Gold occurrences on the Plateau South property (Yukon MINFILE 105N 034, 035, 036), central Yukon

Patrick J. Sack
Yukon Geological Survey

Stefan Kruse
Terrane Geoscience Inc.

Dan Ferraro
Goldstrike Resources Ltd.

Sack, P.J., Kruse, S. and Ferraro, D., 2018. Gold occurrences on the Plateau South property (Yukon MINFILE 105N 034, 035, 036), central Yukon. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 75-91.

ABSTRACT

The Plateau South property is located 130 km east of Mayo, south of the Hess River, in the Lansing area (105N). The property is underlain by the Robert Service Thrust panel which is mostly made up of tightly folded, upright to overturned rocks of the Hyland Group, thickened by minor strata-bound thrust faults. More than 20 individual gold showings have been found since the property was staked in 2010, the most advanced of which is the Goldstack breccia zone. Gold is found in discrete veins and breccia bodies with arsenopyrite - pyrite - gold ± galena; gangue mineralogy is typically quartz-carbonate-muscovite-albite(?). Based on the similar mineralogy and paragenesis, veins and breccias are interpreted as different presentations of the same mineralizing event. Three to four generations of co-axial fold-and-thrust deformation events (D_1-D_4) related to Mesozoic orogen-normal shortening are identified on the property. Gold mineralization is related to a late extensional or transtensional event (D_5). We suggest the gold veins are orogenic as there is no clear evidence relating them to the plutons nearby and the vein geometry is consistent, with respect to regional structural trends, over a 50 km across-strike width.

* *patrick.sack@gov.yk.ca*

INTRODUCTION

Exploration in Yukon over the last decade has largely been focused on gold projects. This is due, in part, to the discovery of several styles of gold mineralization new to basinal strata of Ancestral North America (Selwyn basin area; Fig. 1), an area more commonly known for hosting lead-zinc-silver (*e.g.*, sedimentary exhalative) deposits. Newly discovered gold deposit styles include orogenic gold (*e.g.*, 3 Aces), intrusion-related replacement gold (*e.g.*, Tiger) and Carlin-type gold (*e.g.*, Osiris and Conrad). The discovery of these new deposit styles plus earlier exploration success for reduced intrusion-related gold systems (RIRGS) associated with Cretaceous intrusions (Hart, 2007) make the Selwyn basin area prospective for gold as well as base metal.

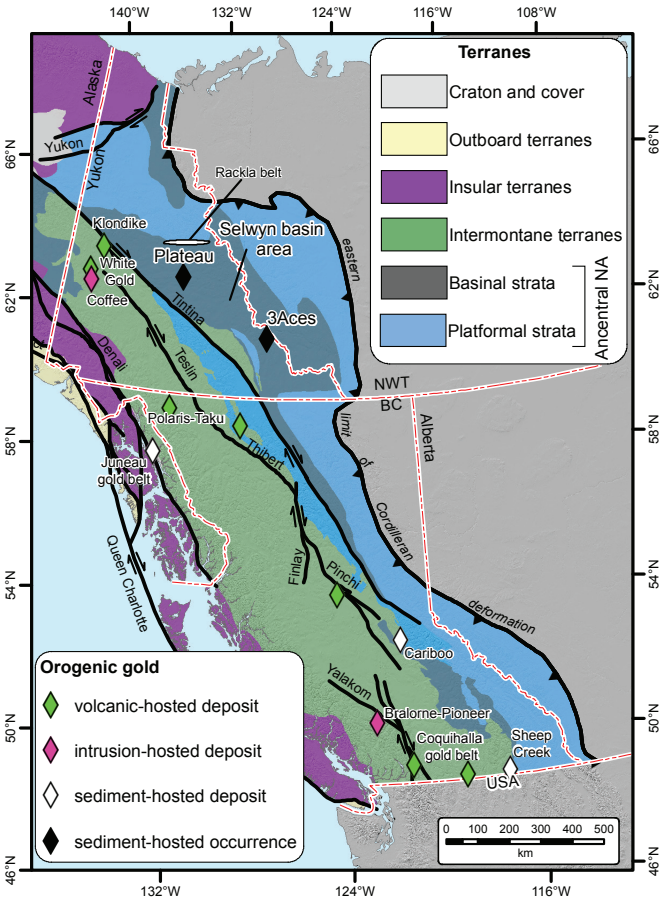

Figure 1. *Terranes, regional faults, significant orogenic gold deposits and camps of British Columbia and Yukon. Deposits from Goldfarb et al. (2005), Dubé and Gosselin (2007) and Yukon MINFILE (2017). Terranes from Colpron and Nelson (2011). NA = North America, Rackla belt includes the Tiger deposit at the western end and Osiris and Conrad occurrences at the eastern end.*

The Plateau property is located within the Russell Range on the Lansing map sheet (105N) approximately 130 km east of Mayo in central Yukon. Access is by helicopter or float plane. The Hess River divides the Plateau property into northern and southern parts and this paper is restricted to observations south of the Hess River, an area referred to as 'Plateau South' that includes Yukon MINFILE occurrences 105N 034, 035 and 036 (Fig. 2). Since discovery in 2011, more than 20 vein gold showings have been found over an across-strike distance of 50 km. Sixty-five holes have been drilled at five showings with most of the drilling in the Goldstack zone. Assays are comparable to those of orogenic gold orebodies in past-producing camps such as Sheep Creek and the Cariboo district of southern British Columbia (Table 1). The purpose of this paper is to describe vein gold mineralization on the Plateau South property as part of a larger research effort in understanding gold mineralization in the Selwyn basin area.

Table 1. *Select diamond drilling and trench results (modified from Goldstrike Resources Ltd. news releases August 20, 2012; September 9, 2013; September 9, 2015; October 3, 2016; October 25, 2016).*

Zone	Showing	Hole No.	From (m)	To (m)	Interval (m)	Au (g/t)
Goldstack	Goldstack	PSGS 15-01	22.00	93.50	17.50	13.25
		PSGS 15-02	25.00	65.50	10.80	8.10
		PSGS 16-01	11.00	56.50	45.50	6.05
		PSGS 16-05	65.50	68.60	3.10	11.01
		PSGS 16-08	71.50	80.00	8.50	3.21
Gold Dome	VG	PSVG 13-03	4.57	13.60	9.03	7.60
		PSVG 15-06	4.00	5.50	1.50	9.09
		PSVG 15-02	72.00	74.00	2.00	3.48
Bonanza	Bonanza main	Trench BC-03			0.90	14.40
		Trench BC-07			1.13	15.06
		Trench BC-10			6.90	1.30

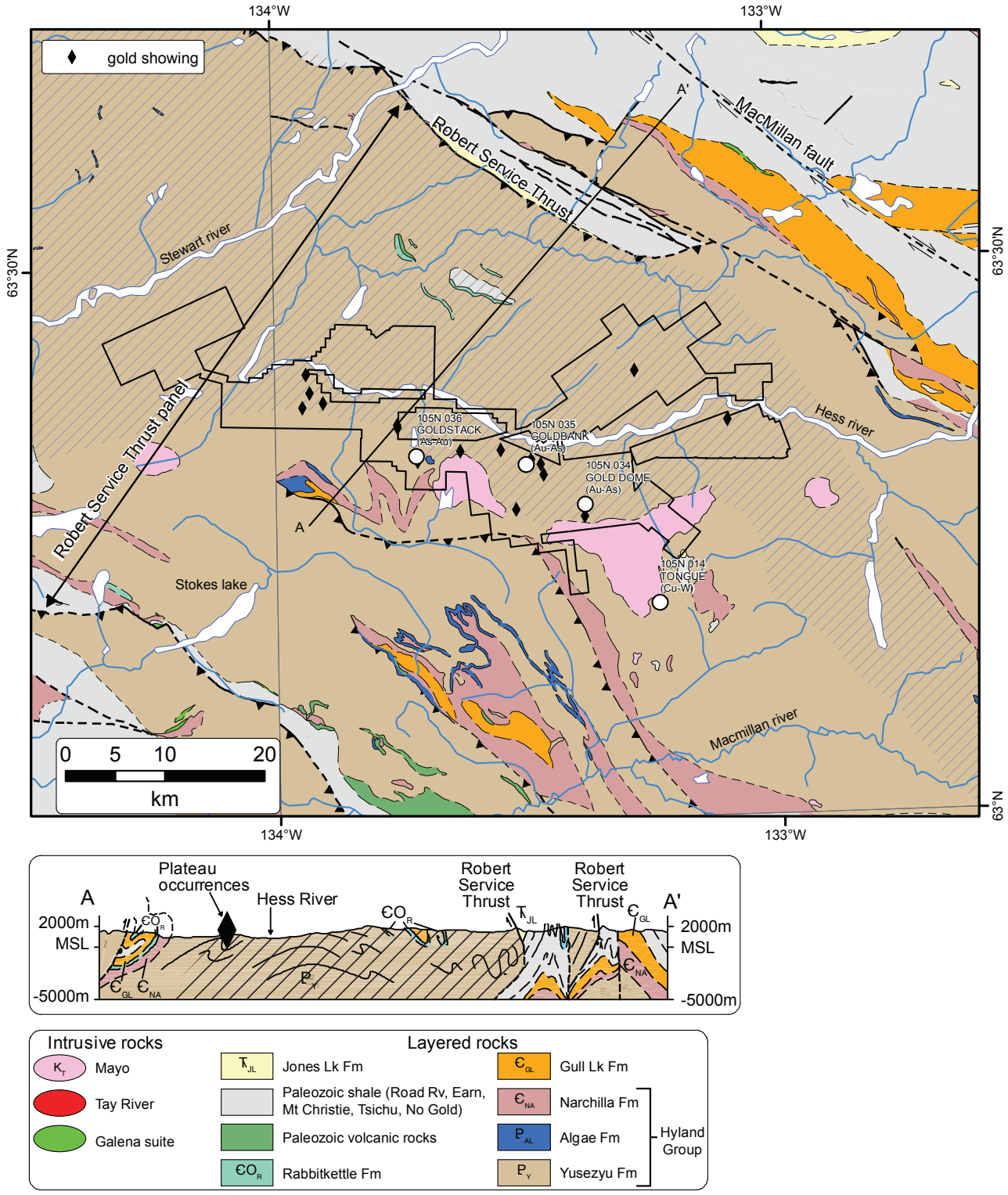

Figure 2. *Simplified regional geology around the Plateau property (YGS, 2017). Claim outline in solid black. Tombstone strain zone shown in diagonal hatching from Roots (1997; 1998). Cross section A-A′ from Roots (2003), diagonal Tombstone strain zone for illustration purposes only.*

EXPLORATION HISTORY

There have been three phases of exploration in the Lansing map area, though very little of the historic work occurred on ground now covered by the Plateau claims. The Hess Joint Venture ran from 1967 to 1969 and focused on base metal exploration primarily within the Earn and Road River groups (Roots, 2003). The Plata occurrence (Yukon MINFILE 105N 003), a 500 000 t silver, gold and base metal vein deposit located 70 km northeast of Plateau, was discovered during this phase (Yukon MINFILE, 2017). In 1975, Union Carbide Ltd. explored for tungsten-copper skarns in the Mount Armstrong area, approximately 10 km south of the Plateau South property; the most encouraging results include 0.13% W and 0.10% Cu over 1.0 m at the Tongue occurrence (Yukon MINFILE 105N 014; Union Carbide, 1976); it is not known whether analysis for gold was undertaken. Several claim packages were staked in the 1990s and exploration on these claims targeted low-grade gold in reduced intrusion-related gold systems (RIRGS) associated with mid-Cretaceous granitoid intrusions (Roots, 2003). The most recent phase of exploration, which is the focus of this paper, is exploring for high-grade gold associated with quartz veins. The Plateau property was initially staked based on anomalous regional stream sediment geochemistry in 2010 and visible gold was discovered in outcrop in 2011; the first diamond drilling occurred in 2012 (Ferraro, 2016). Since 2011, more than 20 separate gold showings have been discovered.

GEOLOGY

REGIONAL GEOLOGY

The Plateau South property is located in Ancestral North America rocks of the Selwyn basin area in the northern Cordillera (Fig. 1). The property is underlain by the Robert Service Thrust (RST) panel which is mostly made up of Hyland Group rocks (Fig. 2; Roots, 2003). The Yusezyu Formation is the most areally extensive Hyland Group map unit in the area (Fig. 3; Roots *et al.*, 1995). To the northeast and southwest of the RST panel are Paleozoic shale of the Road River and Earn groups as well as the Gull Lake, Mt Christie, Tsichu and No Gold formations (Roots, 2003). Mayo suite intrusions and dikes are the most common plutonic rocks in the area (Hart *et al.*, 2004).

The Yusezyu Formation is a coarse to fine-grained sandstone-siltstone succession with fine pebble conglomerate intervals (Roots, 2003). Regionally, the formation is up to 3000 m thick (Gordey and Anderson, 1993) though locally only several hundred metres of strata are recognized (Roots, 1998). The Yusezyu Formation sandstone and siltstone sequences are interpreted as turbidite fan deposits deposited in a basin adjacent to Ancestral North America during the late Neoproterozoic (Gordey and Anderson, 1993). At the top of the Yusezyu Formation is a 10 to 30 m thick unit of coarsely

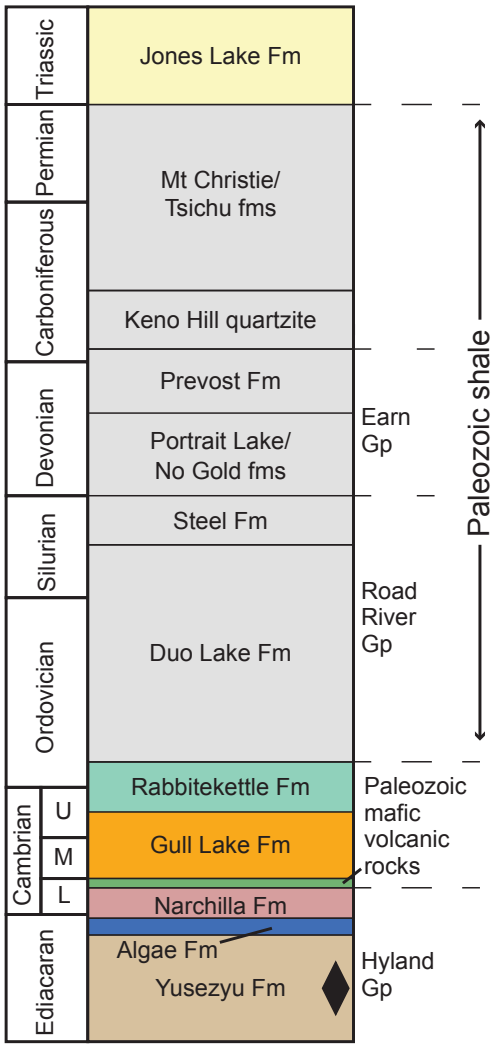

Figure 3. *Simplified stratigraphy for the Plateau area. Modified from (Roots, 1997, 1998, 2003). Unconformities omitted for clarity. Colours same as Fig. 2, black diamond illustrates stratigraphic level of Plateau occurrences.*

recrystallized limestone (Gordey and Anderson, 1993; Roots, 1998). The uppermost Hyland Group rocks, the Narchilla Formation, are a maroon to brick-red argillite, siltstone, and purple slate unit (Roots, 1998).

Within the RST panel, competent rocks of the Hyland Group form tight, upright-to-overturned, south-verging folds with fine-grained strata typically thickened by minor strata-bound thrust faults (Roots, 2003). Several southwest dipping thrust faults, including the regionally extensive RST, are mapped in the area (Roots, 2003). Locally, some of these thrust faults are now vertical, likely due to interaction with the younger Tombstone strain zone (Murphy, 1997), the bottom of which is the Tombstone Thrust that links to the Macmillan fault in the northeast (Fig. 2; Roots *et al.*, 1995). The Plateau property mostly lies within a penetratively strained part of the RST panel (diagonal hatching, Fig. 2; Roots *et al.*, 1995; Roots, 1998). The strain in these rocks is not well understood but likely relates to the Tombstone strain zone (Roots *et al.*, 1995; Murphy, 1997). The southern (upper) boundary of this strain zone is coincident with many of the vein showings (Fig. 4). Based on $^{40}Ar/^{39}Ar$ ages of metamorphic muscovite in the McQuesten area Mair *et al.* (2006) suggest that the end of ductile deformation in the Tombstone strain zone was *ca.* 104 Ma. Steep dipping, northwest trending (dominantly dextral) faults subsequently cut the early north to northeast fabrics associated with shallowly thrust faults (Roots, 2003).

PROPERTY GEOLOGY

Yusezyu Formation siliciclastic rocks and mid-Cretaceous granodiorite almost exclusively underlie the Plateau South property (Figs. 2 and 4); a calcareous unit and mafic volcanic unit are mapped locally. Initial property scale mapping (1:20 000) by Roach (2013) defined nine map units including a 'quartz-feldspar porphyry' and a 'felsic to intermediate volcanic' previously unrecognized in Hyland Group strata. Roach (2013) based the igneous interpretation on features such as "high-silica sub-volcanic quartz porphyry with stoped and/or assimilated slate metasedimentary rocks" and "significant content of quartz-eye, quartz megacrysts and broken angular to sub-angular quartz and feldspar crystals". Based on our observations, we reinterpret the stoped or assimilated slates as large shale 'rip-up' clasts and the quartz-feldspar textures as variations on evenly distributed coarse-grained quartz and feldspar grains in massive arkosic sandstone to pebble conglomerate. This reinterpretation is consistent with sedimentary features within Yusezyu Formation rocks throughout the Lansing map area (Roots, 1997, 1998, 2003) and with subsequent property scale mapping by Vanwermeskerken (2017) and Stubley (2017). The blue colour of the larger quartz grains (Fig. 5a) seen on the property is also typical for the Yusezyu Formation as defined by Gordey and Anderson (1993) to the east in the Nahanni map area (105I). In this contribution, terminology of units is mainly based on sedimentary protoliths but to reflect the metamorphic history, metamorphic map units are used (Fig. 4).

Three metasedimentary map units, one metavolcanic unit and one plutonic unit underlie the Plateau South property (Fig. 4). The most important of these is a psammite unit comprising light grey to pale green, interbedded fine to coarse-grained sandstone (Fig. 5a,b) and quartz pebble conglomerate with minor green siltstone interbeds. Sedimentary features such as shale 'rip-up' clasts and graded bedding have been noted on the property (Fig. 5c,e). Mineralized veins are mostly hosted within the psammite unit (Ferraro, 2016). The other widespread unit is a dark grey pelite that consists of well-bedded mudstone and siltstone with lesser light grey, fine-grained sandstone interbeds. Both the psammite and pelite units are part of the Yusezyu Formation. A thin marble unit is mapped locally east of the Goldstack showing as well as south of the Goldworks showing (Fig. 4). This unit is buff weathering with variable mudstone/siltstone content (Fig. 5d) and likely correlates with the Algae Formation (Cecile, 2000) though it could also correlate with limestone/marble units recently recognized by Moynihan (2016) within the Yusezyu Formation.

A dark green, massive fine-grained chloritic phyllite is seen in the Big Bang area (Fig. 4). Phenocrysts are 100 to 300 µm and are broken or embayed feldspars, identifiable as plagioclase where twinning is present. Groundmass is very fine grained chlorite, locally altered to biotite, quartz and feldspar. Ilmenite is the main opaque mineral, consistent with the low magnetic susceptibility of the unit in outcrop (0.332×10^{-5} SI units; N = 2). This unit is conformable with local strata (Stubley, 2017) suggesting it is either a sill or syndepositional volcanic rock. It may correlate with the Old Cabin Formation (Cecile, 2000), a Paleozoic mafic volcanic and shallow level intrusive unit also found 30 km south of the property in the Plateau Mountain area (Roots, 2003).

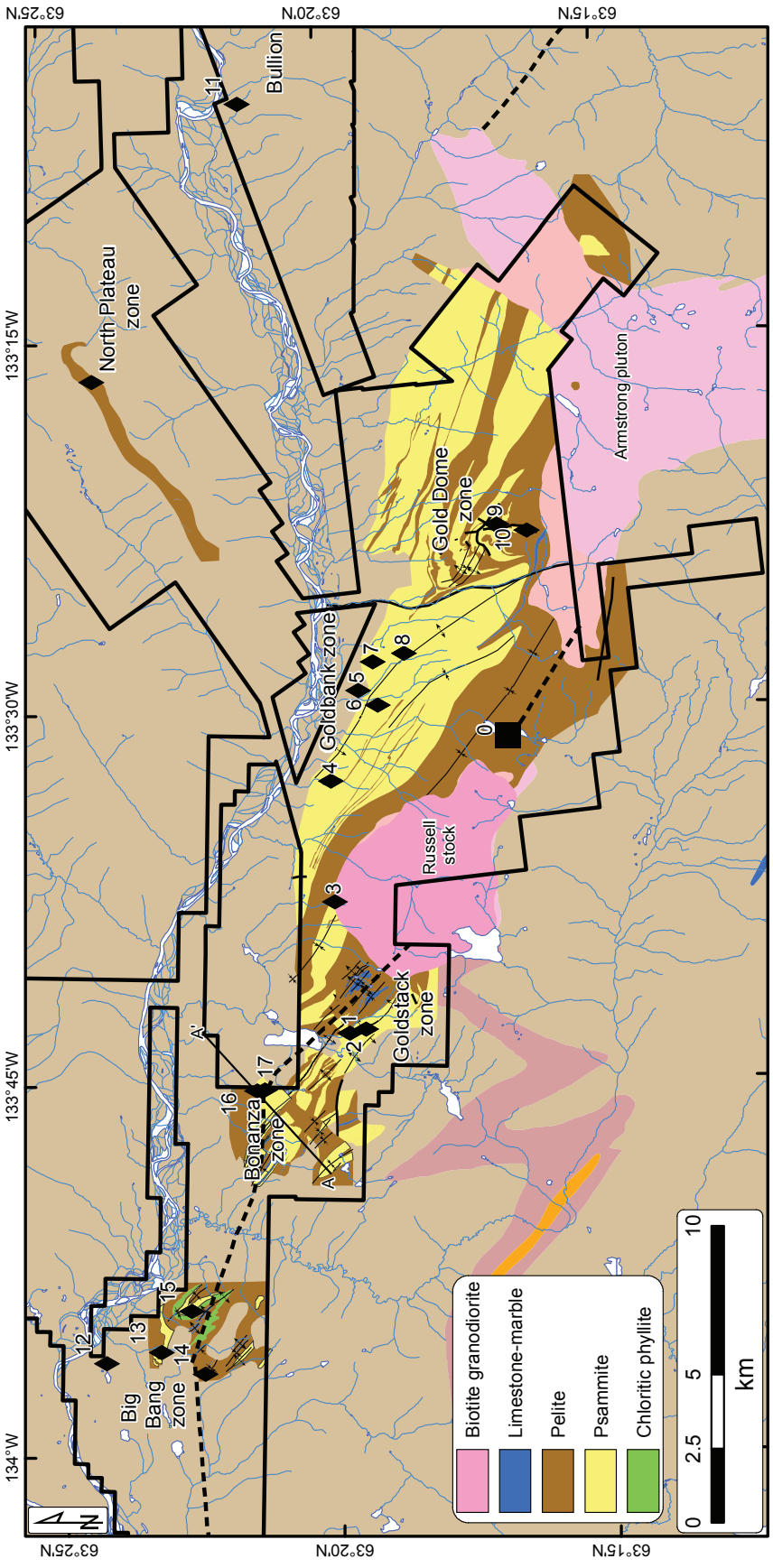

Figure 4. *Simplified Plateau property geology (mapped at 1:20000) from Roach (2013) with detailed mapping (1:2500) in the Goldstack and Bonanza areas from Vanwermeskerken (2017) and Big Bang from Stubley (2017). Location of Fig. 11 A-A' cross section through Bonanza zone shown. Heavy dashed line represents the southern (upper) boundary of the Tombstone strain zone (Roots, 1997, 1998). Based on our observations and those recorded on regional maps (e.g. Roots, 2003), we have reinterpreted map units so they are consistent with sedimentary protoliths of the Hyland Group. Property mapping limited to areas with bold colours, legend in bottom left; regional geology in muted colours from YGS (2016), map units same as Fig. 2. 1 = Goldstack, 2 = Goldback, 3 = Gold Standard, 4 = Goldbar, 5 = Stack W, 6 = Goldbank W, 7 = Ron Stack, 8 = Goldbank E, 9 = Gold Dome, 10 = Goldworks, 11 = Bullion, 12 = Big Bang N, 13 = Big Bang Main, 14 = Big Bang S, 15 = Big Bang SE, 16 = Bonanza main, 17 = Bonanza S.*

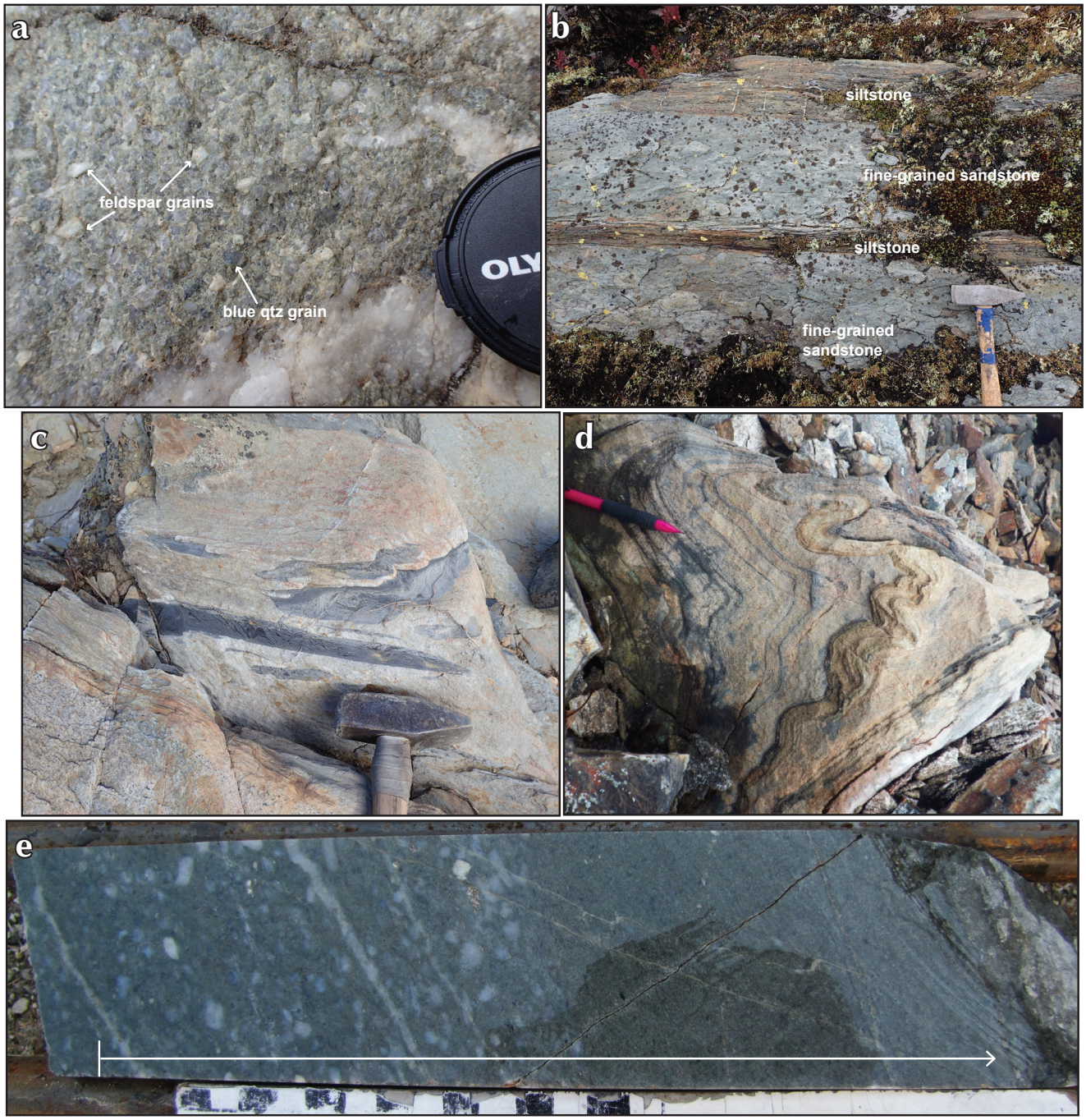

Figure 5. *Layered rocks on the Plateau South property.* ***(a)*** *Coarse-grained sandstone with blue quartz and feldspar grains. Psammite unit, Goldstack showing, lens cap 5 cm across.* ***(b)*** *Interbedded siltstone and fine-grained sandstone, Psammite unit, Goldbar showing, hammer head 13 cm across.* ***(c)*** *Shale 'rip-up' clasts within psammite unit, Big Bang Main showing, hammer head 13 cm across.* ***(d)*** *Folded marble in subcrop, pencil for scale. Photo from Kruse (2017).* ***(e)*** *Coarse-grained sandstone grading uphole into fine-grained sandstone. Psammite unit, Goldstack showing, PSGS1501-40.2 m, bottom scale in cm.*

Two intrusive bodies are found along the southern margin of the property, the Russell stock and Armstrong pluton (Fig. 4). The Russell stock is a medium-grained, equigranular biotite granodiorite (Figs. 6 to 8) with low magnetic susceptibility in the core (0.125×10^{-5} SI units; N=2) and very low magnetic susceptibility in the outer margin (0.0588×10^{-5} SI units; N=6). The Armstrong pluton is also medium-grained and equigranular, but is a slightly more felsic biotite granite (Figs. 6 and 8) with a uniformly very low magnetic susceptibility (0.062×10^{-5} SI units; N=3). The Russell stock has trace garnet and both bodies have minor amounts of magmatic muscovite with biotite as the main mafic phase; hornblende is not present (Fig. 9). The plutons are undeformed (Roots, 2003).

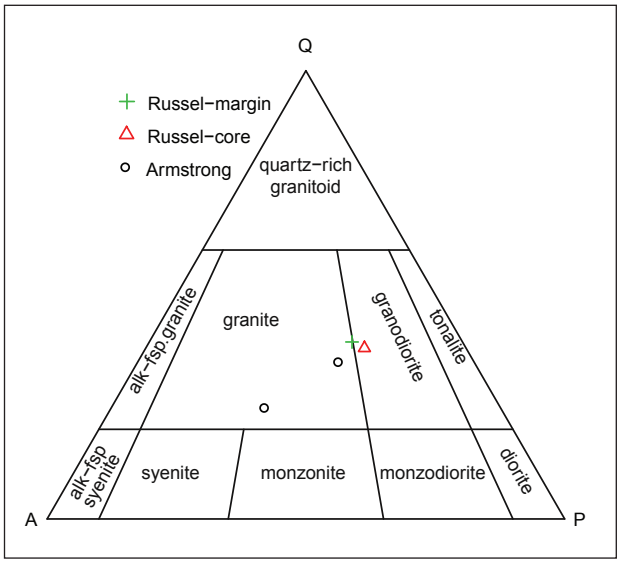

Figure 6. *QAP diagram (Le Bas and Streckeisen, 1991) of Russell stock and Armstrong pluton samples. Q=quartz, A=alkali-feldspar (alk-fsp), P=plagioclase.*

The effects of both regional metamorphism and contact metamorphism are seen on the property. In approximate decreasing abundance, regional metamorphic minerals include muscovite, chlorite and biotite; detrital muscovite is also common in coarser metasedimentary rocks. Foliation planes in metasedimentary rocks are mostly muscovite with lesser chlorite and rarely biotite. Muscovite is fine to medium grained and restricted to foliation planes. Chlorite is very fine to fine grained throughout pelitic and psammitic rocks with a preferred orientation parallel to the foliation of the rock, biotite is rare and within foliation planes of pelitic rocks. The groundmass in the mafic metavolcanic unit is dominantly chlorite with lesser biotite. Pyrite is locally recrystallized to pyrrhotite and aligned with earliest foliation (Richards, 2015). Based on these observations, we interpret the regional metamorphic grade on the property as greenschist, likely upper chlorite zone to lower biotite zone. This is slightly higher than the sub-greenschist facies described for the area by Roots (1998). Contact metamorphic aureoles are noted around both the Armstrong pluton and Russell stock (Roach, 2013). The extent of the aureoles hasn't been defined in detail, but in the vicinity of the Goldstack zone, cordierite, andalusite and biotite in pelitic rocks extend up to 500 m beyond the mapped margin of the Russell stock (Roach, 2013). In this same area, randomly oriented biotite of interpreted contact metamorphic origin are observable in thin sections of samples collected 2 km west of the margin. Contact metamorphism post-dates regional metamorphism based on the undeformed nature of both intrusions (Roach, 2013; Stubley, 2017) and cordierite-andalusite porphyroblasts that overgrow two foliations (Fig. 10).

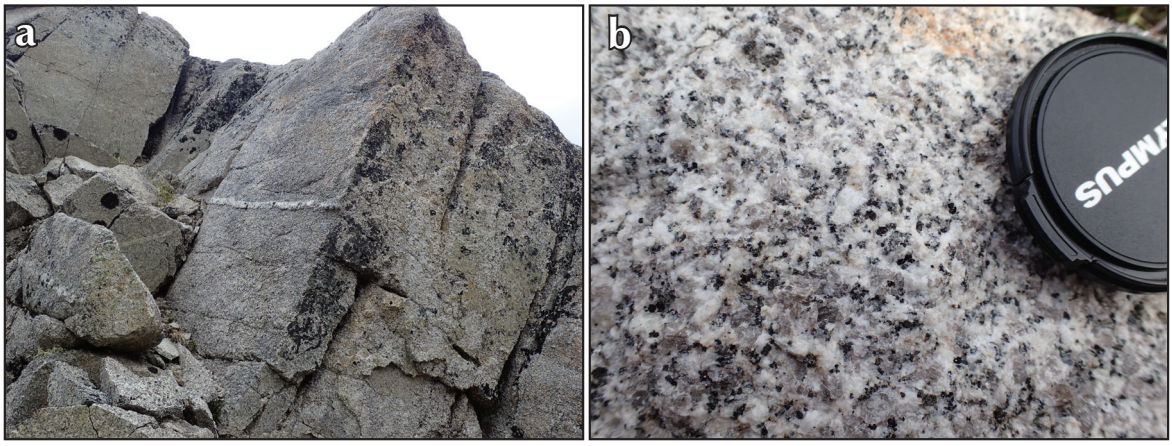

Figure 7. (a) *Granodiorite of the Russell stock, FOV is 2 m wide.* ***(b)*** *Outcrop macro of granite from the Armstrong pluton, 16PS-013-1. Lens cap is 5 cm in diameter.*

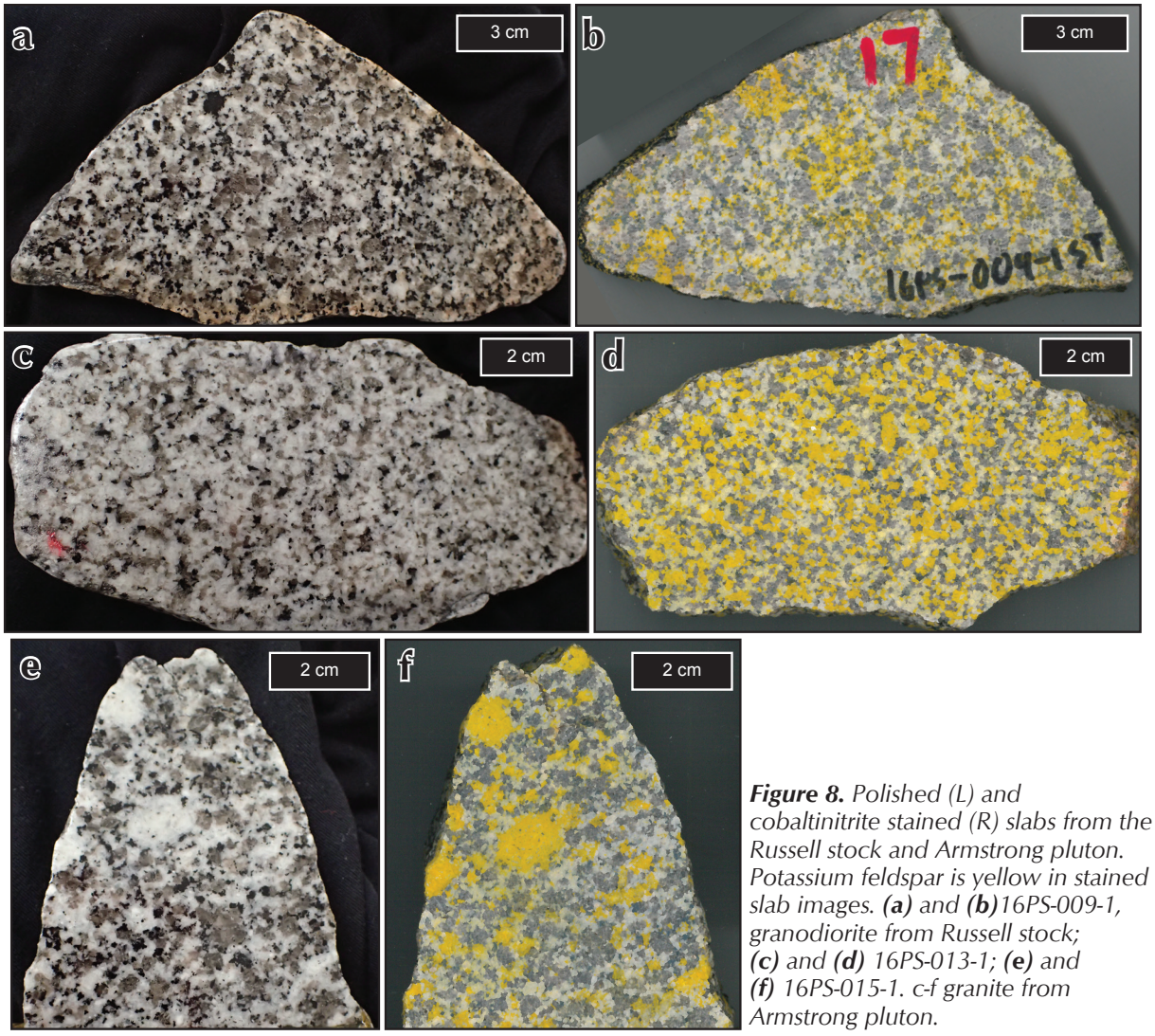

Figure 8. *Polished (L) and cobaltinitrite stained (R) slabs from the Russell stock and Armstrong pluton. Potassium feldspar is yellow in stained slab images.* ***(a)*** *and* ***(b)****16PS-009-1, granodiorite from Russell stock;* ***(c)*** *and* ***(d)*** *16PS-013-1;* ***(e)*** *and* ***(f)*** *16PS-015-1. c-f granite from Armstrong pluton.*

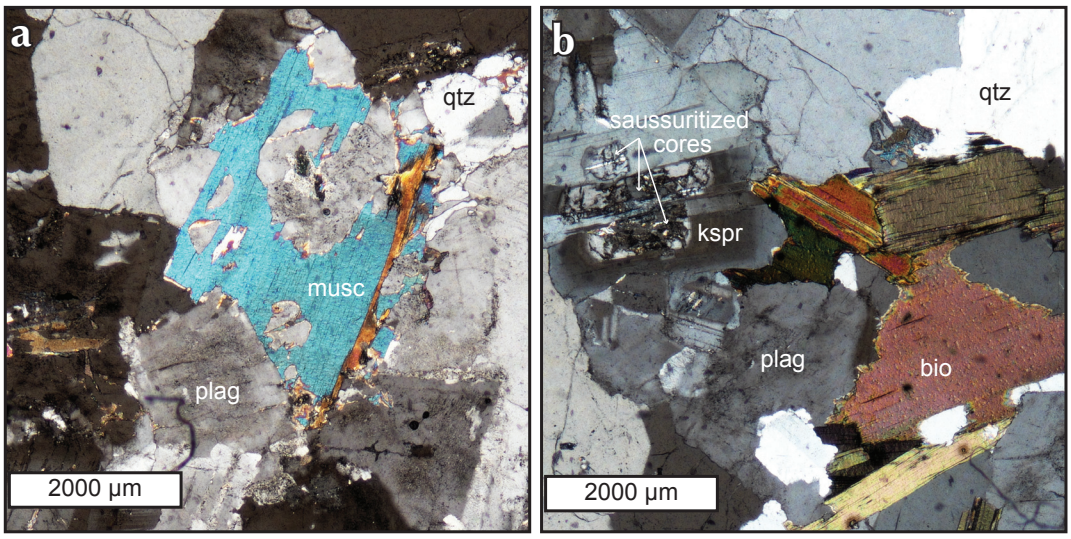

Figure 9. *Cross-polarized light photomicrographs of 16PS-013-1, Armstrong pluton.* ***(a)*** *Coarse-grained magmatic muscovite.* ***(b)*** *Saussuritized feldspar cores and coarse-grained magmatic biotite. qtz = quartz, musc = muscovite, plag = plagioclase, bio = biotite, kspr = potassium feldspar.*

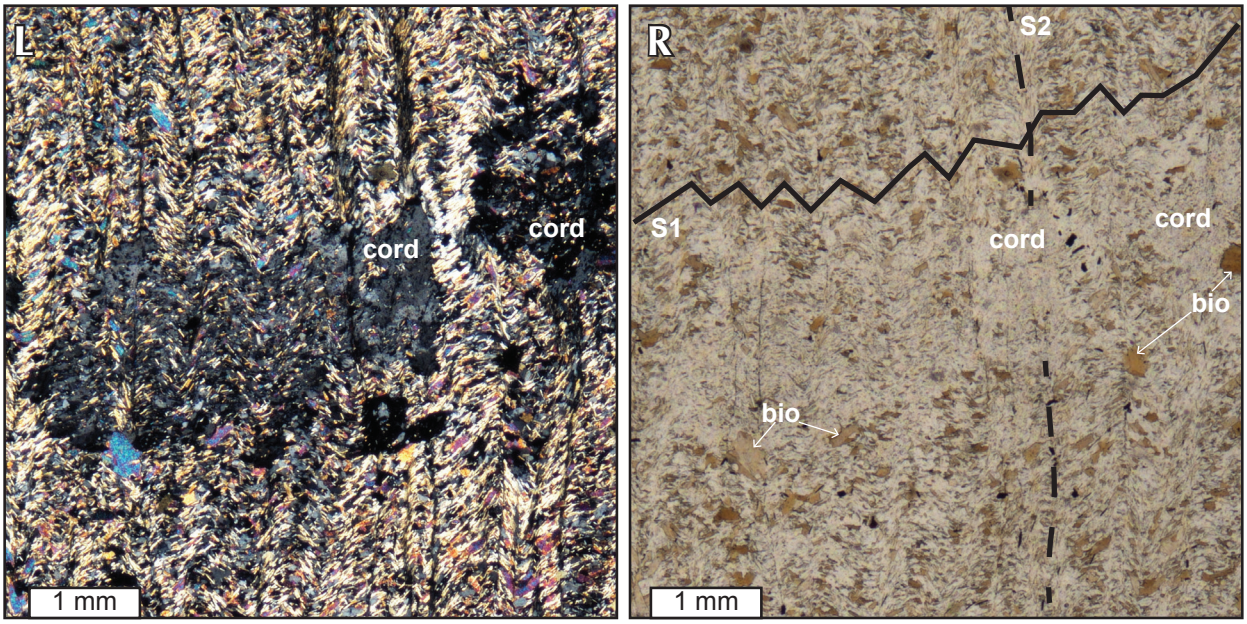

Figure 10. *Cross-polarized **(L)** and plain polarized **(R)** photomicrographs of cordierite overgrowing two generations of foliation in pelite (17PS-09-1). Highly birefringent mineral is muscovite. Cord = cordierite, bio = biotite.*

STRUCTURAL HISTORY

The early compressional history of the Plateau property is recorded in three to four generations of co-axial fold-and-thrust deformation events (D_1-D_4) related to orogen-normal Mesozoic shortening. A late extensional or transtensional event (D_4 or D_5 depending on structural domain) is related to gold mineralization (Barclay, 2012; Kruse, 2017; Stubley 2017).

Two structural domains are recognized on the Plateau property, defined by the attitude of D_1-D_3 fold axial planes and fabrics (Fig. 11). The Upright domain is characterized by upright folds with steep axial planar cleavage. The Upright domain structurally overlies the lower Shallow domain which comprises inclined to recumbent folds with low-angle axial planar cleavage (Stubley, 2017).

Within the Upright domain, three generations of compressional structures are recognized (D_1-D_3). D_1 structures include upright folds (F_1) of bedding (S_0) with variably inclined pervasive NW or SE striking axial planar cleavage (S_1). F_1 upright folds are generally gentle to closed with axes plunging <20° to the NW or SE. The intersection between folded bedding (S_0) and the S_1 cleavage, defines an intersection lineation (L_1), subparallel to the F_1 fold axis. The D_2 generation of structures is characterized by a shallow-dipping to subhorizontal crenulation cleavage (S_2) and small-scale minor folds and tension-gash features. D_2 structures and fabrics are generally localized in argillite horizons or discrete higher-strain zones. D_3 includes sporadic and isolated minor folds of presumed minor regional significance, but coaxial with D_1 and D_2 structures.

Within the Shallow domain, an earlier generation of SW-verging folds is recognized. D_1 structures include recumbent, shallowly plunging, SW verging F1 folds. A penetrative axial planar cleavage (S_1) dips gently to the NE. The intersection between folded bedding (S_0) and the S_1 cleavage, defines an intersection lineation (L_1), subparallel to the F_1 fold axis. D_2 structures include a zonally developed, shallow-dipping transposition foliation (S_2) axial planar to folds with top-to-NE asymmetry and E to NE directed reverse faulting. D_3 structures include a steeply to moderately dipping crenulation cleavage (S_3) and small-scale folds (F_3) in argillite and broad, gentle warps of the stratigraphic sequence about steep axial planes. Localized NW striking high-strain zones have also been noted. D_4 structures include local steeply dipping crenulation cleavage (S_4) and other sporadic and isolated minor folds.

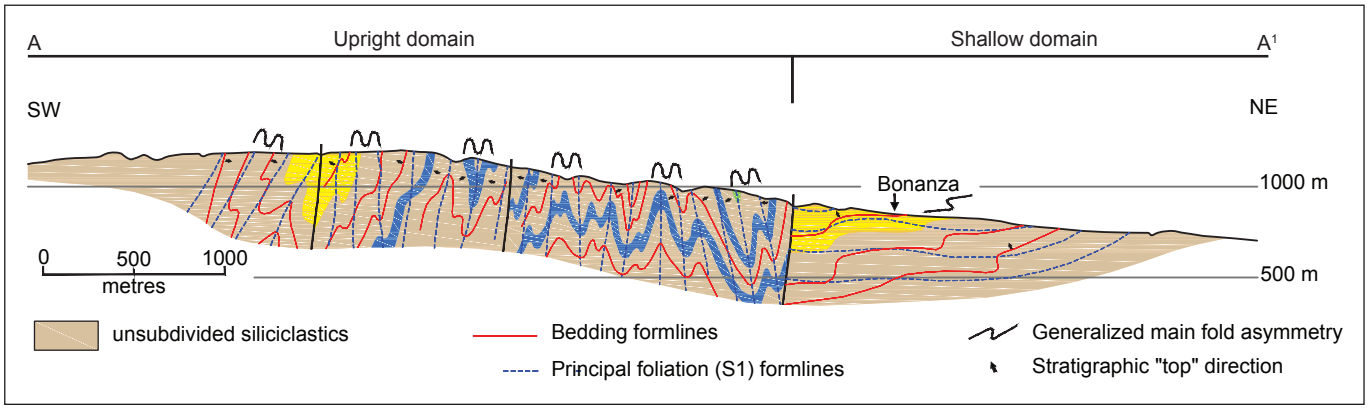

Figure 11. *Preliminary cross section through the Bonanza zone illustrating structural style (Stubley, 2017). Map unit colours same as Fig. 4; location shown on Fig. 4.*

The exact nature of the transition between the Upright and Shallow domains is not well constrained (Fig. 11), but it is likely that the penetrative S_1 cleavage is common to both domains. D_1–D_4 compressional structure and fabrics in both domains are everywhere crosscut by dominantly NE striking quartz veins and related brittle structures, designated D_5.

Mineralization is associated with D_5 quartz veins which are dominantly NE striking extensional veins that crosscut all earlier structures and fabrics (Fig. 12). Quartz vein geometry comprises three common orientations and styles. Set 1 veins are NE striking and are generally subvertical. Set 2 are conjugate sets of NW striking veins, commonly manifest as en echelon tension gash arrays. Set 3 veins are subhorizontal 'ladder' veins commonly linking adjacent, parallel Set 1 veins. Set 1 veins and Set 2 veins commonly display conjugate tension gash geometry consistent with emplacement in dextral and sinistral transtensional settings, respectively.

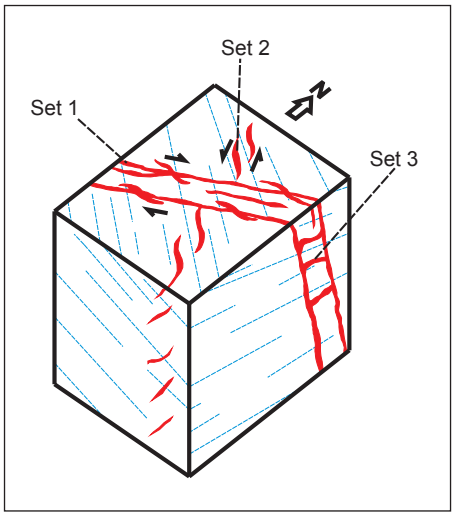

Figure 12. *Block diagram of D_5 veins. Mineralization is primarily associated with Set 1. Blue formlines represent pre-existing foliation.*

Vein swarms are commonly nucleated at lithological contacts with strong rheological contrast. Veins generally appear undeformed where they crosscut competent siliciclastic units, but are locally sheared or folded within highly strained pelitic units (Fig. 13). Microstructural observations by Farquharson (2017) suggest that a least some quartz veins show evidence for ductile deformation accommodated by dislocation creep, and petrography shows early quartz in mineralized veins is commonly recrystallized indicating deformation after emplacement.

Figure 13. *Folded D_5 veins at psammite-pelite contact. Red notebook is 20 cm long.*

VEINS, MINERALIZATION AND ALTERATION

More than 20 gold showings in five zones have been discovered on the Plateau South property (Fig. 4; Table 2).The earliest veins recognized on the property are quartz veins that appear to be unrelated to mineralization and are oriented subparallel to S_2. Quartz-chlorite veins with diffuse margins (Fig. 14a) have only been recognized in core from the Goldstack zone and are also interpreted to be pre-mineralization, though crosscutting relationships have not been observed.

Outcrop and thin section observations suggest that mineralization on the Plateau South property can be broadly divided into two styles: most of the showings are individual, or sets of, massive, discrete, white, D_5 quartz veins (Fig. 14b,c), while Goldstack and possibly Gold Dome showings are breccia bodies (Fig. 14d,e). Both styles have similar mineralogy and paragenesis indicating a similar genesis (Barr, 2017; Farquharson, 2017). The difference between the styles is how they look in outcrop and the relative abundance of massive, recrystallized quartz vs. quartz-muscovite-carbonate-sulphide material. Massive, discrete veins (*e.g.*, Goldbank showings) are mostly composed of coarse-grained quartz with thin quartz-muscovite-carbonate-sulphide veinlets (Fig. 15a). Breccia showings are mostly composed of quartz and wall-rock fragments (Fig. 15b) within quartz-muscovite-carbonate-sulphide cement. In both styles, the earliest quartz is massive and recrystallized (Fig. 15c), commonly with reduced grain boundaries and strong undulatory extinction. Later quartz-muscovite-carbonate-plagioclase (albite?)-sulphide crosscuts the massive quartz and contains most of the gold. Gold is associated predominantly with arsenopyrite (Fig. 15d) but also with pyrite and pyrrhotite. Minor galena and chalcopyrite are noted locally (Richards, 2015).

Wall-rock alteration away from veins and breccia bodies is cryptic. Albitization, as inferred from elevated Na content in whole-rock analyses is associated with anomalous Au content (Franklin, 2013). This is supported by the presence of plagioclase (albite?) in the hydrothermal mineral assemblage of gold-bearing quartz veins (Richards, 2015). Silicification is also noted (Ferraro, 2016), though with veins essentially restricted to the quartz-rich psammite unit, identifying elevated silica as alteration-related is challenging. Correlation coefficient (r^2) values between Au and Ag, As, Pb and Sb are between 0.6 and 0.1, consistent with the presence of arsenopyrite in all gold bearing veins and galena in some.

DISCUSSION

The genesis of the gold bearing veins on the Plateau South property is not well constrained. Genetic models that may be applicable include reduced intrusion-related gold (RIRG; Hart, 2007) and orogenic gold (Groves *et al.*, 1998). Observations consistent with a RIRG genesis are the low magnetic character of the Russell stock and Armstrong pluton and the Tongue W-skarn occurrence (Yukon MINFILE 105N 014) approximately 20 km to the southeast of the Plateau South showings (Fig. 4). This relationship is similar to that seen at the Dublin Gulch property in the northern Selwyn basin area where the Ray Gulch W-skarn is 3 km from the Eagle deposit on the other side of the causative Dublin Gulch pluton (Hart, 2007). Observations consistent with the orogenic gold model include the widespread occurrence of veins, lack of metal zoning across the property, and a dominant vein orientation that crosscuts the regional compressional fabrics (S_1 and S_2). The interpreted syn to late deformation timing of the D_5 vein emplacement is also common to orogenic gold systems. One feature not well documented in the Plateau South area that is found in orogenic gold camps such as the Juneau gold belt is large-scale transtensional fault or shear systems (Goldfarb *et al.*, 1988). However, the area has only been mapped at a 1:250 000 reconnaissance scale and the monotonous nature of the Yusezyu Formation makes identification of structure difficult (Roots, 2003).

Several characteristics at Plateau South are observed in both RIRG and orogenic gold deposits. Although the discrete vein and breccia styles at Plateau South are different from the sheeted vein arrays typically seen in RIRG deposits, properties such as Dublin Gulch have high-grade discrete gold veins (Hart, 2007). Quartz-carbonate-muscovite gangue mineralogy and a sulphide assemblage of arsenopyrite-pyrite ± galena is common to both types of deposit. Preliminary fluid inclusion work shows mineralizing fluids at Plateau South were low salinity, H_2O-CO_2-CH_4 bearing with a temperature range of 250 to 350°C and most likely relate to a metamorphic fluid (Richards, 2015; Barr, 2017). However, these fluid compositions are not unique to orogenic gold deposits and overlap with that of other RIRG occurrences in Selwyn basin such as Scheelite Dome (Mair *et al.*, 2011) and Clear Creek (Marsh *et al.*, 2003).

Table 2. *Summary of vein characteristics on the Plateau South property.*

Zone	Showing	Vein orientation; geometry	Sulphide mineralogy	Gangue mineralogy	Oxidation products	Comments	Reference
Gold Dome	VG	breccia body	py, aspy, po, gal, cpy	qtz, plag, alb, kspr, musc, cal, bio, hem, tour, ep, rt		heavily recrystallized	Richards (2015); Barr (2017); Farquharson (2017); this study
Goldstack	Goldstack	068/48; breccia body	py, aspy, po, gal, sph	qtz, plag, ser, cal, chl, tour, hem, rt		too recrystallized for fluid inclusion measurements	Richards (2015); Barr (2017); Farquharson (2017); this study
Goldbank	Ron Stack	253/65; discrete vein with tension-gashes and "horsetail" terminations	aspy	qtz			this study
Goldbank	Bluff	235/67; discrete vein with tension-gashes and "horsetail" terminations	aspy, gal, py	qtz, plag, musc, kspr, chl			this study
Goldbank	Goldbank W	233/77; discrete vein with tension-gashes and "horsetail" terminations	aspy, py, gal	qtz, alb, rt	scor, ang		Barr (2017); Kruse (2017)
Goldbank	Valley		py, cpy		mal		Barr (2017)
Bonanza	Bonanza main	064/77; discrete vein	aspy, py, gal	qtz, fldspr, musc			Barr (2017); this study
Big Bang	Big Bang Main	260/85; sheeted vein and breccia styles					this study
Bullion	Bullion	???/??; discrete veins	aspy	qtz			this study

aspy = arsenopyrite, py = pyrite, gal = galena, sph = sphalerite, po = pyrrhotite

qtz = quartz, fldspr = feldspar, musc = muscovite, ser = sericite, kspr = k-feldspar, cal = calcite, bio = biotite, chl = chlorite, hem = hematite, tour = tourmaline, ep = epidote, alb = albite, rt = rutile

mal = malachite, scor = scorodite, ang = angelsite

minerals in approximate order of abundance

As regional metamorphism pre-dates pluton emplacement, the age of these two events, and age of mineralization, may be the best constraints on deposit genesis. Field relationships and petrographic observations are consistent with D_5 quartz veins being emplaced syn to late deformation. The Russell and Armstrong plutons were emplaced post-deformation. Direct crosscutting relationships between mineralized quartz veins and plutons have not been observed. Petrographic observations suggest the contact aureole from the Russel stock extends at least 2 km into the country rock and mineralization at Goldstack may be within this aureole. Contact metamorphism could have locally remobilized gold (Barr, 2017).

The maximum age of mineralization should be broadly constrained by regional metamorphism and ductile deformation and the minimum age by pluton emplacement. The best estimate for the end of ductile deformation is *ca.* 104 Ma (Mair *et al.*, 2006), though these data are from the McQuesten area, 130 km northwest of the Plateau property. The age of Cretaceous magmatism in the Lansing map area is constrained to *ca.* 93 Ma by U-Pb zircon data from the Lansing pluton 35 km to the northeast of

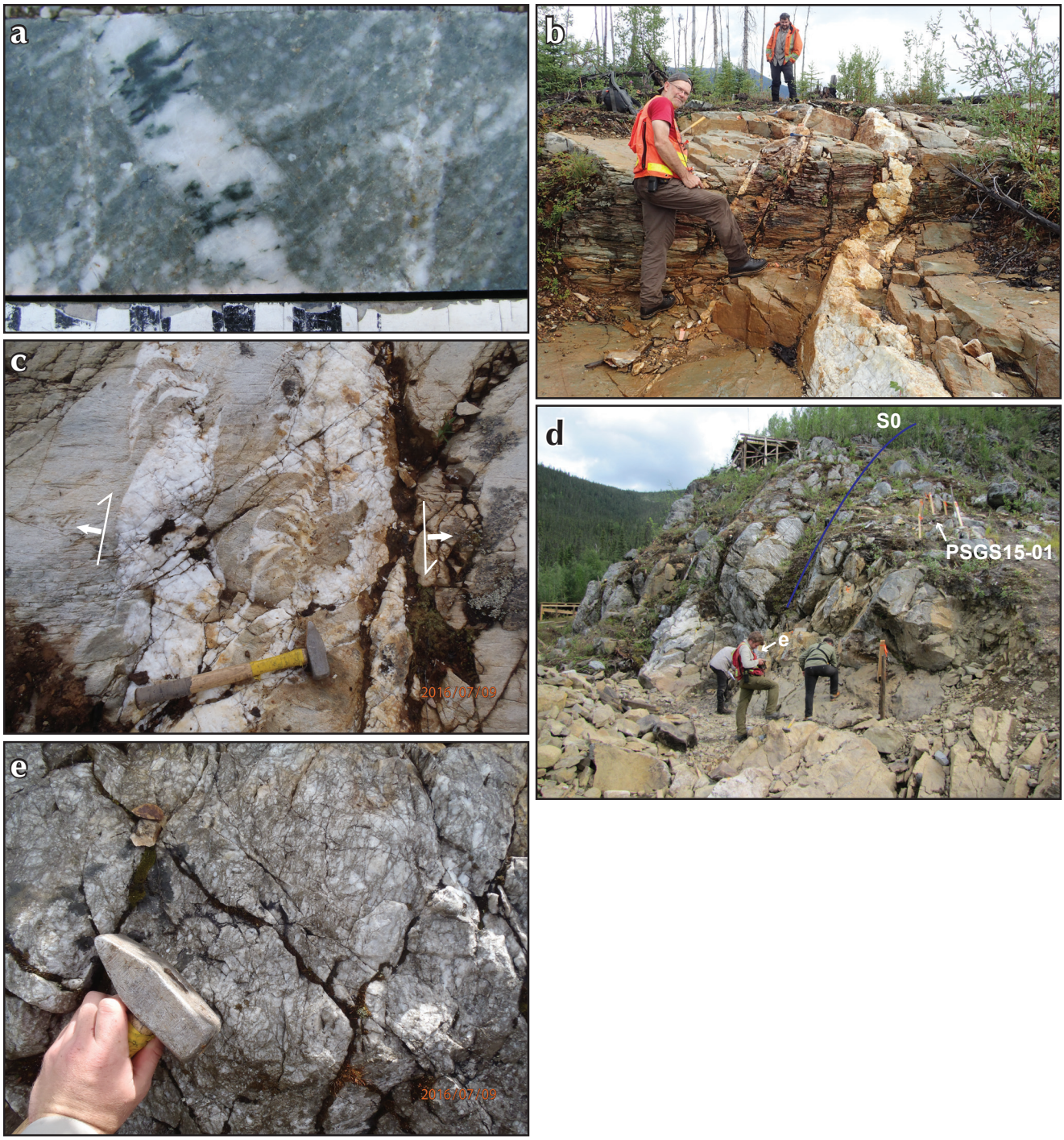

Figure 14. *Approximate paragenetic sequence of veins on the Plateau property.* ***(a)*** *Probable pre-mineralization quartz-chlorite vein from Goldstack showing. PSGS1501-89.90 m, bottom graduations in cm.* ***(b)*** *Steeply dipping mineralized quartz-arsenopyrite veins at the Goldbank showing (Ferrari). Scott Casselman (front) and Dan Ferraro (rear) for scale.* ***(c)*** *Plan view of mineralized tension veins with 'horse tail' terminations at the Goldbank West showing (Bluff). Hammer 45 cm in length, sense of motion from Kruse (2017).* ***(d)*** *Looking uphill towards the southwest at the Goldstack showing discovery outcrop. Antiform closes 50 m to the right of photo. Location of 'e' and PSGS15-01 collar labelled; bedding trace in solid blue line. Stephen Bartlett (front) for scale.* ***(e)*** *Mineralized, quartz-pyrite-arsenopyrite cemented breccia at the Goldstack showing. Hammer head is 13 cm across.*

the Plateau South property (Roots, 2003). Assuming the ages of the Russell stock and Armstrong plutons are *ca.* 93 Ma and the end of metamorphism is similar to that in the McQuesten area, mineralization is constrained to *ca.* 93-104 Ma. At this preliminary level of understanding, we interpret the gold veins as orogenic mainly because they cannot be convincingly related to either of the intrusive bodies nearby and the vein geometry is consistent, with respect to regional compressional fabrics, over 50 km across-strike width.

SUMMARY

Plateau South is a recently staked property with vein gold mineralization hosted by Yusezyu Formation metasandstone. Since 2011, more than 20 vein gold occurrences over 50 km of across-strike distance have been discovered and show the gold potential of the area. Mineralization occurs as both discrete gold bearing quartz veins and breccia bodies. Gold is associated with arsenopyrite and to a lesser extent pyrite and galena. Subtle albite and silica alteration may be found in country rock near veins and a hydrothermal mineral assemblage of quartz, muscovite, calcite, albite(?) and sulphides accompanies mineralization. Sixty-five diamond drill holes have been drilled on the property, and mineralized intervals are comparable to that of orogenic gold orebodies in past producing camps such as Sheep Creek and the Cariboo district in southern British Columbia.

Three to four generations of compressional structures are recognized on the Plateau property within two structural domains. The Upright structural domain is dominated by

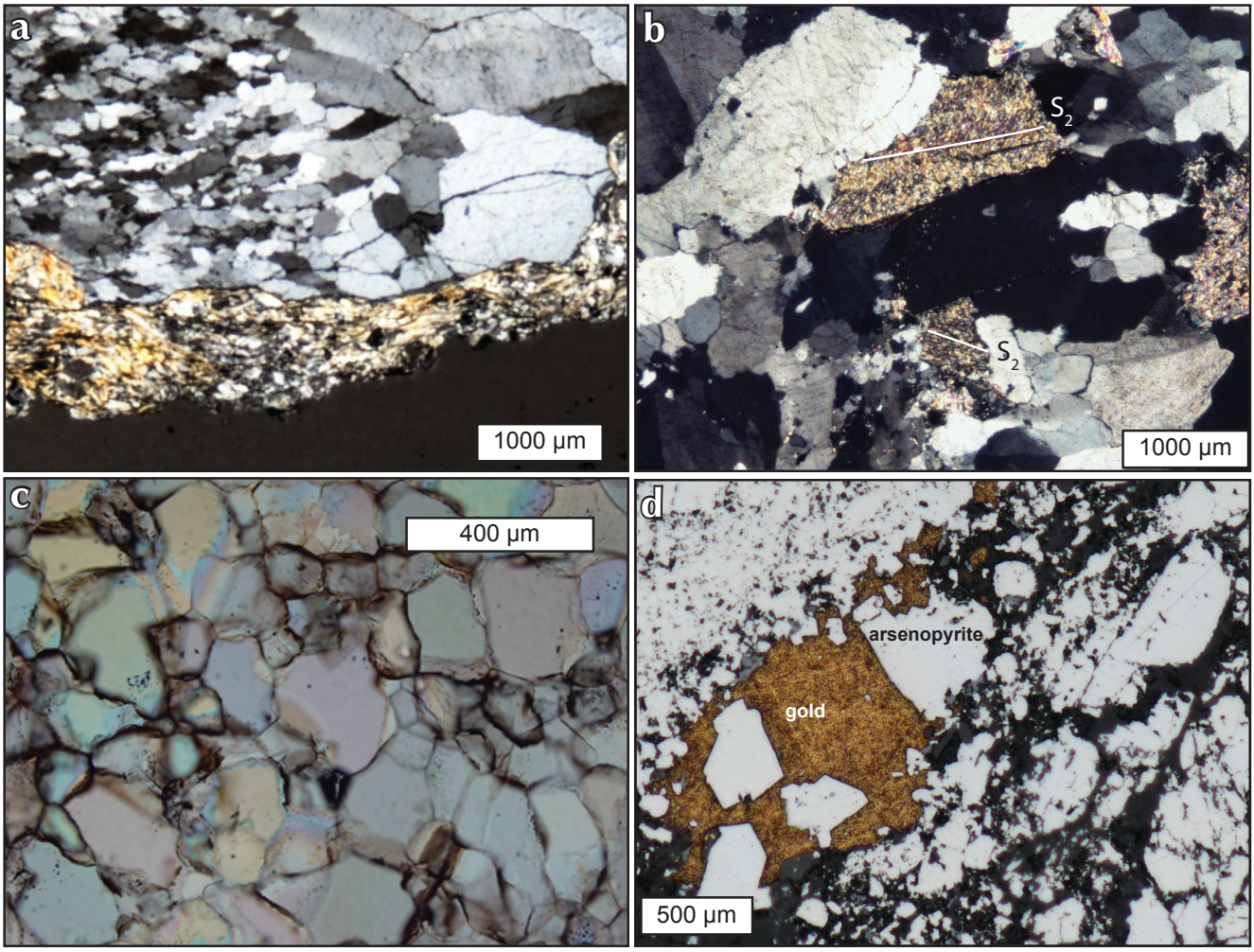

Figure 15. *Mineralized veins on the Plateau South property.* ***(a)*** *Early, recrystallized quartz cut by later thin quartz-sericite-carbonate veinlet, Bonanza main, 16PS07-1.* ***(b)*** *Micaceous wall-rock fragments with rotated foliation (S2) from Big Bang main showing, 17PS-030-1.* ***(c)*** *Recrystallized mosaic quartz, typical of Goldstack and Gold Dome samples (from Barr, 2017).* ***(d)*** *Native gold intergrown with arsenopyrite PSGS1502-37.60 m.*

upright folding and fabrics, whereas the Shallow domain is characterized by recumbent folding and fabrics. These D_1 to D_4 structures and fabrics, relate to Mesozoic orogenesis and are overprinted by D_5 extensional-transtensional veins; mineralization is associated with the D_5 veins. Though there are ambiguities, we prefer the interpretation that the veins on Plateau South are orogenic as opposed to intrusion-related.

ACKNOWLEDGEMENTS

Thank you to Goldstrike Resources Ltd. for permission to visit the property and to publish our observations here. Druid Exploration, particularly Daithi Mac Gearailt, Matt Husslage and Chris Arsenault are thanked for hosting us in camp and for insightful geologic observations and discussion. Stephen Bartlett provided great field and office assistance. Scott Casselman and David Moynihan of the Yukon Geological Survey are thanked for early reviews which clarified the writing considerably.

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