ± chalcopyrite veins cut the early veinlets and are in turn cut by late pyrite veins. At least four stages of veining are shown in the hand sample photograph below.

The zone is bounded on both sides by less altered (quartz) monzonite porphyry dykes; at least two of these later dyke phases are present, including a fine grained and a coarse grained phase. Some of the dykes contain a late phase of mineralization consisting of sheeted quartz veins with chalcopyrite, pyrite, galena and sphalerite (e.g. 16TROP015 /16JBOP322).

At lower elevations toward the valley a significant outcrop area (16JBOP325) consists of K-feldspar rich granitic rocks, which exhibit graphic and pegmatitic textures. These rocks contain a well developed quartz stockwork, which is generally barren of significant sulfide mineralization. The timing relationship between this intrusion and the porphyries is not clear. Further details on the Oxide Creek zone are discussed in the Petrography section below.

Hand sample from Oxide Creek porphyry showing four stages of veining (station 18JBOP578).

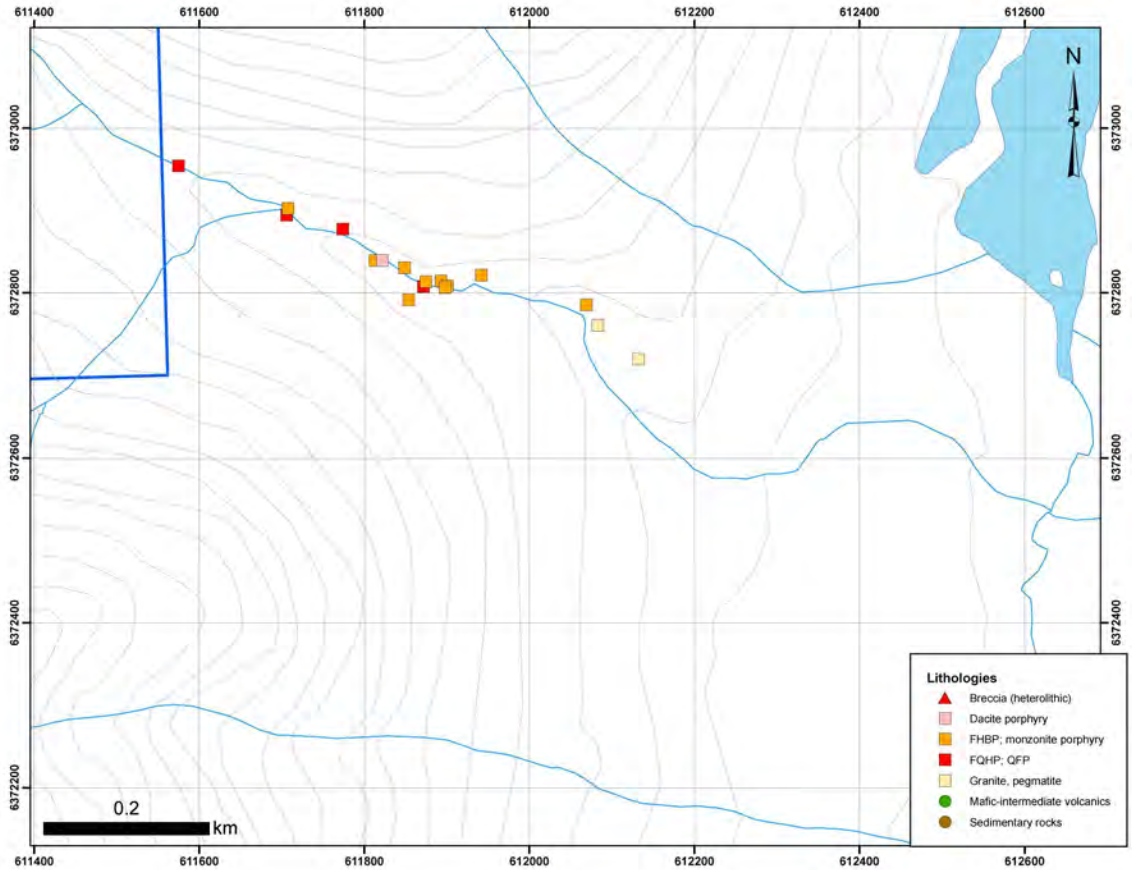

Figure 9: Oxide Creek lithologies

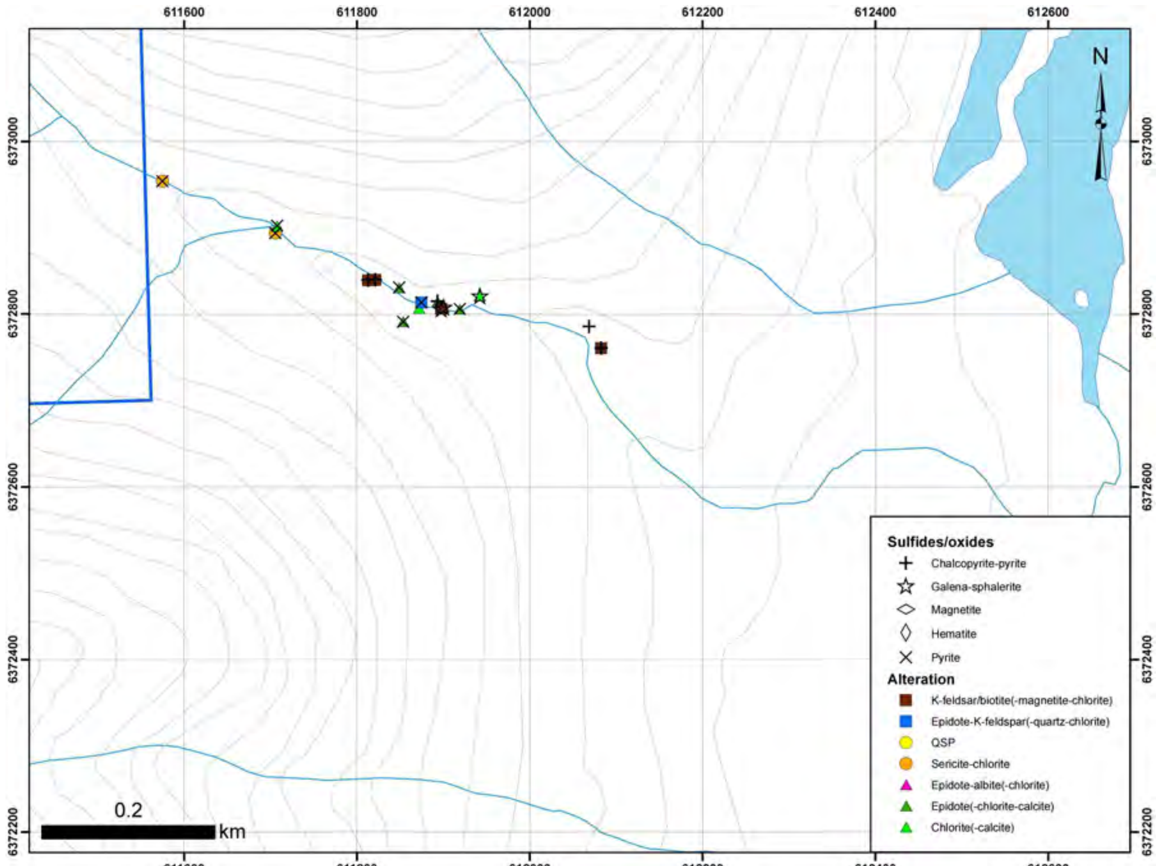

Figure 10: Oxide Creek alteration

Petrography

Six samples were cut and polished thin sections made for petrographic desciptions, five from Oxide Creek and one from the Falcon area. Full petrographic descriptions and photomicrographs by Craig Leitch, PhD are appended to this report (Appendix E).

Falcon

Sample 16TROP051, which corresponds to rock geochemistry sample M456724, is from an area with quartz-epidote-Kspar stockwork with malachite on fractures, cut by a series of QFP dykes with quartz-chalcopyrite veinlets, possibly late to post-mineral. Although chalcopyrite occurs in sample, it is minor, as indicated by the low Cu value (338 ppm). Location of the sample is shown in Figure 5.

The stained offcut from the sample shows considerable matrix K-feldspar, probably primary, as well as an increased intensity of K-feldspar halos adjacent to the quartz veins, suggesting potassic alteration. The veins show multi-phase quartz and epidote deposition.

Stained offcut of petrographic sample 16TROP051.

The petrographic description (Appendix E) describes the rock as a "plagioclase-relict mafic phyric latite (accessory ilmeno-magnetite, apatite)" and the alteration as "transitional propylitic-potassic ... (albite-Kspar?-epidote-chlorite-sericite-leucoxene)". "Veins and veinlets up to 4 mm thick forming a loose network or sub-parallel swarms spaced 1-2 cm apart consist mostly of epidote (acicular euhedra to 1 mm, high Fe content) and central quartz (subhedra to 3 mm, unstrained) and chalcopyrite (irregular masses to 4 mm, partly oxidized to pitch limonite) or lesser pyrite (subhedra <0.35 mm, also partly oxidized to limonite)". Together with the presence of multiple porphyry dyke phases, alteration and mineralization are consistent with a porphyry environment in the Falcon area.

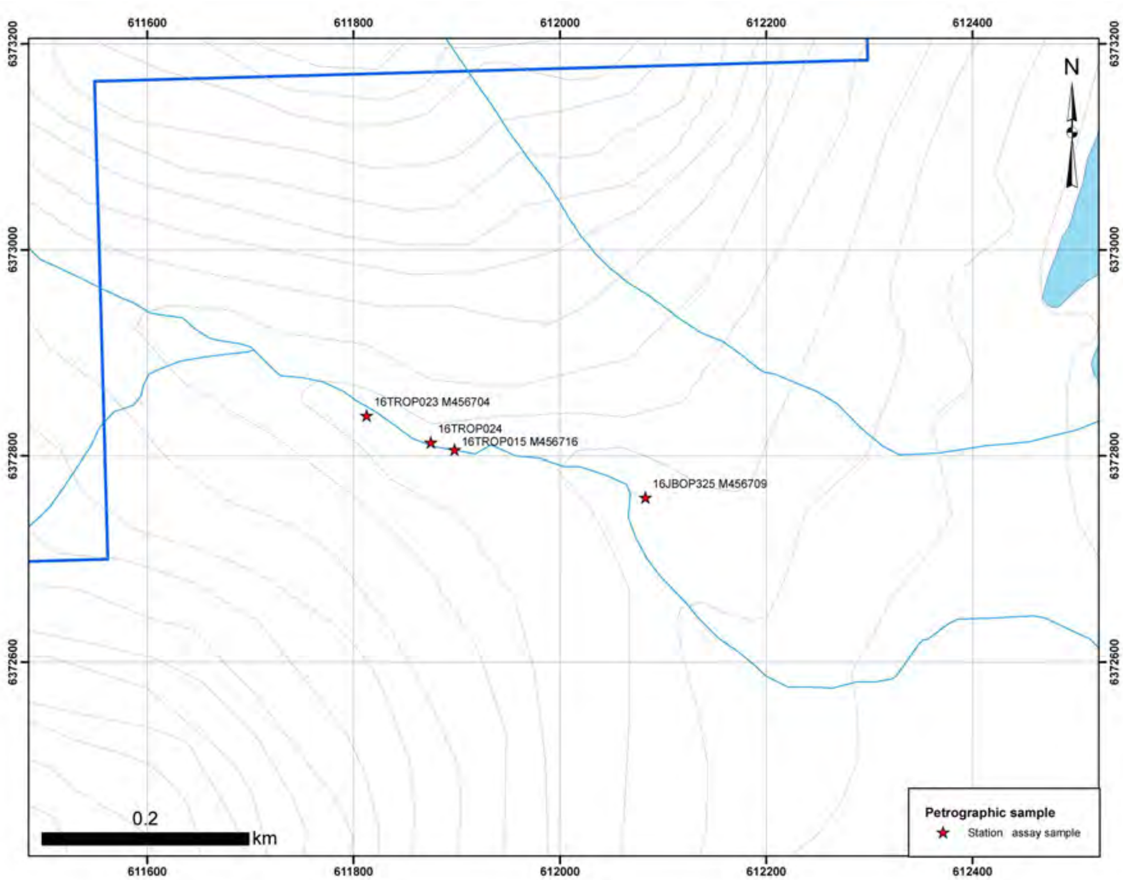

Figure 11: Oxide Creek petrographic sample locations.

Oxide Creek

Five petrographic samples from the Oxide Creek area were examined: 16TROP15 (assay sample M456716), 16TROP23A, 16TROP23B (assay sample M456704), 16TROP24 and 16JBOP325 (assay sample M456709). Locations are shown in Figure 11. Petrographic descriptions (Appendix E) indicate that the samples comprise a suite of intrusive rocks cut by various types of porphyry style veins, with alteration ranging from potassic to propylitic.

Two petrographic samples are from the mineralized Oxide Creek porphyry described above (16TROP23A and 23B), which returned an assay value of 0.137% Cu and 77 ppb Au (sample M456704; Bradford and Ruks 2016). The stained offcut shows only weak stain for K-feldspar, but brecciation and multiple veining stages are evident. The protolith is described as a dacite porphyry, although obscured by strong alteration. Relict mafic sites are altered to chlorite, probably after secondary biotite, magnetite, chalcopyrite, pyrite, rutile and rare epidote, while secondary fracture controlled magnetite is also present.

The presence of secondary magnetite and biotite strongly indicates an early potassic alteration event, although obscured by a strong chlorite-sericite-pyrite overprint. Plagioclase phenocrysts are replaced by secondary K-feldspar and sericite, and the feldspathic groundmass is in part altered to sericite, chlorite and quartz. Quartz-sulfide veins also contain secondary magnetite in places.

Offcuts from petrographic sample 16TROP23B.

Sample 16TROP24 is located about 70 m east of the mineralized porphyry outcrop. The offcuts show a plagioclase (and minor quartz) porphyry intrusive rock with considerable matrix K-feldspar, obviously much less altered than the mineralized porphyry. The petrographic description identifies both hornblende and biotite mafic sites which are pseudomorphed by chlorite-calcite-epidote and closely associated with magnetite, trace chalcopyrite and apatite. Plagioclase phenocrysts are altered to sericite, epidote and probably albite. The rock is weakly fractured and veined by carbonate and minor quartz, but no sulfides.

Offcuts from petrographic sample 16TROP24.

Petrographic sample 16TROP15 is from a dyke located about 90 m southeast of the mineralized porphyry. Geochem sample M456716 returned anomalous Cu (504 ppm), Pb (1030 ppm) and Zn (284 ppm). The offcuts show a brick red plagioclase-quartz porphyry with considerable matrix K-feldspar not too dissimilar to 16TROP24, but here cut by numerous quartz veins. Relict mafic sites are altered to chlorite-calcite-epidote, with associated magnetite, pyrite, chalcopyrite, sphene and apatite. Plagioclase phenocrysts are altered to sericite and albite. The rock is distinguished from the previous porphyry by abundant quartz veins with minor calcite showing evidence of multistage quartz deposition. Although vein sulfides are not present in the thin section, field observations and geochemistry indicate that veins have a polymetallic sulfide assemblage including pyrite, chalcopyrite, galena and sphalerite.

Offcuts from petrographic sample 16TROP15.

Petrographic sample M456709 (16JBOP325) is from a large angular float boulder found about 275 meters east of the mineralized porphyry. The field description of the rock reported disseminated chalcopyrite, which is supported by geochem sample M456709 (737 ppm Cu). The offcut shows a coarse grained granitic intrusive rock riddled by quartz veins; K-feldspar stain is weak except along fractures. The petrographic description reports that plagioclase is partly replaced by sericite, and mafic sites by chlorite-calcite. The quartz stockwork contains rare pyrite and trace chalcopyrite and has textures suggesting multiple stages of brecciation. Possible late K-feldspar may be associated with the final stage of brecciation and veining.

Offcut from petrographic sample M456709 (16JBOP325).

In summary, the suite of petrographic samples from Oxide Creek clearly identifies a mineralized and potassic altered porphyry (strongly overprinted by chlorite-sericite-pyrite) as well as later(?) porphyritic to granitic intrusive rocks. The granitic sample is near a zone of variably pegmatitic and graphic textured granites which contains a largely barren but very strong quartz stockwork at least 100 meters across (Bradford and Ruks, 2016). Although a porphyry environment is clearly indicated, it appears that most of the outcropping intrusives along the creek are either pre- or postmineral porphyry phases or a quartz stockworked granitic / pegmatitic phase whose relationship with the mineralized porphyry is still unclear.

Rock Geochemistry 2018

Four representative rock samples were collected in the Falcon area to document the presence of mineralization associated with alteration.

Procedure

Rock samples were collected from variably mineralized and altered rock in order to help characterize the tenor of different styles of alteration. The samples comprise representative grabs from outcrops. Samples were collected in plastic sample bags and sealed with plastic zip ties. Sample locations were recorded by GPS. Sample locations are marked with flagging tape and embossed aluminum tags. Samples were bundled in security sealed rice bags and flown to Smithers, B.C. and subsequently trucked to ALS Canada's prep laboratory in Terrace, B.C. Sample pulps were assayed at ALS Canada's North Vancouver laboratory.

At the laboratory, the samples were dried, crushed and pulverized using standard rock preparation procedures. The pulps were then analyzed for Au using a 30 gram fire assay with ICP-AES finish and for 35 elements by ICP-AES. Aqua regia digestion was utilized for the ICP analyses. Ore grade (>1%) copper was re-analyzed by ICP-AES. Quality control at the laboratory is maintained by submitting blanks, standards and re-assaying duplicate samples from each analytical batch.

Rock sample descriptions and analytical results are in Appendix C. Sample locations with sample number and Au assays are plotted on Figures 12.

Figure 12: Falcon area 2018 rock samples showing sample numbers and Au values.

Results

Falcon

Bradford and Ruks (2016) reported three samples of altered intrusive rocks with quartz-chalcopyrite veins from the Falcon zone (M456713, M456724-725) which returned anomalous Cu values (2040, 338 and 27400 ppm). M456725 also contained anomalous Au (83 ppm) and Mo (174 ppm). Additional sampling in 2018 included a porphyry dyke with hematite veins but no sulfides (S851301), samples of chlorite-sericite-pyrite (S851302) and QSP (S851303) alteration, and a sample of QSP altered breccia from the north side of the valley (S851304). All samples returned very low base metal values, and only the chlorite-sericite-pyrite altered sample returned anomalous Au (0.108 g/t). The breccia sample had slightly elevated Mo (13 ppm).

Conclusions and Recommendations

Oxide Creek

Outcrops in Oxide Creek are mainly comprised of a varied suite of porphyry and granitic intrusions including a mineralized dacite porphyry with strong evidence of early potassic alteration overprinted by strong chlorite-sericite-pyrite. Chalcopyrite is significant but pyrite/chalcopyrite ratio is high due to the strong overprint. The dacite porphyry is flanked by (quartz) monzonite porphyry intrusions showing evidence of weaker propylitic alteration, locally with a late stockwork of polymetallic quartz-carbonate veins. To the east, a granitic / pegmatitic intrusion is heavily stockworked by quartz veining, albeit with limited copper mineralization.

This strong evidence of a multistage intrusive complex with porphyry-style alteration and veining should be followed up by additional mapping and soil sampling, magnetic and induced polarization surveys, and drilling.

Falcon

In the Falcon area, quartz-chalcopyrite veins, sheeted zones, and stockworks are spatially related to both quartz-phyric and feldspar-hornblende-biotite phyric porphyry dykes intruding Takla Group sedimentary and mafic volcanic rocks. Broad zones of gossanous outcrops are present at lower elevations, and are related to alteration ranging from widespread epidote-chlorite-pyrite, to more restricted zones of chlorite-sericite and quartz-sericite-pyrite. These zones also locally contain strong disseminated pyrite and pyrite stringers. Mapping in 2018 has extended the alteration to the eastern property boundary, a distance of about 2 kilometers, and highlights a zonation of distal hematite and more proximal magnetite veins associated with variable quartz-epidote-K-feldspar stockwork. In addition, a highly altered breccia zone has been identified, but its limits and significance are as yet unknown. Further mapping and soil sampling in the area is recommended, followed by magnetic and induced polarization geophysical surveys in order to attempt to define the core of the system and the potential for drill targets.

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Appendix A Statement of Qualifications

I, John Bradford, P.Geo., certify that:

1. I am presently a Technical Advisor for ArcWest Exploration Inc. with a business address located at:
   2300 - 1177 West Hastings Street
   Vancouver, BC
   V6E 2K3

2. I am a member in good standing of the Association of Professional Engineers and Geoscientists of B.C.

3. I graduated from the University of British Columbia in 1985 with a Bachelor of Science in Geology and from the University of British Columbia in 1988 with a Master of Science in Geology.

4. Since 1988 I have been continuously employed in exploration for base and precious metals in North America, South America and China.

5. I supervised and participated in the 2018 exploration program at Oxide Peak and am therefore personally familiar with the geology of the Oxide Peak Property and the work conducted in 2018. I have co-prepared all sections of this report.

Dated this 2nd Day of April, 2019

John Bradford, MSc, PGeo

Appendix B Statement of Expenditures

					Item sub-total	Sub-totals
Property - Description of work						
WORK COSTS						
Geological - salaries and wages:			days	daily rate		
Tyler Ruks	project geologist	Sept 13 - Sept 14	2	$ 1,000	2,000.00	
John Bradford	project geologist	Sept 13 - Sept 14	2	$ 1,000	2,000.00	
						$ 4,000.00
Food, accommodation:						
Room and Board, Black Lake Lodge (3 nights x 2 people)					1,470.00	
						$ 1,470.00
Geochemical:						
ALS Canada Ltd	TR18243263; 4 samples				140.00	
						$ 140.00
Equipment Rental:						
Satt. Phone	days					
						$ 362.88
Petrography:						
Invoice Vancouver Petrographics					2,068.50	
Shipping					41.58	
						$ 2,110.08
Report:						
Preparation			days	daily rate		
			3	1000	3,000.00	**$ 3,000.00**
					Sub-total Work:	**$ 11,082.96**
Transportation, helicopter						
Silver King Helicopters	flights Sept 12-13				9,980.21	
Lakelse Helicopters	flights Sept 14				2,999.75	
Air Canada	Smithers-Vancouver JB				542.12	
Air Canada	Vancouver-Smithers TR				445.33	
Air Canada	Smithers-Vancouver TR				458.98	
Air Canada	baggage charge				598.50	
Mob-demob						
Salaries and wages:			days	daily rate		
Tyler Ruks	project geologist	Sept. 12, 15	2	$ 1,000	2,000.00	
John Bradford	project geologist	Sept. 12, 15	2	$ 1,000	2,000.00	
			Sub-total travel:		**19,024.89**	
						$ 19,024.89
					Assessment work to claim:	**$ 30,107.85**

Appendix C Rock Samples and Stations

Stations beginning with 16 are also in Bradford and Ruks, 2016 and are included here for completeness. Stations beginning with 18 are from the 2018 fieldwork.

area	ident	sample	y_proj	x_proj	Lith	Alt	Min	description	Au	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg
Falcon	16JBOP349		6368266	617401	SD	EP		pink sparsely Fs-Hb phyric dyke cutting well bedded cherty hornfelsed seds																			
Falcon	16JBOP350		6368410	617388	HT BX	EP	CP	talus float of knobbly/jagged weathering matrix poor brx, poss. Intraformational, rare comb textured qtz vnlets with cp																			
Falcon	16JBOP351	M456713	6368671	617157	FHBP	EP	CP	mixed felsenmeer, rusty pink / green epid altered f.g. dyke, qtz and cp veins/stringers, mal on frcts	0.063	10.6	0.99	3	-10	380	-0.50	7	0.84	-0.50	8	6	2040	3.26	-10	-1	0.03	-10	0.34
Falcon	16JBOP355		6368830	617311	MIV	EP CH	PY	rusty zone, strongly py-chl-epid altered volc																			
Falcon	16JBOP356		6368877	617679	FHBP	QSP	PY	subcrop pervasive QSP altered porphyry with abund clear qtz and qtz-py stringers																			
Falcon	16JBOP357		6368766	617657	FHBP	SE CH	PY	v. rusty weath QSP to chl-ser-py altd porphyry, strongly frctd																			
Falcon	16JBOP358		6368767	617640	FHBP	SE CL	PY	pale green poss illite-py altered porphyry																			
Falcon	16JBOP359		6368789	617630	FHBP	EP CH	PY	Perv epid-chl-py altd porphyry																			
Falcon	16JBOP360		6368780	617601	FHBP	EP CH	PY	same as last, chl, weak epid, strong py																			
Falcon	16JBOP363		6347458	623371	GOS			gossan																			
Falcon	16JBOP366		6368797	617767	FHBP	EP CH	PY	weakly rusty f-m.g. monzodior porph, patchy epid-chl, thin sx stringers																			
Falcon	16JBOP367		6368800	617809	FHBP	EP AB	PY	intense epid-qtz-py veining, Ksp/alb halos																			
Falcon	16JBOP368		6368788	617843	FHBP		PY	rusty dyke with salt and pepper text, diss Mt																			
Falcon	16JBOP369		6368982	616874	MIV	EP CH	PY	rusty talus here mix of strong epid-py and qtz-ser-chl-py - structural zones?																			
Falcon	16JBOP370		6368951	616867	MIV	EP CH AB	PY	Base of cliffs, prob interm volc, patchy epid-chl+/-alb?, variable py cut by silicous or silicified f.g. pink dykes cut by numerous steeply to modly dipping narrow qtz stringers																			
Falcon	16TROP045		6368361	617408	SD	EP		Light green, well bedded siltstones (bluey-green) x-cut by finer grained pink monz dyke. Local qtz-ep veining in hornfelsed seds. Seds are Stuhini like? Cannot find any sulfides. Dyke looks fresh. No veins in dyke. Picture: 102-3416. Note: Previous pictures of JD and Ox Peak, looking west from this station.																			
Falcon	16TROP046		6368436	617396	HT BX	EP	CP	Heterolith bx, clast supported, with ep altered volca and sed clasts. JB found some qtz-cpy veins here. Volc bx or hydro bx? Potential qtz cement in places in float. Picture: 3417.																			
Falcon	16TROP047		6368631	617340	INLT	EP		Talus slope. Have heterolith lap tuff with xtal rich matrix. Up to 3-5% clasts to 2 cm size. Some purple green, some hematitic/purplish. Bt monz dyke along ridgetop trending 330. Is an extension of dyke seen in cliff in last photo. Mod ep alteration, patchy. Pink. Picture: 102-3418 (looking south: well bedded volc and seds x-cut by vertical pink dykes).																			
Falcon	16TROP049		6368816	617313	MIV	EP	PY	Gossan along flank of ridge. IN volc or porph? Intense qtz-epy-ep alteration with py-ep veins. Gus thinks qtz-py is overprinting ep alteration here. Picture: 102-3419 (add to Arc).																			
Falcon	16TROP050		6368760	617428	MIV	EP CH AB	PY	IN volc or intrusion? Intense/strong qtz-ep-chl alteration. Qtz-ep veins have white selvages (albite?). Rep and t.s. Alteration vector to porph?																			
Falcon	16TROP051	M456724	6368665	617500	QFP	EP KF	CP PY	QFP with qtz-cpy veinlets. Real porph veinlets. Not the cockcomb/int sulf style we have been seeing to date. Downslope have strong qtz-ep-kspar stockwork. Qtz ep veins with pink haloes. Mal on fractures. Alteration zonation approaching this area. Ep increases. Qtz-py zone and ep veins pick up fspar selvages. QSP in valley floor with mag high underneath (JB). Picture: 3420 (add to Arc: picture of zone from valley floot. QFP with qtz-cpy veinlets is a dyke. Probably post to late mineral. Rep.	0.005	0.5	0.72	3	-10	50	-0.50	-2	0.49	-0.50	5	5	338	1.26	-10	-1	0.25	20	0.27

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

area	ident	sample	y_proj	x_proj	Lith	Alt	Min	description	Au	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg
Falcon	16TROP052		6368798	617823	FHBP	EP CH	PY	Felsenmeer in ck of monz porph plus/minus qtz phenos with intense chl-ep-qtz alteration. Abundant qtz veins with inner epidote selvage and outer kspar (?) selvage. Look hot. Also intensely chl-ep altered volc rocks. More bleached, QSP-like zones grade in and out. Picture: 102-3421 (qtz-ep-kspar vein in monz).																			
Falcon	16TROP053	M456725	6369051	616877	FHBP	EP CH	CP PY	Moving west towards Falcon 1. At base of skree slope have rusty boulder. One boulder contains intense ep/chl with 4% py +/- cpy. Qtz veins with cpy in sample.	0.083	26.2	1.28	3	-10	50	-0.50	26	0.96	-0.50	18	4	27400	7.83	-10	-1	0.04	10	0.47
Falcon	16TROP054		6368913	616872	MIV	EP CH AB	PY	Oc above rusty talus. More chl-ep-py altered volc (fspar phyric) with ep +/- qtz veins with white haloes (alb?). Picture: 1020-3422.																			
Falcon	18JBOP562		6368704	618738	FHBP	EP CH		crdd FP dykes cutting epid alt volcanics																			
Falcon	18JBOP563		6368719	618683	FHBP	EP CH CA		weakly magnetic chl-cal-epid alt intrus																			
Falcon	18JBOP564		6368707	618620	FHBP	EP CH KF	HT	f.g. intrus? Patchy epid, QV's, loc Ht and epid+Ksp haloes; Ht veins in places																			
Falcon	18JBOP567		6368705	618549	FHBP	EP CH KF		mod magnetic subcrdd FP intrus cut by qtz-epid -Ksp stkwk																			
Falcon	18JBOP569		6368659	618391	QFP			QFP dyke																			
Falcon	18JBOP570		6368641	618110	MIV	EP		big boulder sim to 567 but less stkwk here; lots of float of epid alt maroon volcs																			
Falcon	18JBOP571		6368634	618103	FHBP	EP	PY	v rusty FP intrus																			
Falcon	18JBOP572	S851302	6368625	618078	FHBP	SE CH	PY	rusty frctd zone adjacent to FP dyke, strong chl-py+/-ser alt, narrow qtz, py veinlets	0.108	0.50	0.61	2	-10	120	-1	2	0.20	-0.50	6	5	5	2.12	-10	-1	0.21	-10	0.17
Falcon	18JBOP573	S851303	6368643	617967	FHBP	QSP	PY	v rusty narrow (10m?) zone of chl-epid-py to text dest QSP alt poss intrus, loc up to 5% diss py, in area with abund qtz-epdi+/-Ksp veins	0.001	0.20	0.79	3	-10	50	-1	-2	0.28	-0.50	2	3	2	7.44	-10	-1	0.22	-10	0.25
Falcon	18JBOP574		6368935	617551	FHBP	QSP	PY	QSP to chl-py alt intrus, weak qtz-py veinlets																			
Falcon	18JBOP576		6369213	616866	BRX	EP CH		steeply dipping clast supp brx zone, chl alt, cutting epid alt volcs, maybe hyp FP clasts																			
Falcon	18JBOP577		6369258	616839	FHBP	SE CH EP	PY	f.g. rusty intrus with Hb needles, perv chl+/-ser-epid-py alt, no veining to speak of																			
Falcon	18TROP001		6368715	618716	MIV	EP CH	PY	Fspar phyric intermediate volcanic rock with pervasive, moderate chl-ep +/- py alteration. Trace pyrite. Mottled epidote, patchy in places. Intruded by numerous crowded, fspar phyric diorite porphyry dikes.																			
Falcon	18TROP002	S851301	6368720	618644	FHBP		HT	Biotite-feldspar porphyry. Weakly trachytic with 30% phenos (5% bt and 25% plag?). Grey. Hematite veining present at 2mm/150mm VD. No sulfides evident. Picture: 100-0266.	0.004	-0.20	0.96	2	-10	190	-1	-2	0.35	-0.50	4	5	1	3.06	-10	-1	0.40	10	0.37
Falcon	18TROP003		6368707	618550	FHBP	EP CH	PY	Feldspar porphyry intrusive. Pink-green. Strong qtz-ep-chl stockwork. 0.5% py dissem.																			
Falcon	18TROP004		6368680	618486	FHBP	EP CH	HT	Bt-fspar porphyry with qtz-ep +/- hem stockwork. Strongly magnetic. Strong ep alteration of fspar. Sample: Rep and thin section.																			
Falcon	18TROP005		6368633	618112	FHBP	EP CH	MT	Bt-fspar porphyry/monzonite with strong qtz-epidote-magnetite stockwork. Picture: 100-0267 (qtz-ep-magnetite vein), 100-0268 (stockwork).																			
Falcon	18TROP006		6368646	618084	MIV	EP CH	PY	Back into fine grained fspar phyric intermediate volc? Fairly gossanous in places, with fine grained dissem py. Structure: FT: 200/70; L1 (Slickensides): 19 -> 188																			
Falcon	18TROP007		6368664	617967	FHBP	EP CH	PY	Gossanous zone. Two gossans with zone of strong qtz-ep +/- ksp stockwork in between. Qtz-ep veins up to 2mm/10mm VD. Intense stockwork. Some qtz-ep veins with pink haloes (kspar?). Pictures: 100-0269 (JB on gossan with less gossanous qtz-ep stockwork zone to right); 100-0270 (Qtz-ep vein with pink halo); 100-0271 (Intense qtz-ep stockwork).																			

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

area	ident	sample	y_proj	x_proj	Lith	Alt	Min	description	Au	Ag	Al	As	B	Ba	Be	Bi	Ca	Cd	Co	Cr	Cu	Fe	Ga	Hg	K	La	Mg
Falcon	18TROP008	S851304	6369301	616904	BRX	QSP	PY	Decent gossan on north side of creek, on hill. Appears to be a breccia of sorts (hydrothermal-magmatic??) with chl-ep-py altered to QSP altered fspar phyric intrusive clasts within a QSP altered matrix. Clasts to boulder size (40 cm), often appear sub-ang/subrnd. Local qtz veins in matrix. Have not found cpy here yet. Sharp contacts appear flat lying with a pyritiferous fine grained phase (chilled margin or other intrusive phase?) at base (cherty, grey with disseminated fine grained pyrite). Structure: CT: 270/44 (pyrite rich dike at base?). Pictures: 100-0272 (trachytic textured clasts); 100-0273, 274, 275, 276 (breccia); 100-0277(rhy dike at base with fine grained pyrite).	-0.001	0.30	0.90	3	-10	70	-1	2	0.48	0.70	6	3	9	3.27	-10	-1	0.23	10	0.39
Oxide Creek	16JBOP299		6372791	611854	FHBP	EP CH	PY	very pink FHBP, weak chl-epid, tr py																			
Oxide Creek	16JBOP300		6372830	611849	FHBP	EP CH	PY	very pink FHBP, weak chl-epid, tr py																			
Oxide Creek	16JBOP301	M456704	6372839	611822	DACP	BI MT CH	CP PY	rusty weath porphyry, intense qtz-chl-py alt with abund py and thin qtz-py stringers, also blk chl-py stringers poss after sec biot; patchy black chl-mt alt also poss after sec biot, tr Mo +/- bo? along vein margins	0.077	1.4	1.48	14	-10	30	-0.50	-2	0.13	-0.50	19	5	1365	10.85	10	-1	0.13	-10	0.61
Oxide Creek	16JBOP317		6372938	611560				near center of big wide open area																			
Oxide Creek	16JBOP318		6372954	611575	FQHP	SE CH	PY	very coherent, hard subcrdd FQHP dyke																			
Oxide Creek	16JBOP319	M456706	6372894	611706	FQHP	SE CH	PY	strongly frctd, pervasively qtz-py-chl-ser alt porphyry, abund py stringers	0.038	1.7	0.95	3	-10	200	-0.50	3	0.09	-0.50	4	4	325	4.58	10	-1	0.16	-10	0.66
Oxide Creek	16JBOP321		6372814	611893	FHBP	EP CH	CP PY	FHP, brick red matrix, patchy epid-chl alt, loc qtz veinlets, small clots cp/py in mafics, loc dark rounded more mafic inclusions																			
Oxide Creek	16JBOP322	M456705	6372808	611901	FHBP	EP CH	GN SP PY CP	TR sample site; sheeted QV's in brick red porphyry, tr cp-py, loc sp, gn	0.001	0.3	0.88	3	-10	160	-0.50	2	0.88	7.80	5	7	368	2.21	-10	-1	0.11	10	0.59
Oxide Creek	16JBOP323		6372821	611942	FHBP	CH CB	GN SP PY CP	porphyry cut by qtz-cal-chl veins with minor gn, sp																			
Oxide Creek	16JBOP325	M456709	6372760	612083	GRAN	KF	CP	potassic alt porphyry cut by numerous qtz veins to 1.5 cm, diss cp	0.001	0.2	1.10	2	-10	80	-0.50	-2	1.65	-0.50	4	6	737	2.48	-10	-1	0.18	10	0.70
Oxide Creek	16JBOP326		6372719	612132	GRAN			strong qtz stkwk in porphyry, only tr cp, loc graphic texture, pegmatite																			
Oxide Creek	16TROP014		6372807	611872	FQHP	CH		Walked down to ck to N. SLP: All qtz monz porph. Weak chl alteration with no sulfides. Strongly magnetic.																			
Oxide Creek	16TROP015	M456716	6372806	611898	FHBP	KF	GN SP PY CP	Bt monz. Reddish. Coarser grained with less qtz than uphill. Mafics to mt-cpy +/- secondary bt. Qtz-Gn-cpy veins. Nice stockwork. Picture: 102-3397, 3398, 3363, 3364 (stockwork)	-0.001	0.8	1.13	2	-10	240	-0.50	-2	1.29	3.40	6	6	504	2.26	-10	-1	0.13	10	0.81
Oxide Creek	16TROP021		6372902	611708	FHBP	CH	PY	Rusty oc on north side of creek. Crowded/coarse grained monzodior porph. Bleached chl-py alteration and silica. Py stringers. Mafics to chl-py. Picture: 102-3362.																			
Oxide Creek	16TROP022		6372877	611774	FQHP			Light pink, finer grained FQP with 20-30% fsp-qtz phenos to 2-3 mm. No sulfides.																			
Oxide Creek	16TROP023		6372839	611813	FHBP	BI MT CH	CP PY	Gossan that JB and GZ sampled yesterday. Mt-py veining in coarse grained porph. Contact with finer grained FQP to west, not far. Trace to 0.1% cpy (0.5-1mm) on some fractures. 5-10% py in places. Potential bx texture in places?																			
Oxide Creek	16TROP024		6372813	611875	FHBP	EP CH MT	PY	Bt monz porph. Mafics (bt and hbl) to mt-chl. Also ep-chl. Mt and trac py here.																			
Oxide Creek	16TROP025		6372806	611919	APL	EP CH	PY	Pink, aphyric dyke x-cuts monz. Local chl-ep and ep veining in porph. Picture: 102-3365.																			
Oxide Creek	16TROP026	M456717	6372785	612069	FHBP		CP	Avalanche chute by creek. Has float of finer grained monz porph (reddish colour) with qtz +/- cpy stockwork. Noticeably finer grained phase. Nice qtz-cpy stockwork in oc only meters to the east.	-0.001	-0.2	1.06	-2	-10	200	-0.50	-2	0.72	-0.50	6	5	194	2.29	-10	-1	0.18	10	0.75
Oxide Creek	18JBOP578		6372839	611822	DACP	BI MT CH	CP PY	Strongly fractured, variably brecciated rusty weathering dacite porphyry, strong chl-py overprinting possible early biot-Mt; early Mt/biot±Cp veinlets, multiphase quartz-sulfide veins with late pyrite stringers; diss py, clots and stringers, minor Cp																			

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

area	ident	sample	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn
Falcon	16JBOP349																		
Falcon	16JBOP350																		
Falcon	16JBOP351	M456713	754	6	-0.01	-1	360	78	0.19	-2	1	121	-20	0.09	-10	-10	21	10	93
Falcon	16JBOP355																		
Falcon	16JBOP356																		
Falcon	16JBOP357																		
Falcon	16JBOP358																		
Falcon	16JBOP359																		
Falcon	16JBOP360																		
Falcon	16JBOP363																		
Falcon	16JBOP366																		
Falcon	16JBOP367																		
Falcon	16JBOP368																		
Falcon	16JBOP369																		
Falcon	16JBOP370																		
Falcon	16TROP045																		
Falcon	16TROP046																		
Falcon	16TROP047																		
Falcon	16TROP049																		
Falcon	16TROP050																		
Falcon	16TROP051	M456724	633	1	0.05	-1	240	7	0.04	-2	1	10	-20	0.01	-10	-10	7	-10	43

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

area	ident	sample	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn
Falcon	16TROP052																		
Falcon	16TROP053	M456725	739	174	0.01	5	640	113	5.26	-2	1	93	-20	0.09	-10	-10	19	-10	68
Falcon	16TROP054																		
Falcon	18JBOP562																		
Falcon	18JBOP563																		
Falcon	18JBOP564																		
Falcon	18JBOP567																		
Falcon	18JBOP569																		
Falcon	18JBOP570																		
Falcon	18JBOP571																		
Falcon	18JBOP572	S851302	171	3	0.02	1	1080	4	0.92	-2	1.00	8	-20	-0.01	-10	-10	8	-10	30
Falcon	18JBOP573	S851303	227	1	0.05	1	740	18	7.34	-2	1.00	30	-20	0.03	-10	-10	9	-10	34
Falcon	18JBOP574																		
Falcon	18JBOP576																		
Falcon	18JBOP577																		
Falcon	18TROP001																		
Falcon	18TROP002	S851301	599	-1	0.05	1	1120	3	-0.01	-2	1.00	23	-20	0.10	-10	-10	44	-10	67
Falcon	18TROP003																		
Falcon	18TROP004																		
Falcon	18TROP005																		
Falcon	18TROP006																		
Falcon	18TROP007																		

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

area	ident	sample	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th	Ti	Tl	U	V	W	Zn
Falcon	18TROP008	S851304	420	13	0.04	-1	1290	17	2.17	-2	2.00	17	-20	0.15	-10	-10	20	-10	66
Oxide Creek	16JBOP299																		
Oxide Creek	16JBOP300																		
Oxide Creek	16JBOP301	M456704	574	22	0.03	2	390	56	7.03	-2	3	10	-20	0.07	-10	-10	80	-10	63
Oxide Creek	16JBOP317																		
Oxide Creek	16JBOP318																		
Oxide Creek	16JBOP319	M456706	253	12	0.06	-1	1100	7	0.52	-2	3	12	-20	0.08	-10	-10	57	-10	28
Oxide Creek	16JBOP321																		
Oxide Creek	16JBOP322	M456705	638	1	0.05	1	490	202	0.12	-2	3	33	-20	0.08	-10	-10	51	-10	600
Oxide Creek	16JBOP323																		
Oxide Creek	16JBOP325	M456709	796	1	0.04	1	680	-2	0.08	-2	4	18	-20	0.08	-10	-10	48	-10	78
Oxide Creek	16JBOP326																		
Oxide Creek	16TROP014																		
Oxide Creek	16TROP015	M456716	787	1	0.05	3	510	1030	0.10	-2	3	32	-20	0.03	-10	-10	40	-10	281
Oxide Creek	16TROP021																		
Oxide Creek	16TROP022																		
Oxide Creek	16TROP023																		
Oxide Creek	16TROP024																		
Oxide Creek	16TROP025																		
Oxide Creek	16TROP026	M456717	688	-1	0.05	2	500	7	0.03	-2	2	17	-20	0.01	-10	-10	39	-10	68
Oxide Creek	18JBOP578																		

All assays in parts per million except
Al, Ca, Fe, K, Mg, Na, S, and Ti in wt. %

Appendix D Analytical Certificates

Note: Analytical certificates for 2016 samples are included in Bradford and Ruks, 2016. Certificates include data from other properties in addition to Oxide Peak.

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VANCOUVER
VANCOUVER BC V6E 2K3

Finalized Date: 27-NOV-2018
This copy reported on
28-NOV-2018
Account: SOJEXP

CERTIFICATE TR18243263

Project: Todd Creek& Oweegee Dome

This report is for 182 Rock samples submitted to our lab in Terrace, BC, Canada on 28-SEP-2018.

The following have access to data associated with this certificate:

JEFF KYBA		

SAMPLE PREPARATION

ALS CODE	DESCRIPTION
WEI-21	Received Sample Weight
LOG-21	Sample logging - ClientBarCode
LOG-23	Pulp Login - Rcvd with Barcode
CRU-QC	Crushing QC Test
PUL-QC	Pulverizing QC Test
CRU-31	Fine crushing - 70% <2mm
SPL-21	Split sample - riffle splitter
PUL-31	Pulverize split to 85% <75 um

ANALYTICAL PROCEDURES

ALS CODE	DESCRIPTION	
Cu-OG46	Ore Grade Cu - Aqua Regia	
Pb-OG46	Ore Grade Pb - Aqua Regia	
Zn-OG46	Ore Grade Zn - Aqua Regia	
Au-ICP21	Au 30g FA ICP-AES Finish	ICP-AES
Au-GRA21	Au 30g FA-GRAV finish	WST-SIM
ME-ICP41	35 Element Aqua Regia ICP-AES	ICP-AES
Ag-OG46	Ore Grade Ag - Aqua Regia	
ME-OG46	Ore Grade Elements - AquaRegia	ICP-AES

This is the Final Report and supersedes any preliminary report with this certificate number. Results apply to samples as submitted. All pages of this report have been checked and approved for release.

***** See Appendix Page for comments regarding this certificate *****

Signature:
Colin Ramshaw, Vancouver Laboratory Manager

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Project: Todd Creek& Oweegee Dome

CERTIFICATE OF ANALYSIS TR18243263

Sample Description	Method / Analyte / Units / LOD	WEI-21 Recvd Wt. kg 0.02	ME-ICP41 Ag ppm 0.2	ME-ICP41 Al % 0.01	ME-ICP41 As ppm 2	ME-ICP41 B ppm 10	ME-ICP41 Ba ppm 10	ME-ICP41 Be ppm 0.5	ME-ICP41 Bi ppm 2	ME-ICP41 Ca % 0.01	ME-ICP41 Cd ppm 0.5	ME-ICP41 Co ppm 1	ME-ICP41 Cr ppm 1	ME-ICP41 Cu ppm 1	ME-ICP41 Fe % 0.01	ME-ICP41 Ga ppm 10
S851011		2.12	0.4	0.05	17	<10	2550	<0.5	<2	2.15	0.7	3	25	14	2.42	<10
S851012		2.51	1.5	1.38	9	10	40	<0.5	<2	0.12	<0.5	3	9	37	4.13	10
S851013		2.19	0.4	1.24	12	<10	60	<0.5	<2	0.03	<0.5	1	2	68	4.13	<10
S851014		2.38	<0.2	1.11	8	<10	70	<0.5	<2	0.22	<0.5	4	2	33	4.14	<10
S851015		0.09	0.6	1.73	7	<10	100	<0.5	<2	0.90	<0.5	11	33	4870	3.76	10
S851016		3.16	<0.2	1.20	10	10	30	<0.5	<2	2.12	<0.5	10	3	312	4.00	10
S851017		2.65	<0.2	0.33	11	<10	60	0.8	<2	2.80	<0.5	3	6	18	2.57	<10
S851018		2.48	0.2	0.28	13	<10	50	0.7	<2	1.16	<0.5	3	10	23	2.12	<10
Y603251		1.97	0.2	1.59	3	<10	50	<0.5	<2	0.95	<0.5	10	3	318	3.30	10
Y603252		1.78	<0.2	0.61	7	<10	30	<0.5	<2	13.4	0.5	19	2	63	3.48	<10
Y603253		3.19	<0.2	0.37	11	<10	50	<0.5	<2	6.67	<0.5	20	4	114	3.48	<10
Y603254		1.47	<0.2	2.54	2	10	40	0.5	<2	2.43	<0.5	11	9	65	3.53	10
Y603255		0.10	0.7	1.68	6	<10	100	<0.5	<2	0.86	<0.5	11	32	4780	3.68	10
Y603256		2.13	<0.2	3.49	60	10	50	<0.5	<2	2.32	0.6	20	31	121	6.30	10
Y603257		1.59	<0.2	0.54	5	10	20	<0.5	<2	8.2	<0.5	19	58	175	4.18	<10
Y603258		1.98	<0.2	2.95	5	10	40	0.5	<2	2.41	<0.5	15	9	53	4.06	10
Y603259		1.29	<0.2	1.42	4	<10	20	<0.5	<2	0.79	<0.5	13	11	979	4.71	10
Y603260		1.99	0.3	1.14	11	<10	270	0.5	<2	14.5	0.6	10	22	32	2.62	<10
S851301		1.37	<0.2	0.96	2	<10	190	<0.5	<2	0.35	<0.5	4	5	1	3.06	<10
S851302		1.40	0.5	0.61	2	<10	120	<0.5	2	0.20	<0.5	6	5	5	2.12	<10
S851303		1.26	0.2	0.79	3	<10	50	<0.5	<2	0.28	<0.5	2	3	2	7.44	<10
S851304		1.50	0.3	0.90	3	<10	70	<0.5	2	0.48	0.7	6	3	9	3.27	<10

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Finalized Date: 27-NOV-2018
Account: SOJEXP

Project: Todd Creek& Oweegee Dome

CERTIFICATE OF ANALYSIS TR18243263

Sample Description	Method	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41
	Analyte	Hg	K	La	Mg	Mn	Mo	Na	Ni	P	Pb	S	Sb	Sc	Sr	Th
	Units	ppm	%	ppm	%	ppm	ppm	%	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm
	LOD	1	0.01	10	0.01	5	1	0.01	1	10	2	0.01	2	1	1	20
S851011		<1	0.02	<10	0.13	814	1	0.01	2	20	32	0.10	2	<1	159	<20
S851012		<1	0.20	10	0.84	2230	1	0.03	2	1090	10	0.48	2	3	5	<20
S851013		1	0.15	10	0.57	271	4	0.05	1	950	9	0.05	<2	2	9	<20
S851014		<1	0.12	10	0.79	375	<1	0.06	1	1130	<2	1.22	<2	3	10	<20
S851015		<1	0.14	<10	0.80	465	223	0.11	33	600	4	0.68	<2	5	42	<20
S851016		<1	0.16	10	1.05	1225	1	0.06	1	1050	4	3.36	<2	3	25	<20
S851017		<1	0.30	30	0.24	989	<1	0.01	1	910	17	0.02	9	3	139	<20
S851018		<1	0.26	20	0.05	479	<1	0.01	1	560	21	0.03	9	2	52	<20
Y603251		<1	0.21	10	0.80	754	<1	0.05	2	1150	<2	0.04	<2	3	25	<20
Y603252		<1	0.11	<10	0.59	2210	<1	0.03	4	530	2	0.32	4	8	292	<20
Y603253		<1	0.13	<10	0.43	795	1	0.05	6	820	<2	0.54	<2	7	152	<20
Y603254		1	0.10	<10	1.16	1035	<1	0.06	2	1110	<2	0.10	<2	4	55	<20
Y603255		<1	0.14	<10	0.78	452	204	0.10	32	580	3	0.64	<2	5	41	<20
Y603256		<1	0.07	<10	2.36	1410	1	0.06	12	1050	5	0.98	<2	14	23	<20
Y603257		4	0.05	<10	0.79	1035	<1	0.04	15	770	5	0.57	2	17	116	<20
Y603258		<1	0.13	<10	1.72	1105	<1	0.05	4	1030	<2	0.11	<2	7	69	<20
Y603259		<1	0.07	<10	1.25	356	24	0.09	4	980	<2	3.36	<2	7	9	<20
Y603260		<1	0.13	10	0.71	5900	2	0.03	59	3030	6	0.69	<2	11	554	<20
S851301		<1	0.40	10	0.37	599	<1	0.05	1	1120	3	<0.01	<2	1	23	<20
S851302		<1	0.21	<10	0.17	171	3	0.02	1	1080	4	0.92	<2	1	8	<20
S851303		<1	0.22	<10	0.25	227	1	0.05	1	740	18	7.34	<2	1	30	<20
S851304		<1	0.23	10	0.39	420	13	0.04	<1	1290	17	2.17	<2	2	17	<20

***** See Appendix Page for comments regarding this certificate *****

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CERTIFICATE OF ANALYSIS TR18243263

Sample Description	Method	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	ME-ICP41	Ag-OG46	Cu-OG46	Pb-OG46	Zn-OG46	Au-ICP21	Au-GRA21
	Analyte	Ti	Tl	U	V	W	Zn	Ag	Cu	Pb	Zn	Au	Au
	Units	%	ppm	ppm	ppm	ppm	ppm	ppm	%	%	%	ppm	ppm
	LOD	0.01	10	10	1	10	2	1	0.001	0.001	0.001	0.001	0.05
S851011		<0.01	<10	<10	29	<10	66					<0.001	
S851012		0.17	<10	<10	60	<10	85					0.040	
S851013		0.05	<10	<10	30	<10	47					0.014	
S851014		0.19	<10	<10	45	<10	24					0.015	
S851015		0.15	<10	<10	65	<10	49					0.562	
S851016		0.11	<10	<10	53	<10	75					0.007	
S851017		<0.01	<10	<10	3	<10	51					<0.001	
S851018		<0.01	<10	<10	3	<10	31					<0.001	
Y603251		<0.01	<10	<10	36	<10	75					0.005	
Y603252		<0.01	<10	<10	80	<10	49					0.002	
Y603253		<0.01	<10	<10	80	<10	67					0.003	
Y603254		0.26	<10	<10	83	<10	67					0.004	
Y603255		0.14	<10	<10	63	<10	48					0.608	
Y603256		0.35	<10	<10	204	<10	220					0.005	
Y603257		0.01	<10	<10	183	<10	50					0.005	
Y603258		0.42	<10	<10	130	<10	83					0.004	
Y603259		0.19	<10	<10	107	<10	19					0.053	
Y603260		<0.01	<10	<10	44	<10	108					0.002	
S851301		0.10	<10	<10	44	<10	67					0.004	
S851302		<0.01	<10	<10	8	<10	30					0.108	
S851303		0.03	<10	<10	9	<10	34					0.001	
S851304		0.15	<10	<10	20	<10	66					<0.001	

***** See Appendix Page for comments regarding this certificate *****

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CERTIFICATE OF ANALYSIS TR18243263

CERTIFICATE COMMENTS

LABORATORY ADDRESSES

Processed at ALS Terrace located at 2912 Molitor Street, Terrace, BC, Canada.

Applies to Method:	CRU-31	CRU-QC	LOG-21	LOG-23
	PUL-31	PUL-QC	SPL-21	WEI-21

Processed at ALS Vancouver located at 2103 Dollarton Hwy, North Vancouver, BC, Canada.

Applies to Method:	Ag-OG46	Au-GRA21	Au-ICP21	Cu-OG46
	ME-ICP41	ME-OG46	Pb-OG46	Zn-OG46

Appendix E Petrography Report

PETROGRAPHIC REPORT ON 6 SAMPLES, OXIDE PEAK PROPERTY, TOODOGGONE

Report for: John Bradford, VP Expl'n Invoice 180794
Sojourn Exploration Ltd.
2300-1177 West Hastings Street
Vancouver, B.C. V6E 2K3 Dec. 13, 2018.

SUMMARY:

Samples are described as representing a suite of intrusive rocks from Oxide Peak property, Toodoggone district, B.C.
Capsule descriptions are as follows:

16TROP15: plagioclase-biotite/hornblende? quartz phyric, quartz latite porphyry altered to a propylitic assemblage of albite-chlorite-calcite-epidote-sericite-accessory magnetite-pyrite-trace chalcopyrite-sphene-apatite, cut by loose stockwork of quartz ±calcite veins.

16TROP23A: plagioclase-relict mafic-quartz phyric, possible dacite porphyry altered to potassic (overprinted by phyllic) assemblage of quartz-Kspar-albite-chlorite (after biotite?)-sericite-epidote-pyrite-magnetite-chalcopyrite-rutile, cut by thick quartz-pyrite ±magnetite-chalcopyrite veins.

16TROP23B: plagioclase-relict mafic ±quartz phyric, possible dacite porphyry altered to potassic (overprinted by phyllic) assemblage of quartz-Kspar-albite-chlorite (after biotite?)-sericite-epidote-pyrite-magnetite/hematite-chalcopyrite, cut by quartz-pyrite ±magnetite-chalcopyrite veins/fractures.

16TROP24: plagioclase-biotite/hornblende? ±quartz phyric, quartz latite porphyry altered to a propylitic assemblage of albite-chlorite-calcite-epidote-sericite, with accessory magnetite-trace chalcopyrite-apatite, cut by rare thin calcite-epidote ±quartz fractures.

16TROP51: plagioclase-relict mafic phyric latite (accessory ilmeno-magnetite, apatite) showing transitional propylitic-potassic alteration (albite-Kspar?-epidote-chlorite-sericite-leucoxene) associated with veins of epidote-quartz-chalcopyrite ±pyrite (partly oxidized to limonite).

M456709: granite (sericitized, hematite-stained albite, quartz, Kspar, scattered chlorite-calcite altered relict mafics associated with relict (rutile altered) ilmeno-magnetite, cut by a strong but essentially barren stockwork of quartz veins (trace pyrite), later calcite, quartz, possible secondary Kspar fractures. Alteration may be incipient potassic (quartz-Kspar-chlorite-calcite).

Detailed petrographic descriptions and photomicrographs are appended (by email attachment). If you have any questions regarding the petrography, please do not hesitate to contact me.

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16TROP15: Plagioclase-Biotite/Hornblende? Quartz Phyric, Quartz Latite Porphyry Altered To A Propylitic Assemblage Of Albite-Chlorite-Calcite-Epidote-Sericite-Accessory Magnetite-Pyrite-Trace Chalcopyrite-Sphene-Apatite, Cut By Loose Stockwork Of Quartz ±Calcite Veins

Hand sample shows brick-red coloured, medium-grained felsic porphyry intrusive with sub-equal amounts of pink plagioclase, dark green relict mafic and lesser quartz phenocrysts in a Kspar rich groundmass, cut by a network of grey/white, somewhat vuggy, quartz veins spaced 1-2 cm apart. Sparsely disseminated sulfides are not obviously related to the veins. The rock is distinctly magnetic, shows local rapid reaction to cold dilute HCl (less in veins), and pervasive stain for K-feldspar (white etched plagioclase) in the etched slab. Modal mineralogy in polished thin section is approximately:

K-feldspar (microperthite groundmass, mainly primary?)	35%
Plagioclase (phenocrysts, hematite-stained albite, likely secondary?)	25%
Quartz (small primary phenocrysts, secondary veins)	20%
Chlorite (with carbonate, epidote, after mafic relics)	10%
Carbonate (mainly calcite; mafic sites/minor in veinlets)	5%
Epidote (mafic sites)	2%
Sericite (after plagioclase)	2%
Magnetite (disseminated, fractured)	<1%
Pyrite (disseminated)	<1%
Chalcopyrite (disseminated)	<1%
Sphene (relict mafic sites)	<1%
Apatite (primary, accessory)	trace

This sample consists of about 20-25% plagioclase, 15-20% relict (chlorite-carbonate-epidote-sphene altered) mafic, and 5-10% quartz phenocrysts in a phaneritic groundmass of microperthitic Kspar. Disseminated pyrite-trace chalcopyrite is associated with mafic sites and magnetite rather than with veins of quartz-minor carbonate.

Plagioclase phenocrysts are mainly euhedral, up to 5 mm (where glomeratic), finely dusted by sericite as minute randomly oriented sub/euhedral flakes <25 µm, and probably albitized since relief is negative compared to quartz and extinction Y^010=16º, Z^001=12º suggestive of An_{0-5}.

Relict mafic sites have sub- to euhedral outlines mostly <3 mm (rarely glomeratic to ~8 mm) composed of variable ratios of chlorite (subhedral flakes <0.5 mm with distinct green pleochroism, near-zero to weakly anomalous bluish-grey, length-slow birefringence suggestive of Fe/Fe+Mg, or F:M, ratio around 0.5-0.6?), carbonate (aggregates to 2.5 mm of subhedra mainly <1.5 mm, likely calcite), lesser epidote (aggregates to ~2 mm of subhedra <0.85 mm with only weak yellow colour suggestive of moderate Fe content). Accessory magnetite (sub/euhedra <1 mm, commonly fractured and partly replaced by chlorite), pyrite (sub/euhedra to 1.2 mm), minor chalcopyrite (sub/anhedra <0.4 mm) plus traces of sphene and apatite (euhedra <0.2 mm) are closely associated with mafic sites.

Quartz phenocrysts have rounded sub/anhedral outlines mainly <1.5 mm in diameter, locally with indications of resorption but only traces of overgrowth rims <35 µm thick. The crystals are essentially unstrained (show no undulose extinction, sub-grain development, sutured grain boundaries)

The groundmass consists mainly of randomly oriented to semi-radiating, sub-to euhedral interlocking crystals of Kspar <0.5 mm in size, with prominent microperthitic texture due to abundant acicular inclusions of albite (that may make up to 40% of the crystal). Both Kspar and to a lesser extent the plagioclase are strongly stained by minute particles of hematite.

Veins and veinlets up to 4.5 mm thick consist of quartz (subhedra mainly <1 mm, but locally feathery euhedra up to 3.5 mm long, in places set in much finer-grained crystals <0.1 mm) and minor local carbonate (subhedra <0.5 mm, calcite?) but no obvious sulfides. The veins appear to be multi-stage, as suggested by fractured and brecciated appearance, and contain local vugs to 1.5 mm. Quartz in veins is more strained than the phenocrysts (shows undulose extinction, sub-grain development).

In summary, this is plagioclase-biotite/hornblende? quartz phyric, quartz latite porphyry altered to a propylitic assemblage of albite-chlorite-calcite-epidote-sericite-accessory magnetite-pyrite-trace chalcopyrite-sphene-apatite, cut by loose stockwork of quartz ±calcite veins.

16TROP23A: PLAGIOCLASE-RELICT MAFIC-QUARTZ PHYRIC DACITE? PORPHYRY ALTERED TO POTASSIC/PHYLLIC ASSEMBLAGE: QUARTZ-KSPAR-ALBITE-CHLORITE (AFTER BIOTITE?)-SERICITE-EPIDOTE-PYRITE-MAGNETITE-CHALCOPYRITE-RUTILE, CUT BY THICK QUARTZ-PYRITE ±MAGNETITE-CHALCOPYRITE VEINS

Hand sample shows pale grey/white, medium-grained felsic porphyry intrusive (prominent white etched plagioclase, lesser pyritized relict mafic and quartz phenocrysts in an altered siliceous groundmass, cut by major quartz-pyrite veins, local pyrite ±chalcopyrite fractures. The rock is distinctly magnetic, shows no reaction to cold dilute HCl, and weak stain for K-feldspar (mainly secondary?) in the etched slab. Modal mineralogy in polished thin section is approximately:

Quartz (largely secondary, vein/groundmass; recrystallized relict phenos)	40%
Relict plagioclase (sericite-albite-Kspar altered)	20%
K-feldspar (largely secondary, after phenocrysts/groundmass)	20%
Pyrite (disseminated, veins, fractures; slightly oxidized to limonite)	7%
Chlorite (relict mafic sites, in veins, after secondary biotite?)	7%
Sericite (mainly after plagioclase)	3-5%
Magnetite (partly secondary?)	1%
Chalcopyrite	<1%
Epidote (relict mafic sites)	<1%
Rutile (relict mafic sites)	<1%

This sample is strongly altered, obscuring original protolith, but appears to consist of about 30-35% relict (sericitized, thoroughly albite-Kspar altered) plagioclase, 10-15% relict mafic (chlorite after secondary biotite?-magnetite-pyrite ±chalcopyrite-rutile-epidote altered) and 5-10% recrystallized quartz phenocrysts in groundmass altered to secondary Kspar-quartz-chlorite-sericite, cut by major quartz-pyrite veins and pyrite ±magnetite-chalcopyrite fractures.

Relict plagioclase phenocrysts are subhedral/corroded, up to 5 mm (where glomeratic), ~15-35% replaced by sericite as randomly oriented sub/euhedral flakes <25 µm, and by secondary alkali feldspar ranging from albite (extinction Y^010=15°, Z^001=12° suggestive of $An_{5-7)}$ to local Kspar, especially near rims or fractures cutting the crystals, or alongside major veins/veinlets.

Relict mafic sites have sub- to euhedral outlines mostly <1 mm (locally to 2 mm) composed of variable ratios of chlorite (subhedral flakes <0.15 mm with pale green pleochroism, weakly anomalous grey, length-slow birefringence suggestive of F:M around 0.5 or locally greenish-brown colour, second-order birefringence suggestive of former secondary biotite?), rare epidote (subhedra <0.1 mm with local pale yellow colour suggestive of moderate Fe content). Abundant pyrite (ragged subhedra to 2 mm), trace chalcopyrite (subhedra <0.1 mm, locally included within pyrite), magnetite (ragged subhedra <0.5 mm) and variable rutile (crude aggregates to 0.3 mm of dark golden brown subhedra <50 µm) are closely associated with mafic sites, or controlled along fractures.

Quartz phenocrysts have rounded sub/anhedral outlines up to 2.5 mm in diameter, locally with indications of resorption, but overgrowths are obscured by recrystallization to granular aggregates of interlocking anhedral secondary quartz crystals <0.5 mm. The crystals are mostly unstrained (little undulose extinction, sub-grain development, no sutured grain boundaries)

The groundmass consists mainly of granular interlocking, anhedral crystals of quartz and (probably mostly secondary?) alkali feldspar both mainly <0.1 mm but locally up to 0.25 mm, with some feldspar (mainly Kspar, local albite?) partly altered to sericite, and there is local sericite and chlorite (both subhedral flakes <30 µm). In places the quartz has a distinctly secondary appearance, particularly where organized into poorly defined, narrow (<0.25 mm) irregular veinlets.

Well defined, thick planar veins up to 1.5 cm thick consist of quartz (sub/anhedra <1 mm), pyrite (subhedra <2 mm, rarely with trace chalcopyrite inclusions <0.2 mm), and local magnetite (subhedra <0.1 mm). Oxidation of pyrite to limonite (goethite?) is rarely present along fractures.

In summary, this is plagioclase-relict mafic-quartz phyric, possible dacite porphyry altered to potassic (overprinted by phyllic) assemblage of quartz-Kspar-albite-chlorite (after biotite?)-sericite-epidote-pyrite-magnetite-chalcopyrite-rutile, cut by thick quartz-pyrite ±magnetite-chalcopyrite veins.

16TROP23B: PLAGIOCLASE-RELICT MAFIC ±QUARTZ PHYRIC, ?DACITE PORPHYRY ALTERED TO POTASSIC/PHYLLIC) ASSEMBLAGE OF QUARTZ-KSPAR-ALBITE-CHLORITE (AFTER BIOTITE?)-SERICITE-EPIDOTE PYRITE-MAGNETITE-CHALCOPYRITE, CUT BY QUARTZ-PYRITE±MAGNETITE/HEMATITE-CHALCOPYRITE VEINS/FRACTURES

Hand sample shows grey, medium-grained felsic porphyry intrusive (prominent white etched plagioclase, lesser pyritized relict mafic phenocrysts in an altered siliceous groundmass, cut by quartz -pyrite ± local chalcopyrite veins and fractures. The rock is weakly magnetic, shows no reaction to cold dilute HCl, and weak stain for K-feldspar (mainly secondary?) in the etched slab. Modal mineralogy in polished thin section is approximately:

Quartz (largely secondary, vein/groundmass; recrystallized relict phenos)	45%
Relict plagioclase (sericite-albite ±Kspar altered)	20%
K-feldspar (largely secondary, after phenocrysts/groundmass)	15%
Chlorite (relict mafic sites, in veins, after secondary biotite?)	7%
Pyrite (disseminated, veins, fractures; slightly oxidized to limonite)	5-7%
Sericite (mainly after plagioclase)	3-5%
Epidote (relict mafic sites)	1%
Magnetite (largely hematized, originally partly secondary?)	1%
Chalcopyrite	<1%

This sample is strongly altered, obscuring original protolith, but appears to consist of about 30-35% relict (sericitized, thoroughly albite-Kspar altered) plagioclase, 10-15% relict mafic (chlorite after secondary biotite?-epidote-magnetite/hematite-pyrite ±chalcopyrite altered) and <5% recrystallized quartz phenocrysts in groundmass altered to quartz-secondary Kspar-chlorite-sericite, cut by stockwork quartz-pyrite ±magnetite-chalcopyrite veins and fractures.

Relict plagioclase phenocrysts are subhedral/corroded, up to 5 mm (where glomeratic), ~10-20% replaced by sericite as randomly oriented sub/euhedral flakes <50 μm, and by secondary alkali feldspar ranging from albite (untwinned/vaguely twinned, suggesting An_{0-2}) to <u>local Kspar</u> (subhedra to 0.5 mm, especially near rims or fractures cutting the crystals, or alongside major veins/veinlets.

Relict mafic sites have sub- to euhedral outlines mostly <2 mm (locally to 4 mm) composed of variable ratios of chlorite (subhedral flakes <0.2 mm with pale to distinct green pleochroism, near-zero to weakly anomalous grey, length-slow birefringence suggestive of F:M around 0.5 or locally greenish-brown colour, second-order birefringence <u>suggestive of former secondary biotite</u>?), minor epidote (subhedra <0.4 mm with strong yellow colour=high Fe content). Abundant pyrite (ragged subhedra to 1 mm), trace chalcopyrite (subhedra <0.2 mm, locally included within pyrite), magnetite (ragged subhedra <0.5 mm largely replaced by fine-grained hematite as subhedral flakes <0.1 mm) are closely associated with mafic sites, or controlled along veins and fractures.

Rare remnant quartz phenocrysts have rounded sub/anhedral outlines <1.5 mm, locally with indications of resorption and overgrowths largely obscured by recrystallization to granular aggregates of interlocking anhedral secondary quartz crystals <0.5 mm. The remnant crystals are weakly strained (minor undulose extinction, sub-grain development; no sutured grain boundaries).

The groundmass consists mainly of granular interlocking, anhedral crystals of quartz and (probably mostly secondary?) alkali feldspar both mainly <0.1 mm but locally up to 0.25 mm, with some feldspar (mainly Kspar, local albite?) partly altered to sericite, and there is local sericite and chlorite (both subhedral flakes <30 µm). In places the quartz has a distinctly secondary appearance, particularly where organized into poorly defined, narrow (<0.25 mm) irregular veinlets.

Well defined, planar veins up to 0.5 cm thick consist of quartz (sub/anhedra <1 mm), pyrite (subhedra <1 mm, rarely with trace chalcopyrite inclusions <0.1 mm), and local magnetite (subhedra <0.2 mm, hematized). Oxidation of pyrite to limonite (goethite?) is rarely present along fractures.

In summary, this is plagioclase-relict mafic ±quartz phyric, possible dacite porphyry altered to potassic (overprinted by phyllic) assemblage of quartz-Kspar-albite-chlorite (after biotite?)-sericite-epidote-pyrite-magnetite/hematite-chalcopyrite, cut by quartz-pyrite ±magnetite-chalcopyrite veins.

16TROP24: PLAGIOCLASE-BIOTITE/HORNBLENDE? ±QUARTZ PHYRIC, QUARTZ LATITE PORPHYRY ALTERED TO A PROPYLITIC ASSEMBLAGE OF ALBITE-CHLORITE-CALCITE-EPIDOTE-SERICITE, WITH ACCESSORY MAGNETITE-TRACE CHALCOPYRITE-APATITE, CUT BY RARE THIN CALCITE-EPIDOTE ±QUARTZ FRACTURES

Hand sample shows brick-red coloured, medium-grained felsic porphyry intrusive with sub-equal amounts of pink plagioclase, dark green relict mafic and rare quartz phenocrysts in a Kspar rich groundmass, cut by rare fractures only. The rock is distinctly magnetic, shows local rapid reaction to cold dilute HCl (mainly in relict mafic sites), and pervasive stain for K-feldspar groundmass (white etched plagioclase) in the etched slab. Modal mineralogy in polished thin section is approximately:

K-feldspar (microperthite groundmass, mainly primary?)	40%
Plagioclase (phenocrysts, hematite-stained albite, likely secondary?)	30%
Quartz (small phenocrysts, groundmass; rare secondary fractures)	10%
Chlorite (with carbonate, epidote, after mafic relics)	10%
Carbonate (mainly calcite; mafic sites/minor in fractures)	3-5%
Epidote-group mineral (mafic sites, minor in plagioclase)	2-3%
Sericite (after plagioclase)	2%
Magnetite (disseminated, fractured)	1-2%
Chalcopyrite (rare, mafic sites)	<1%
Apatite (primary, accessory)	trace

This sample consists of about 25-30% plagioclase, 15-20% relict (chlorite-carbonate-epidote altered) mafic, and <5% small quartz phenocrysts in a somewhat spherulitic, phaneritic groundmass of microperthitic Kspar. Trace disseminated chalcopyrite is associated with mafic sites and magnetite rather than with microfractures partly filled with carbonate-epidote-minor quartz.

Plagioclase phenocrysts are mainly euhedral, up to almost 1 cm (where glomeratic), finely dusted by sericite as minute randomly oriented sub/euhedral flakes <35 µm or local epidote to 45 µm, and probably albitized since relief is negative compared to quartz and twining is somewhat vague, with extinction Y^010=15°, Z^001=13° suggestive of An_{0-5}.

Relict mafic sites have mostly euhedral outlines <3 mm (locally glomeratic to ~7 mm long, with shapes suggestive of possible former hornblende, lesser biotite?) pseudomorphed by variable proportions of chlorite (subhedral flakes <0.5 mm with distinct green pleochroism, near-zero to weakly anomalous bluish-grey, length-slow birefringence suggestive of F:M around 0.5-0.6?), carbonate (aggregates to 0.75 mm of subhedra mainly <0.35 mm, likely calcite), lesser epidote (aggregates to ~2 mm of semi-radiating subhedra <0.85 mm with yellow pleochroism suggestive of moderate/high Fe content). They may contain included euhedral Kspar crystals <0.5 mm. Accessory magnetite (sub/euhedra <1 mm, commonly fractured/rarely replaced by chlorite), trace chalcopyrite (sub/anhedra <0.1 mm) plus traces of apatite (euhedra <0.2 mm) are closely associated with mafics.

Quartz phenocrysts have rounded subhedral outlines mainly <1.5 mm in diameter, generally showing strong resorption features but no overgrowth rims. The crystals are essentially unstrained (show no undulose extinction, sub-grain development, sutured grain boundaries)

The groundmass consists mainly of randomly oriented, semi-radiating to spherulitic, sub-to euhedral interlocking crystals of Kspar <0.35 mm in size, with prominent microperthitic texture due to common radial acicular inclusions of albite (that may make up to 30% of the crystal), with very minor primary quartz interstitial to the Kspar. Both Kspar and to a lesser extent the plagioclase are strongly stained by minute particles of hematite.

Fractures and irregular veinlets mainly <0.25 mm thick consist of carbonate (aggregates to 2.5 mm, subhedra <1 mm, calcite) or epidote (subhedra <0.35 mm), rare quartz (anhedra up to 0.25 mm long by <0.1 mm wide) but no sulfides. Quartz in veins may be slightly more strained than the phenocrysts (weak undulose extinction, sub-grain development).

In summary, this is plagioclase-biotite/hornblende? ±quartz phyric, quartz latite porphyry altered to a propylitic assemblage of albite-chlorite-calcite-epidote-sericite, with accessory magnetite-trace chalcopyrite-apatite, cut by rare thin calcite-epidote ±quartz fractures.

16TROP51: PLAGIOCLASE-RELICT MAFIC PHYRIC LATITE WITH ACCESSORY ILMENO-MAGNETITE, APATITE; TRANSITIONAL PROPYLITIC-POTASSIC ALTERATION (ALBITE-KSPAR?-EPIDOTE-CHLORITE-SERICITE-LEUCOXENE) ASSOCIATED WITH VEINS OF EPIDOTE-QUARTZ-CHALCOPYRITE ±PYRITE (PARTLY OXIDIZED TO LIMONITE)

Hand specimen shows dark purplish-grey, relatively fine-grained intermediate-looking volcanic porphyry characterized by small pale greenish saussuritized plagioclase and darker green relict mafic phenocrysts in a variably purplish/pinkish groundmass, cut by yellow-green (epidote-rich) veinlets/fractures with bleached envelopes to 5 mm wide. The rock is weakly magnetic, shows trace reaction to cold dilute HCl (veinlets/envelopes), and major stain for K-feldspar in the etched offcut (could be related to veins, secondary?). Modal mineralogy in polished thin section is approximately:

Plagioclase (saussuritized, albitized?)	30%
K-feldspar (groundmass, primary/local secondary?)	30%
Epidote (after mafics, plagioclase; in veins, envelopes)	20%
Chlorite (after mafics, less in plagioclase)	15%
Quartz (secondary, veinlets only)	2%
Sericite (after plagioclase)	1%
Sphene (after ilmeno-magnetite, traces of which remain)	1%
Chalcopyrite (veinlets only, partly altered to pitch limonite)	<1%
Pyrite (veinlets only, partly oxidized to limonite)	<1%
Carbonate (mainly calcite; veinlets/envelopes only)	<1%
Apatite (primary accessory)	<1%

This sample consists of about 30-40% small saussuritized/albitized plagioclase and 10-15% epidote-chlorite altered relict mafic phenocrysts (associated with accessory relict ilmeno-magnetite altered to "leucoxene", i.e. fine-grained mixtures of sphene/rutile, local apatite), cut by a network of veinlets of epidote-quartz-local chalcopyrite-trace pyrite-calcite with epidote-possible Kspar envelopes.

Relict plagioclase phenocrysts are randomly oriented, with sub- to euhedral outlines mostly <2 mm long, generally 15-30% replaced by fine-grained epidote (sub/euhedra <0.1 mm) and lesser sericite (randomly oriented sub/euhedral flakes <35 µm), or local chlorite of similar size to sericite; carbonate is not seen. General lack of, or vague remnant twinning with extinction Y^010 up to 15° and relief close to that of surrounding Kspar groundmass suggests most plagioclase has been albitized (An_5?). Near veinlets the proportion of epidote replacement may reach almost 90%. Variable staining by minutely divided hematite causes the pink colouration in hand specimen.

Relict mafic sites have mainly euhedral outlines <1 mm but locally up to 2.5 mm long, also with random orientations. They are pseudomorphed by variable proportions of epidote (tightly interlocking, randomly oriented sub/euhedra mainly <0.1 mm long, with bright yellow pleochroism indicative of high Fe content) and chlorite (matted subhedral flakes mainly <50 µm with distinct pale green pleochroism but near-zero birefringence suggestive of F:M around 0.5?), and typically closely associated with relict Fe-Ti oxides that display euhedral outlines <0.5 mm, pseudomorphed by fine-grained sphene and rutile mixed with epidote and/or chlorite, local euhedral apatite to 0.3 mm.

In the groundmass, K-feldspar typically occurs as randomly oriented, fine feathery subhedral laths mainly <75 µm long, variably stained by minutely divided hematite. Near and along veinlets of quartz and epidote (see below), increased yellow stain in the etched slab suggests concentration of Kspar increases, and thus may be partly secondary (?), in incipient potassic alteration envelopes.

Veins and veinlets up to 4 mm thick forming a loose network or sub-parallel swarms spaced 1-2 cm apart consist mostly of epidote (acicular euhedra to 1 mm, high Fe content) and central quartz (subhedra to 3 mm, unstrained) and chalcopyrite (irregular masses to 4 mm, partly oxidized to pitch limonite) or lesser pyrite (subhedra <0.35 mm, also partly oxidized to limonite).

In summary, this is plagioclase-relict mafic phyric latite (accessory ilmeno-magnetite, apatite) showing transitional propylitic-potassic alteration (albite-Kspar?-epidote-chlorite-sericite-leucoxene) associated with veins of epidote-quartz-chalcopyrite ±pyrite (partly oxidized to limonite).

M456709: GRANITE: SERICITIZED, HEMATITE-STAINED ALBITE, QUARTZ, KSPAR, SCATTERED CHLORITE-CALCITE ALTERED RELICT MAFICS ASSOCIATED WITH RELICT (RUTILE ALTERED) ILMENO-MAGNETITE, CUT BY A STRONG BUT ESSENTIALLY BARREN STOCKWORK OF QUARTZ VEINS (TRACE PYRITE), LATER CALCITE, QUARTZ, POSSIBLE SECONDARY KSPAR FRACTURES

Hand specimen shows brick-red (hematite-stained), medium-grained, granitic-looking intrusive cut by a prominent stockwork of grey siliceous (mainly quartz?) veins up to 0.5 cm thick, replacing 30-40% of the rock. The rock is weakly magnetic, shows rapid reaction to cold dilute HCl, and only minor yellow stain for K-feldspar in the etched offcut (along fractures which appear to cut the stockwork veins, therefore secondary?), but thin section evidence suggests there is also abundant primary Kspar (stain test may be inaccurate?). Modal mineralogy in polished thin section is roughly:

Quartz (largely secondary, veins; also primary, interstitial)	40%
Plagioclase (sericitized, hematite-stained albite?)	35%
K-feldspar (mainly primary, minor secondary?)	15%
Chlorite (relict mafic sites)	5%
Carbonate (mafic sites, thin fracture veinlets, mainly calcite?)	3%
Sericite (after plagioclase)	1%
Rutile (after ilmeno-magnetite)	1%
Pyrite (partly oxidized to limonite), rare trace chalcopyrite	<<1%
Apatite (primary accessory)	<<1%

This sample displays hypidiomorphic-granular texture, composed of interlocking plagioclase (sericitized, hematite stained albite?), quartz and Kspar, with only scattered chloritized relict mafics and relict accessory Fe-Ti oxides (now mainly rutile) and apatite, cut by major quartz-trace pyrite (oxidized to limonite) veins. Some secondary quartz replaces margins of plagioclase crystals.

Plagioclase forms randomly oriented, sub- to euhedral crystals mainly <4 mm long, partly (5-10%) replaced by very fine-grained sericite as randomly oriented, subhedral flakes mostly <30 μm. Well-defined twinning with extinction Y^010 to 14º and relief negative compared to quartz but positive compared to adjacent Kspar suggests composition near albite (An_{5-10}?), partly secondary?

Quartz interstitial to feldspars, likely primary, forms irregular to ragged or skeletal sub- to anhedra up to about 4.5 mm in diameter with moderate to locally strong strain indicated by undulose extinction, sub-grain development, and local suturing of grain boundaries, associated with fracturing along which thin carbonate veinlets are developed (these also affect Kspar, but not plagioclase).

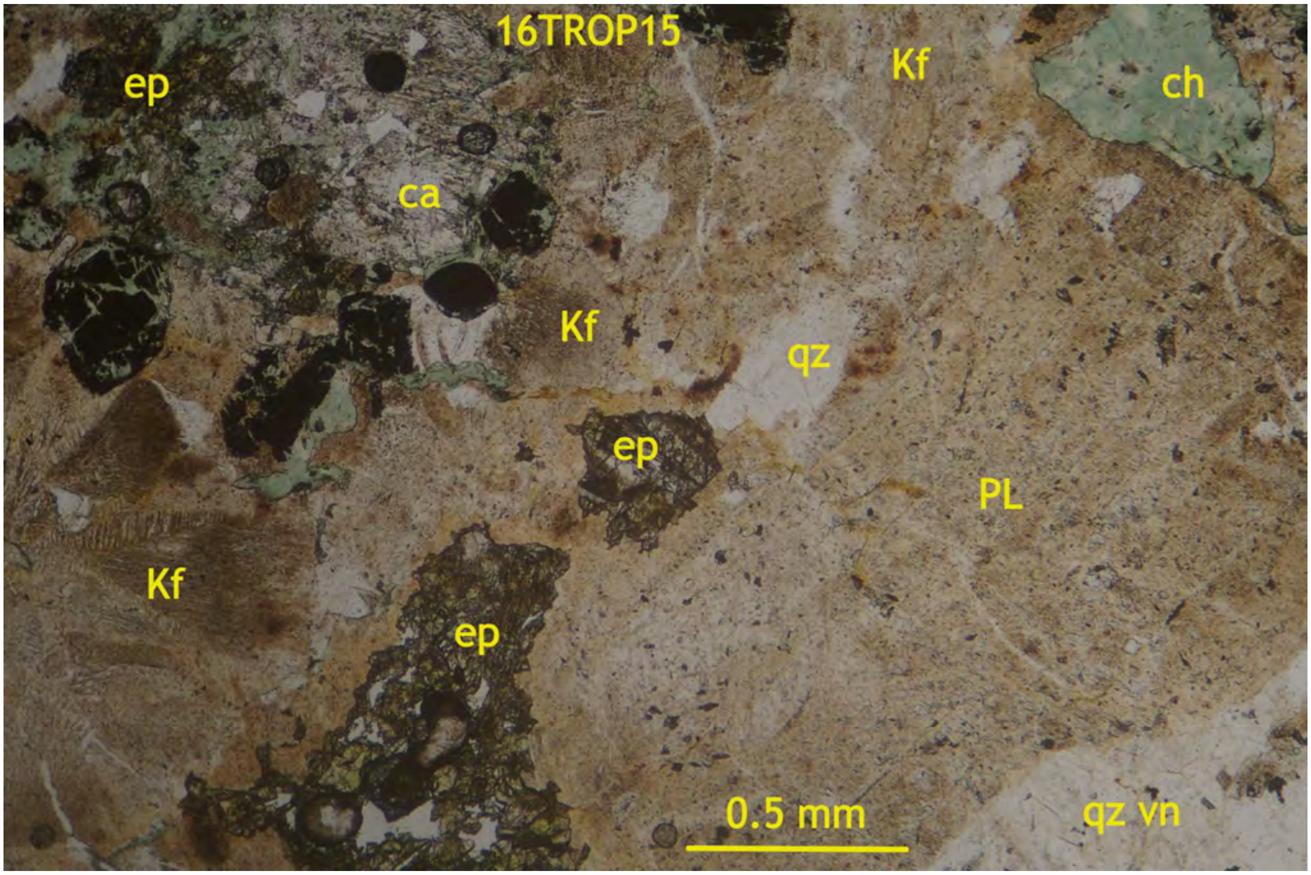
Kspar forms sub- to anhedral crystals up to ~4 mm, strongly stained by hematite, poikilitically enclosing inclusions of plagioclase. Large negative 2V suggests it is likely orthoclase, and it appears primary. Possibly secondary Kspar suggested by staining is not readily distinguishable in section.

Relict mafic sites are sparse, with irregular ragged to locally rounded subhedral outlines mostly <2 mm, pseudomorphed by variable mixtures of chlorite (matted subhedral flakes <0.1 mm with pale but distinct green pleochroism, near-zero to weakly anomalous grey, length-slow birefringence suggestive of F:M ~0.5?) and carbonate (ragged sub/anhedra <0.5 mm, likely calcite?) associated with accessory rutile (aggregates of dark brown subhedra <0.1 mm with crude subhedral outlines to 0.65 mm, suggestive of former ilmeno-magnetite?) and minor apatite (euhedra to 0.4 mm).

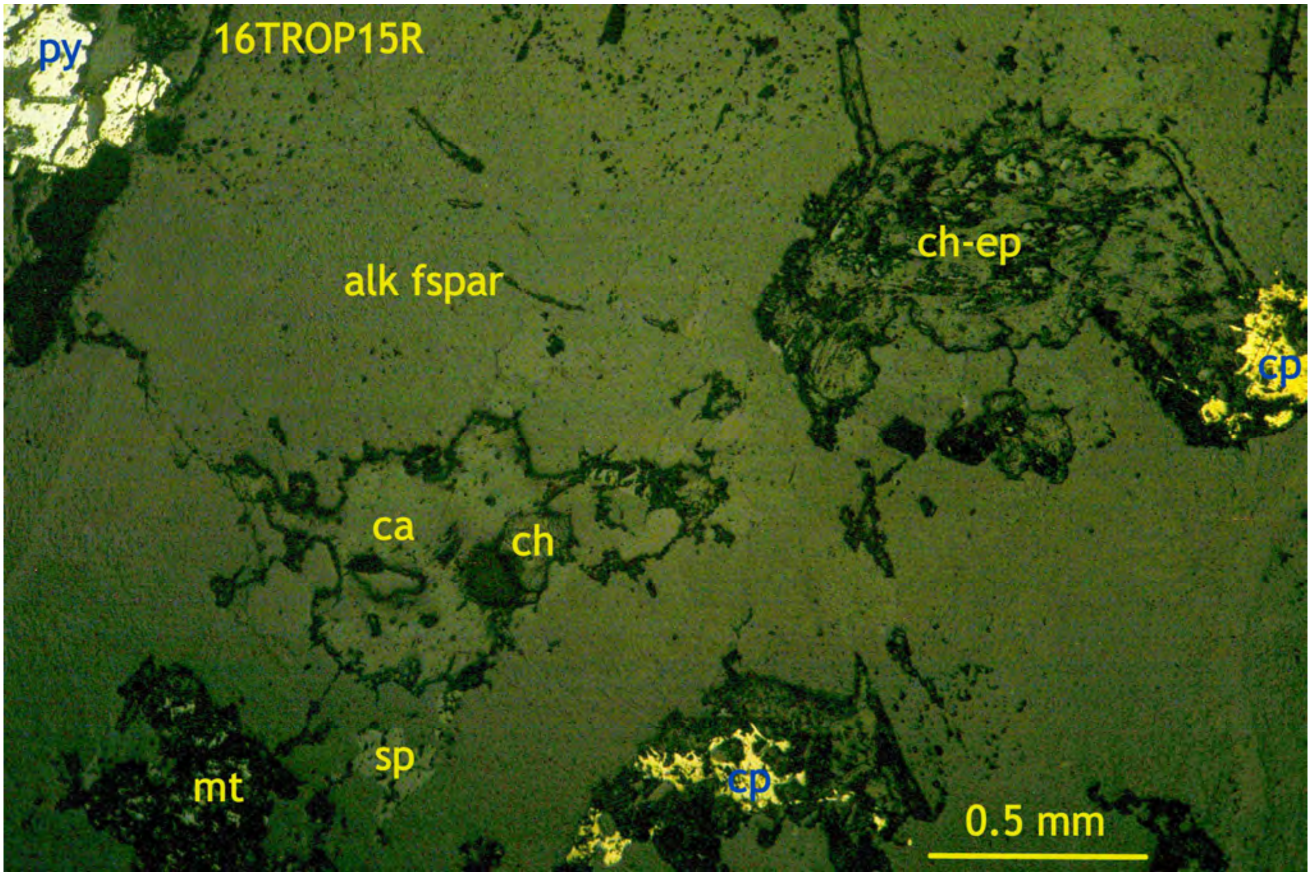
The major stockwork veins consist of variable-textured secondary quartz that varies from coarse bladed euhedra up to 3 mm long to a matrix of much finer, more randomly oriented sub- to euhedra mainly <0.25 mm; these are both locally cut by thin fractures <0.2 mm thick of later quartz, suggesting multiple stages of brecciation/veining (the final stage may be associated with secondary Kspar?). Rare pyrite found along the margins of the quartz veins forms rounded subhedra to 0.45 mm, partly oxidized to limonite, and traces of chalcopyrite occur with the late quartz fractures.

In summary, this appears to represent granite (sericitized, hematite-stained albite, quartz, Kspar, scattered chlorite-calcite altered relict mafics associated with relict (rutile altered) ilmeno-magnetite, cut by a strong but essentially barren stockwork of quartz veins (trace pyrite), later calcite, quartz, Kspar? fractures. Alteration may be incipient potassic (quartz-Kspar-chlorite-calcite).

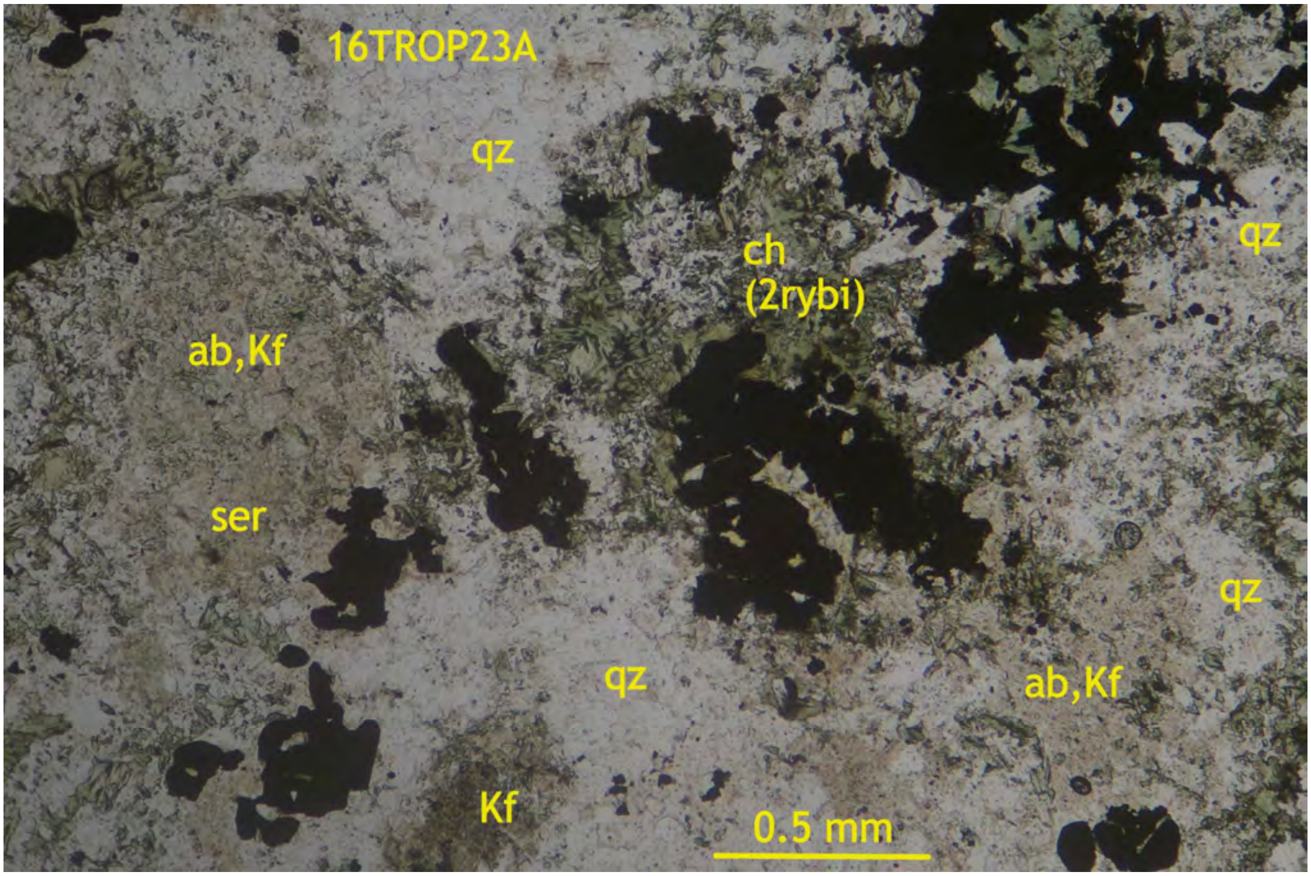
PHOTOMICROGRAPH CAPTIONS



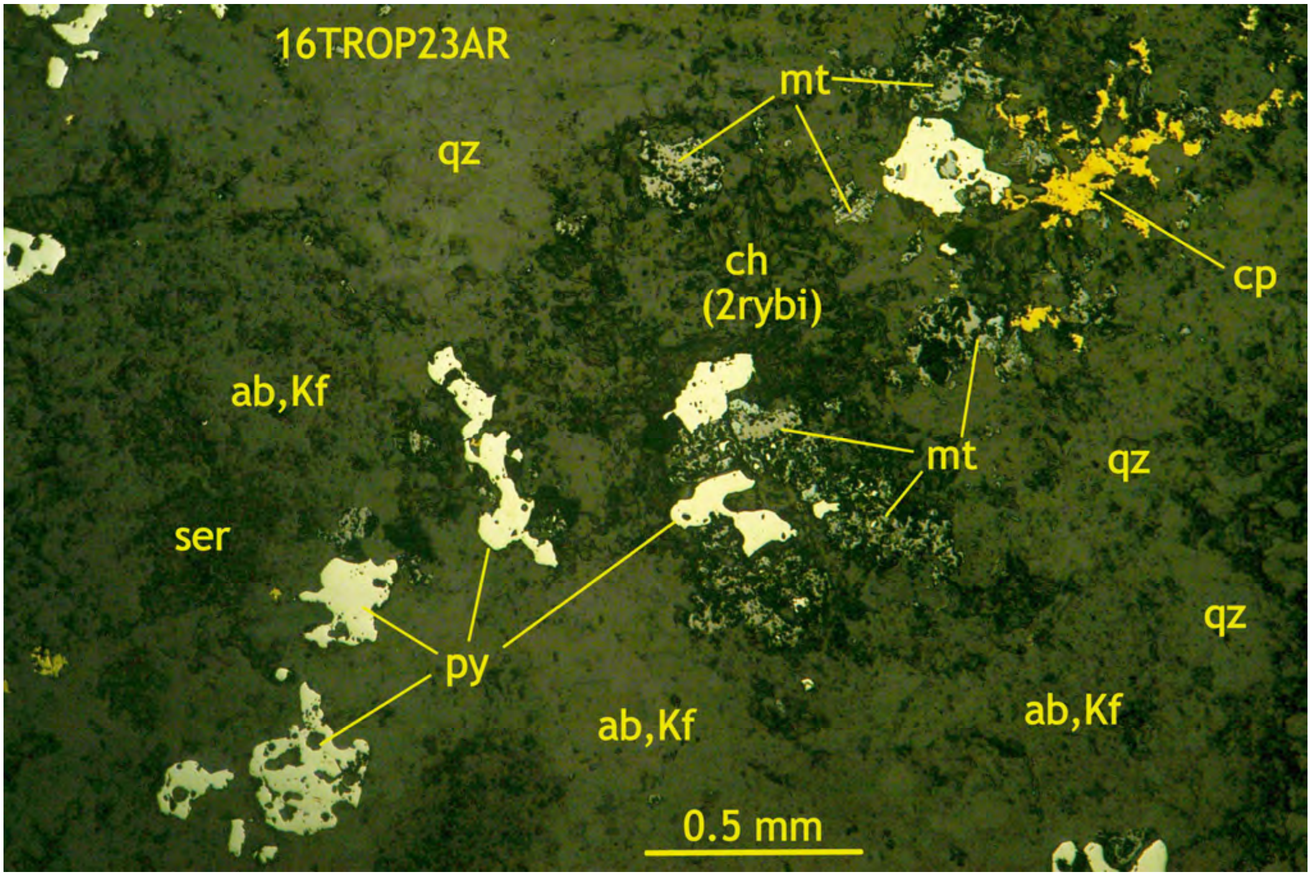
16TROP15: quartz latite porphyry: phenocrysts of albitized plagioclase (PL), relict mafics altered to chlorite (ch), calcite (ca) or epidote (ep), associated with magnetite and sulfides (opaque), minor quartz (QZ), in phaneritic groundmass of Kspar (Kf, microperthitic), cut by quartz veinlets (qz). Transmitted plane light, field of view ~3 mm wide.



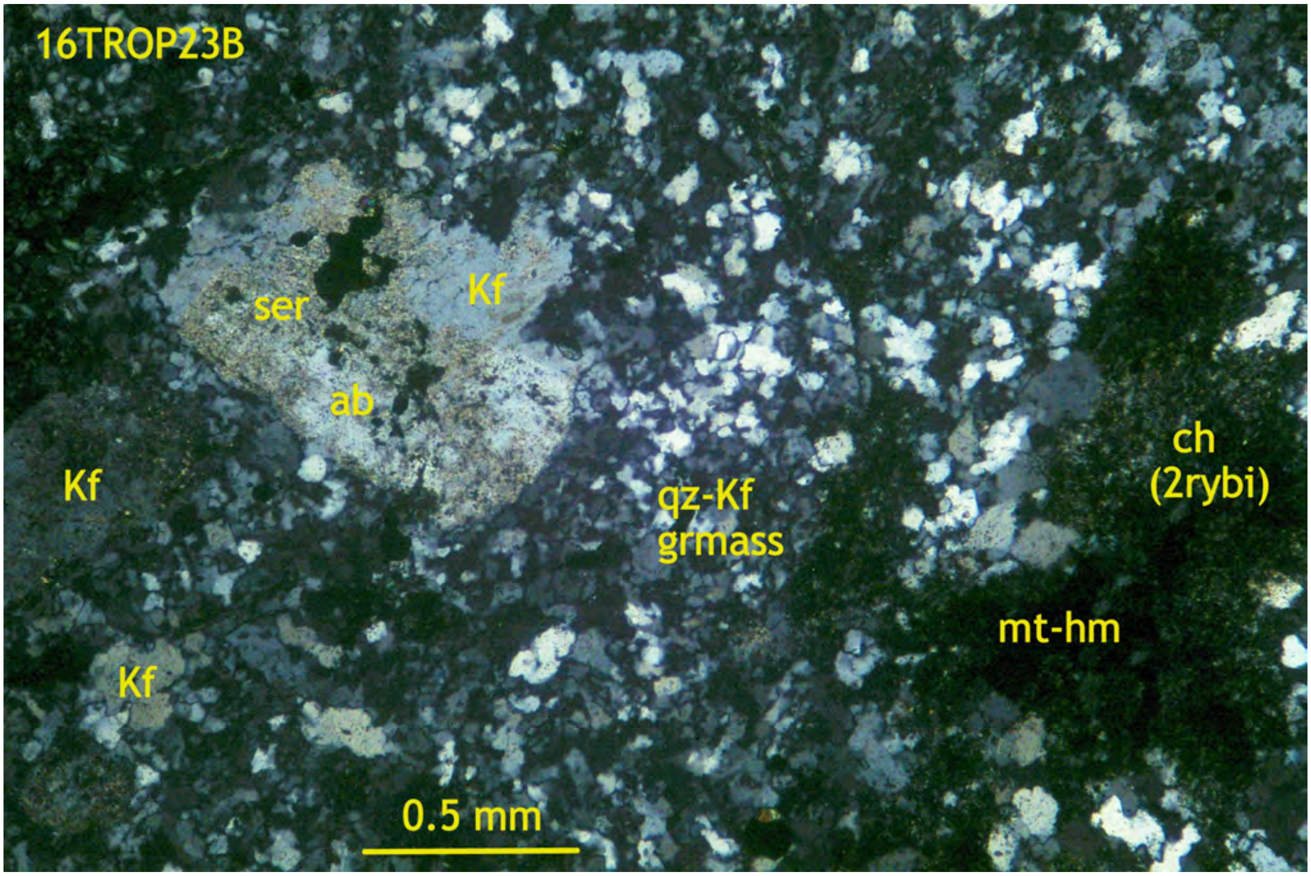
16TROP15R: disseminated sulfides (pyrite, py, chalcopyrite, cp) and magnetite (mt) both closely associated with relict mafic sites altered to chlorite-minor epidote (ch, ep) or calcite (ca) and minor sphene (sp), in matrix of alkali feldspar. Reflected light, uncrossed polars, field of view ~3 mm wide.



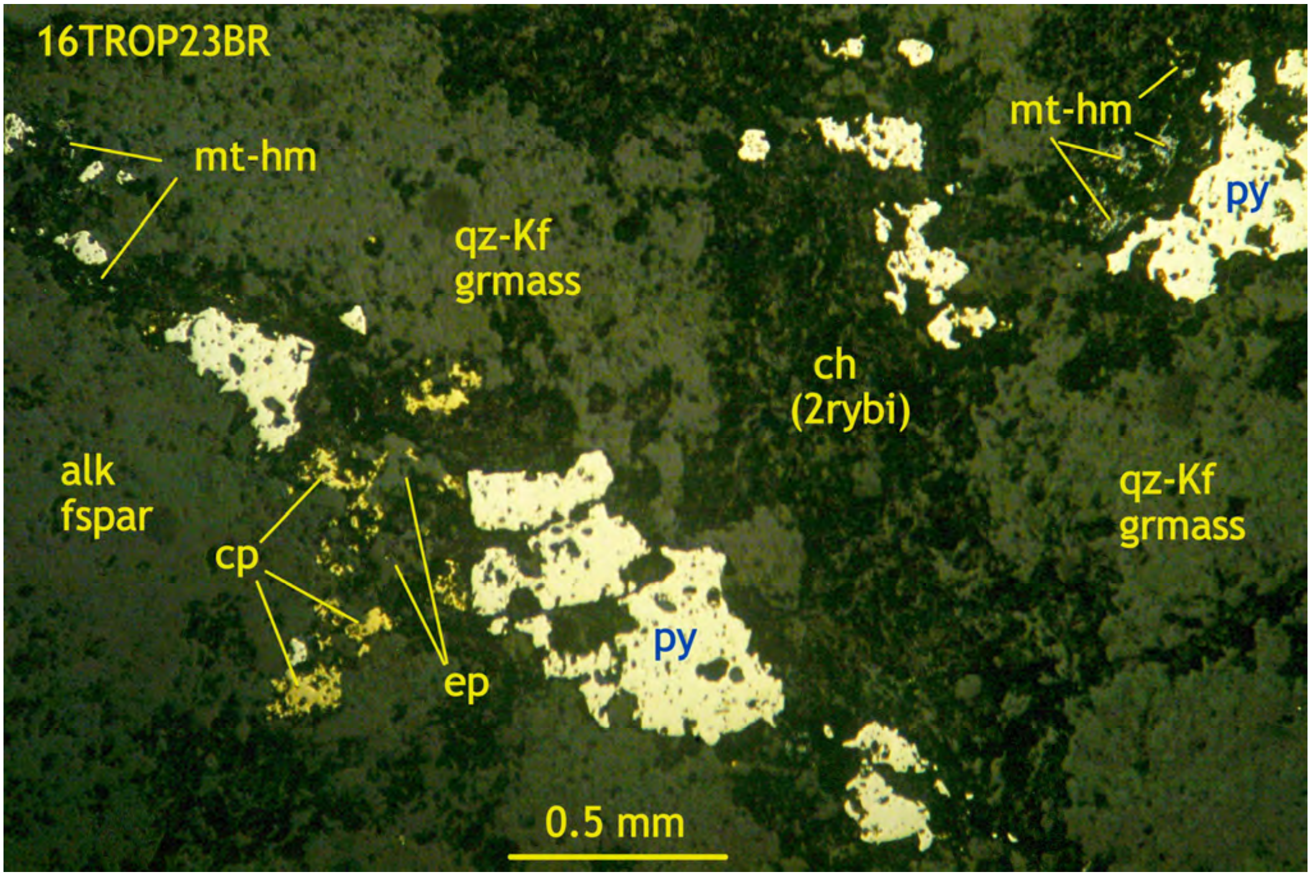
16TROP23A: relict (sericite-albite-Kspar altered) plagioclase and (chlorite after secondary biotite?) mafic phenocrysts, the latter associated with opaque sulfides and magnetite (see below), in groundmass strongly altered to quartz and Kspar, indicative of potassic assemblage overprinted by phyllic. Transmitted plane light, field of view ~3 mm wide.



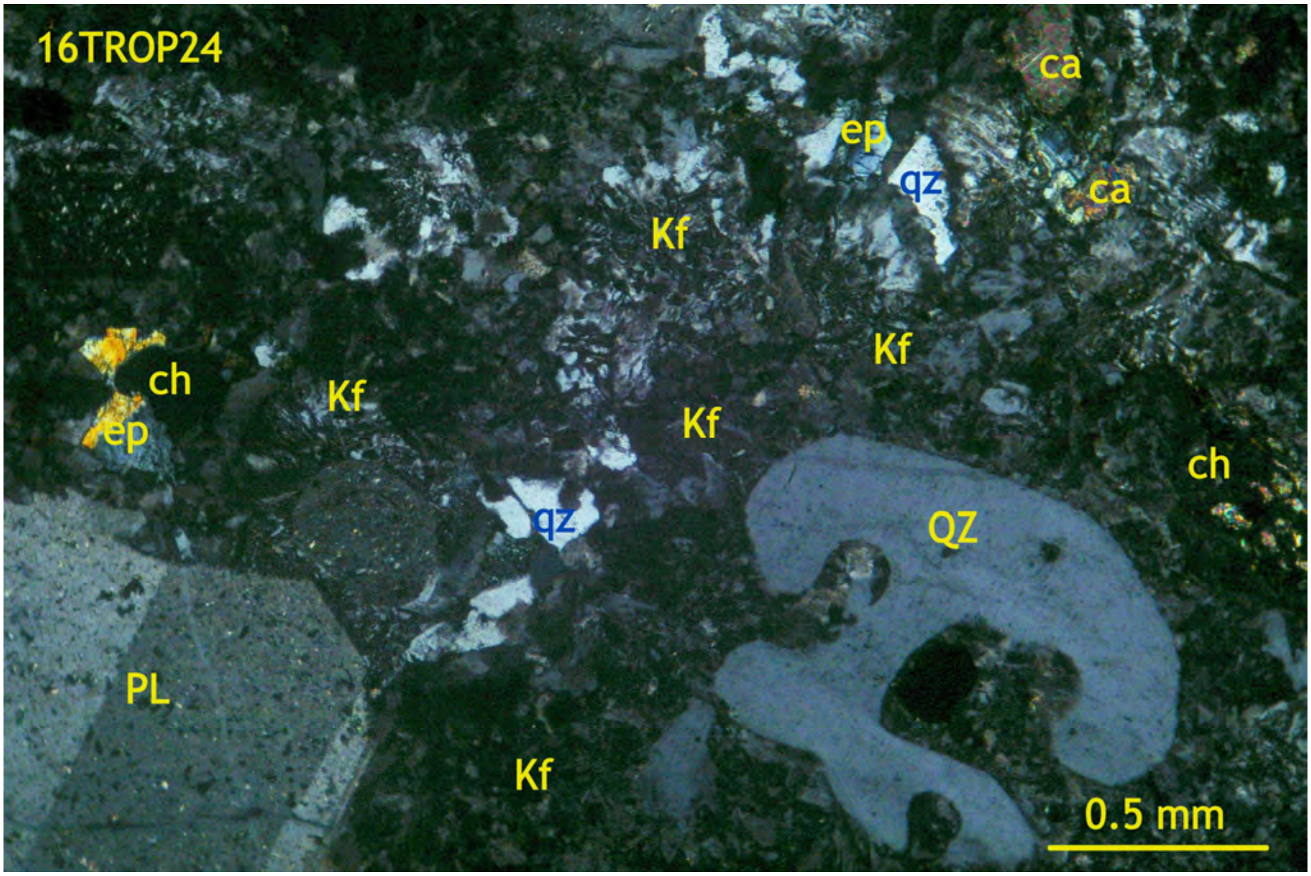
16TROP23AR: same area to show magnetite (mt, probably partly secondary) partly replaced by sulfides (pyrite, lesser chalcopyrite) all partly controlled along poorly defined microfracture trending NE-SW associated with chlorite (after secondary biotite?) and sericite-albite-Kspar altered feldspar. Reflected light, uncrossed polars, field of view ~3 mm wide.



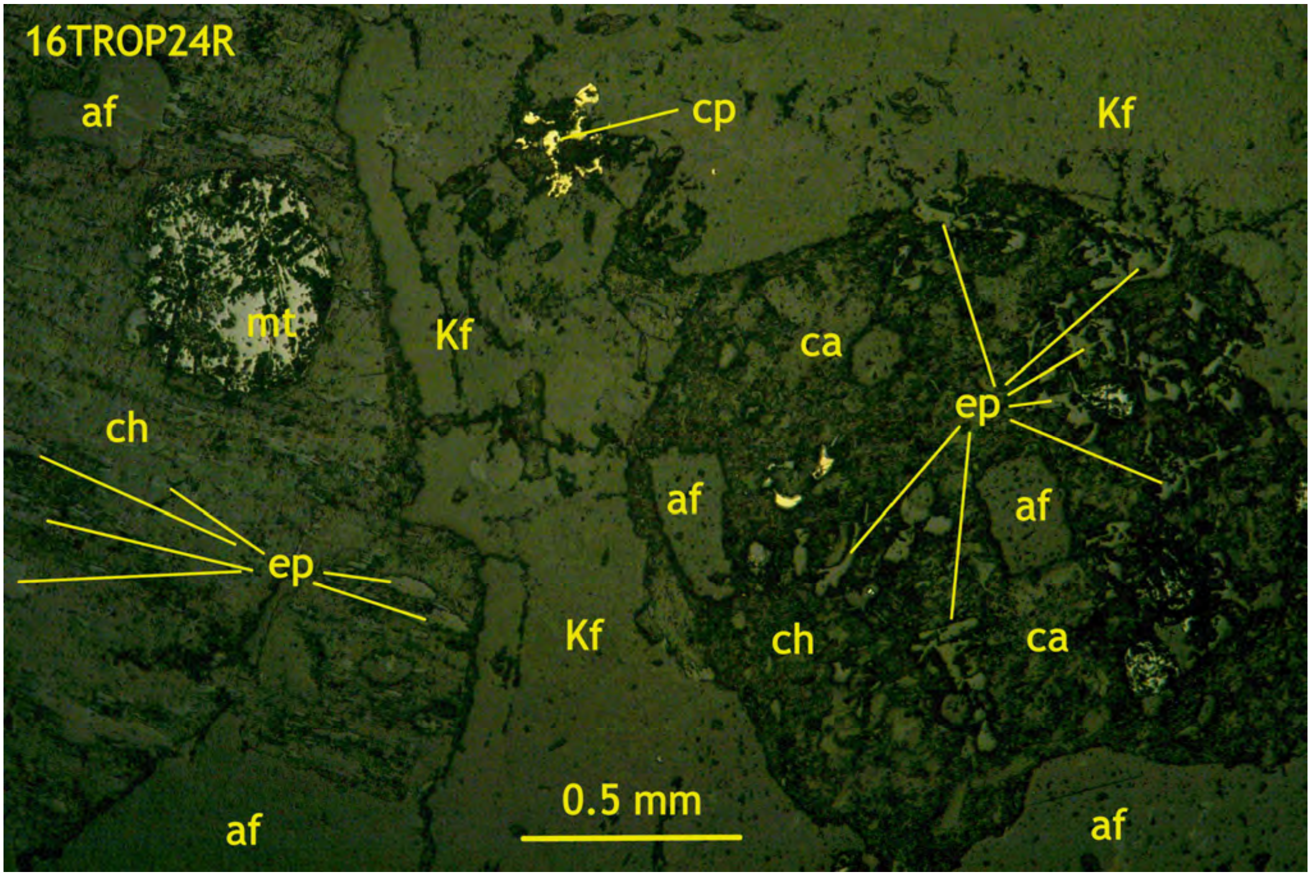
16TROP23B: relict (sericite, albite, ab, Kspar, Kf altered) plagioclase and (chlorite after secondary biotite, 2rybi?) altered mafic phenocrysts, the latter associated with opaque sulfides and magnetite, in groundmass so strongly altered to quartz and Kspar that quartz phenocrysts have been almost totally recrystallized, indicative of potassic assemblage overprinted by phyllic. Transmitted light, crossed polars, field of view ~3 mm wide.



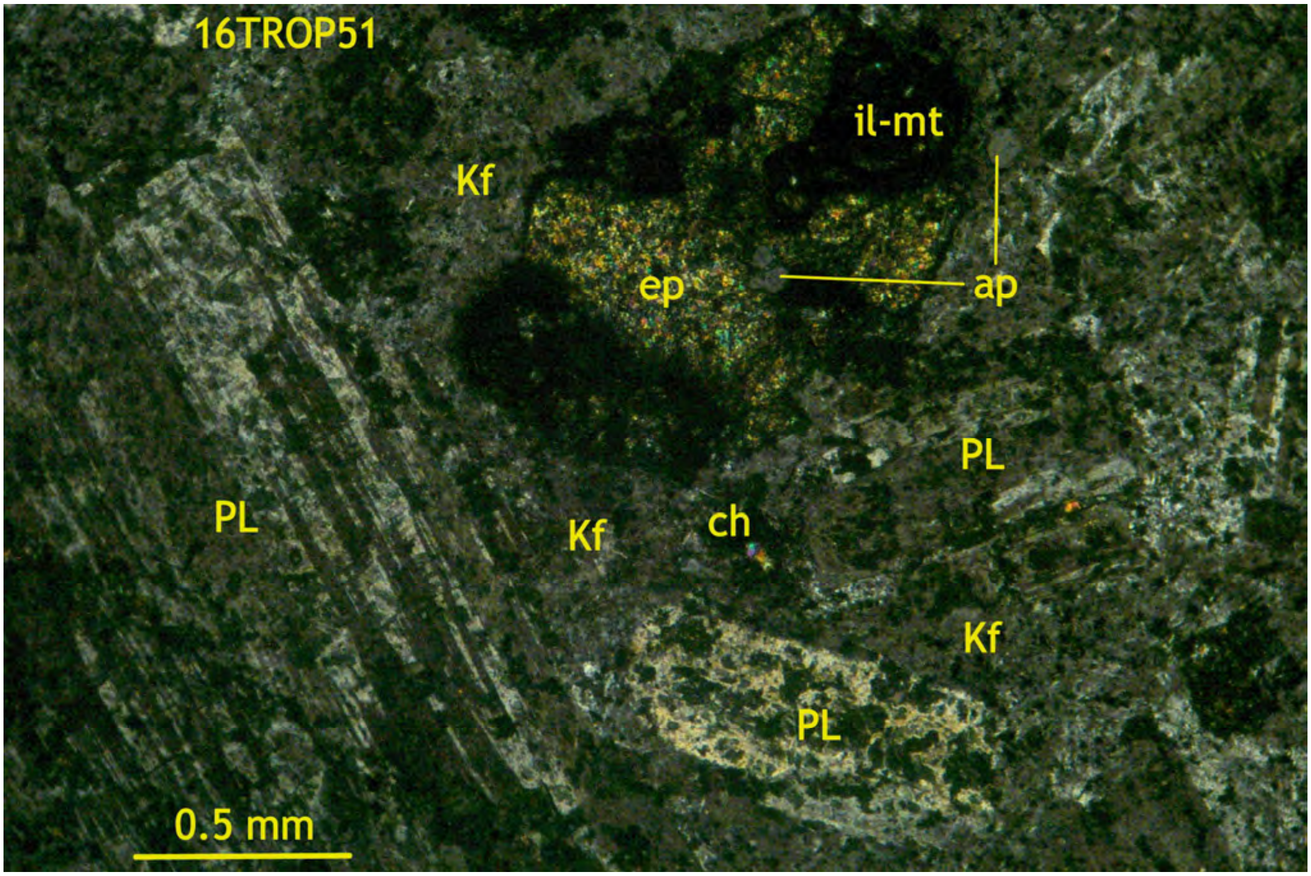
16TROP23BR: relict mafic sites and well defined veinlets/fractures (both mainly chlorite after secondary biotite?) trending NW-SE and SW-NE, with hematized magnetite (mt/hm, probably originally partly secondary) partly replaced by sulfides (pyrite, lesser chalcopyrite). Reflected light, uncrossed polars, field of view ~3 mm wide.



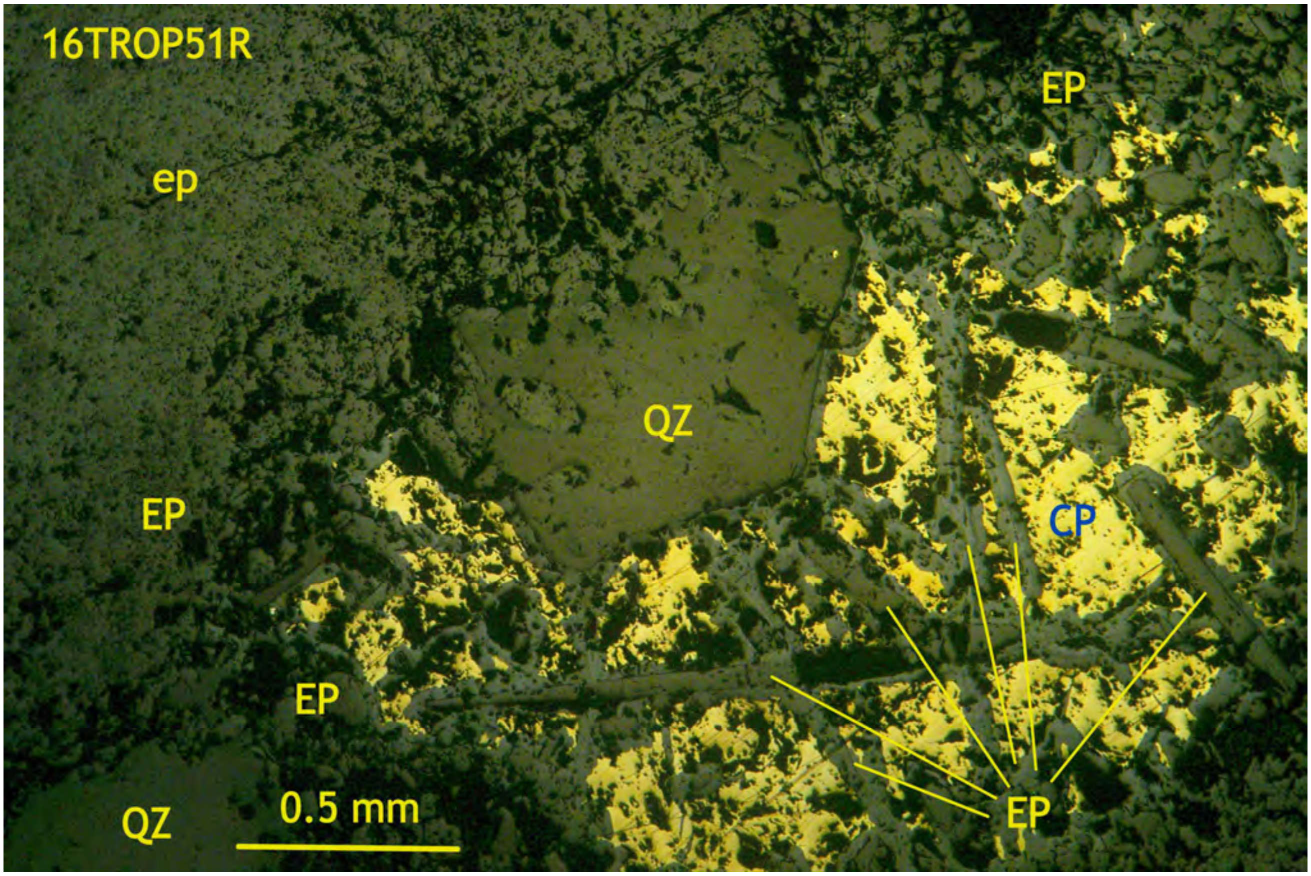
16TROP24: quartz latite porphyry: phenocrysts of albitized plagioclase (PL), relict mafics altered to chlorite, calcite or epidote, minor strongly resorbed quartz (QZ), in groundmass of spherulitic, microperthitic Kspar (Kf,) and minor quartz (qz). Transmitted plane light, field of view ~3 mm wide.



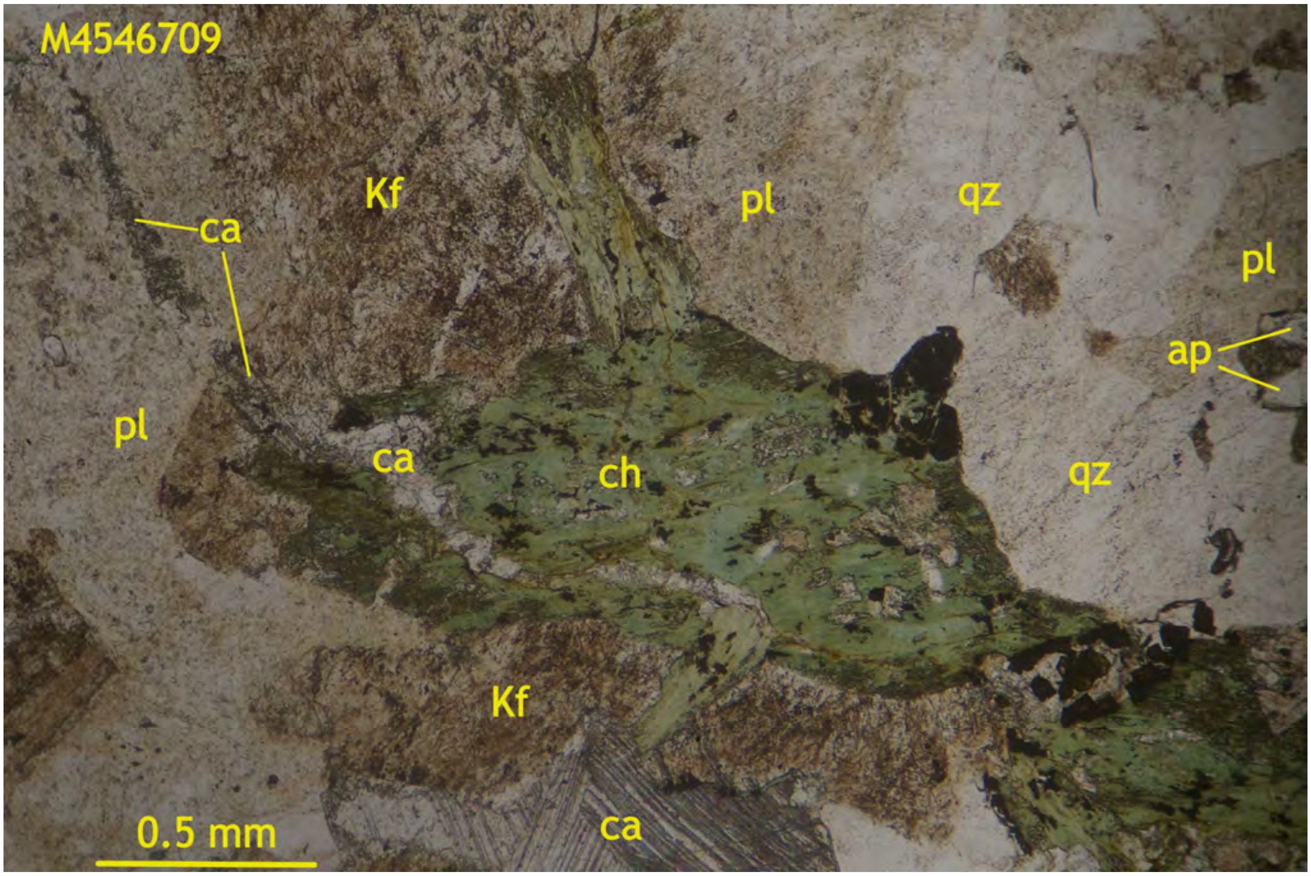
16TROP24R: relict mafic sites pseudomorphed by chlorite (ch) or calcite (ca) and lesser epidote (ep), with included euhedral alkali feldspar (af, albite or Kspar?), closely associated with accessory magnetite (mt, mainly primary), traces of chalcopyrite (cp), in groundmass of Kspar (Kf). Reflected light, uncrossed polars, field of view ~3 mm wide.



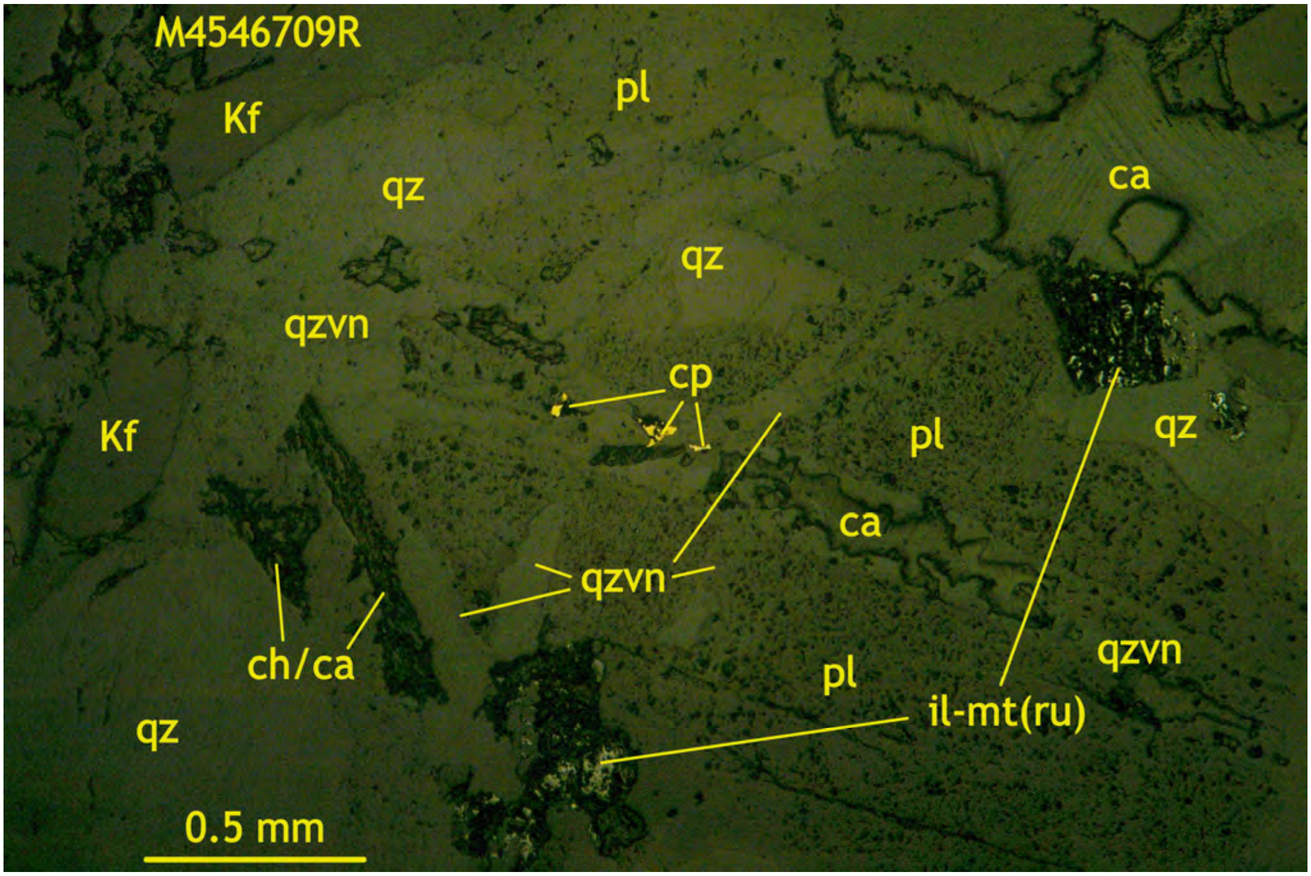
16TROP51: latite porphyry volcanic (?): relict phenocrysts of twinned plagioclase (albitized, saussuritized) and mafics (pseudomorphed by mixtures of epidote or chlorite, associated with relict opaque ilmeno-magnetite altered to leucoxene, trace apatite, ap), in groundmass of fine-grained Kspar. Transmitted light, crossed polars, field of view ~3 mm wide.



16TROP51R: vein of euhedral acicular epidote (EP), intergrown with coarser quartz (QZ), chalcopyrite (CP, oxidized to pitch limonite; minor malachite occurs in fractures in adjacent epidote); note strongly epidote altered envelope (ep) adjacent to vein. Reflected light, uncrossed polars, field of view ~3 mm wide.



M456709: transitional propylitic-potassic altered granite composed of sericitized, hematite stained albitic plagioclase (pl), lesser interstitial quartz (qz), more hematite-stained Kspar (Kf) and chlorite-calcite (ch-ca) altered relict mafics associated with rutile altered Fe-Ti oxides (opaque) and apatite (ap). Transmitted plane light, field of view ~3 mm wide.



M456709R: traces of chalcopyrite along late quartz (qz)-calcite (ca) veinlet cutting granite as described above; note local secondary quartz replacing margins of albitized plagioclase (pl) but not Kspar (Kf), accessory highly fractured, relict ilmeno-magnetite partly altered to rutile. Reflected light, uncrossed polars, field of view ~3 mm wide.

Overview of thin sections and offcuts (blue semi-circles mark photomicrograph locations).