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EXPLORATION & GEOLOGY OVERVIEW 2017

Edited by

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Front cover photograph: Pale grey limestone of the Upper Triassic Lewes River Group is thrust over brown weathering, thin bedded mudstone of the Lower-Middle Jurassic Laberge Group; east shore of Lake Laberge. Photo by Esther Bordet, Yukon Geological Survey.

PREFACE

Yukon Exploration and Geology (YEG) papers and the Yukon Exploration and Geology Overview continue to be the main publications of the Yukon Geological Survey (Energy, Mines and Resources, Government of Yukon). Individual YEG papers, with colour images, are only available in digital format and can be downloaded from our website. The YEG Overview is available in digital format and in a limited colour print run.

YEG 2017 contains up-to-date information on mining and mineral exploration activity, studies by industry and results of recent geological field studies. Information in this volume comes from prospectors, exploration and government geologists, mining companies and students who are willing to contribute to public geoscience for the benefit of the scientific community, general public and mineral and petroleum industries of Yukon. Their work is appreciated.

Many of the papers submitted have been authored or reviewed by colleagues at the Yukon Geological Survey - thank you for being involved and making production of this publication easier.

Sherry Tyrner of the Queen's Printer ensured that the printing process went smoothly.

We welcome any input or suggestions that you may have to improve future YEG publications. Please contact me at (867) 667-8519, or by e-mail at karen.macfarlane@gov.yk.ca.

Karen MacFarlane

YUKON GEOLOGICAL SURVEY

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INTRODUCTION

The mandate of the Yukon Geological Survey (YGS) is to provide the geoscience information required to support resource and land management decisions for the benefit of Yukoners. The projects delivered each year by the survey help to increase our understanding of Yukon's geologic framework (in particular its mineral endowment) and to identify geohazards which could impact buildings and infrastructure. This information is disseminated in a variety of formats, including maps, reports, raw data, public lectures and school visits, in order to meet the different needs of YGS clients.

In 2017, YGS staff undertook or supported nineteen field-based projects and six graduate student thesis studies, and worked on five data mining/information management projects. Sixty-six YGS publications and five papers in refereed journals were released. This paper provides an overview of 2017 project highlights; more detailed reports on many of these projects are presented in the accompanying 2017 Yukon Exploration and Geology volume; other projects will be summarized in stand-alone publications.

YGS tracked 2017 hard rock and placer exploration and mining activities and provided support to industry clients through the provision of data, advice and access to YGS' drill core collection. Highlights of hard rock exploration and placer operations are reported on separately (*see* Lewis and Casselman, 2018 and Bond and van Loon, 2018, respectively). YGS administered fifty-nine grants totaling $1.6M under the Yukon Mineral Exploration Program (YMEP) in 2017. An overview of YMEP projects is presented in Torgerson (2018).

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YUKON GEOLOGICAL SURVEY PROGRAM FUNDING

Yukon Geological Survey's budget for fiscal year 2017-18 totals $4 027 724. This includes $1 265 000 in core O&M funding, $1 600 000 for the Yukon Mineral Exploration Program, $1 100 000 from the Canadian Northern Economic Development Agency's (CanNor's) Strategic Investments in Northern Economic Development (SINED) Program, and $62 724 from Indigenous and Northern Affairs Canada's Climate Change Preparedness in the North Program.

YMEP funds are allocated entirely to support early-stage hard rock and placer exploration activities and the Climate Change funding is committed to a project that will be delivered in collaboration with Yukon College (the funds are being transferred to the college to support permafrost research in the greater Whitehorse area). SINED and YGS' O&M funds have varying degrees of discretion with respect to how they are spent: O&M funds are used to deliver YGS' core geoscience program activities (~80%), and to cover administrative costs (building maintenance, software, equipment maintenance, *etc.* (~20%). SINED funds are applied to projects that have potential to stimulate exploration investment and/or support infrastructure development decisions. In the following sections, the activities described are funded by YGS' core O&M budget unless otherwise indicated.

The allocation of funds is influenced by client input (including the advice provided each year by YGS' Technical Liaison Committee), opportunities to leverage partnered funding through collaborations (*e.g.*, with universities or the Geological Survey of Canada), and the strategic priorities of the Department of Energy, Mines and Resources.

YUKON GEOLOGICAL SURVEY ORGANIZATIONAL OVERVIEW

Yukon Geological Survey's organization chart is shown in Figure 1. The chart reflects a few staff changes since last year. In April, Sydney van Loon was hired on a two-year term as a Placer Geology Technician. She enhances the Surficial Geology unit's capacity to visit placer operations and track placer exploration and production statistics.

Following ten month's education leave to earn a teaching degree, Outreach Geologist Sarah Laxton tendered her resignation in July to pursue a career in teaching. Leyla Weston was hired as YGS' new Outreach Geologist in December.

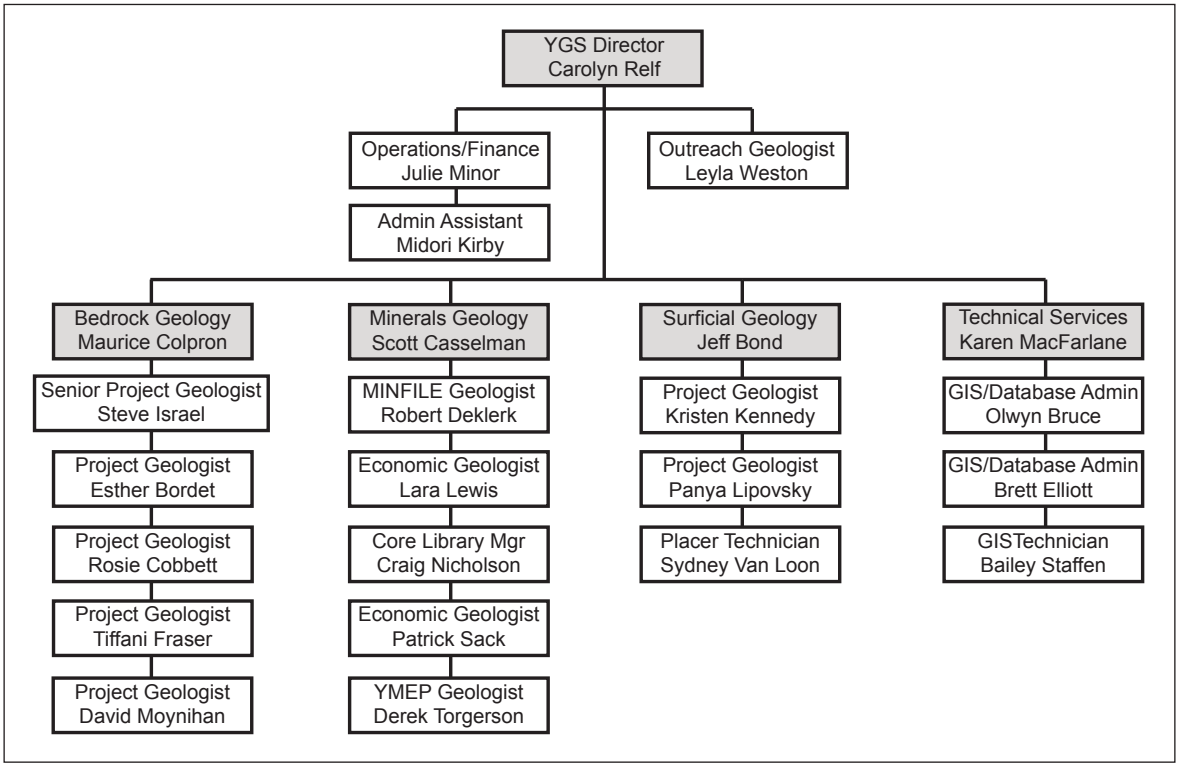

Figure 1. *Yukon Geological Survey organizational chart.*

Bailey Staffen started a year's maternity leave in August, and in November, Rosie Cobbett returned from maternity leave, suggesting that perhaps the law of conservation of energy has a maternity-leave counterpart.

The survey would like to thank Sarah for the contributions she made to YGS' outreach program during her five years with the survey, and wish her luck in her new career. I would also like to take this opportunity to say welcome to Sydney and Leyla, welcome back to Rosie, and congratulations to Bailey on the birth of her daughter.

INFORMATION SERVICES

The impacts of YGS' investments in geoscience knowledge are only realized if the data are made publicly available, and therefore a significant effort is made each year to disseminate the information YGS collects. In 2017, sixty-six publications were released (*see* the appended publication list at the end of this volume), and staff co-authored five papers in referred journals. The 2017 Yukon Exploration & Geology volume, to be released early in 2018, contains overviews of hard rock and placer exploration and development activities, as well as eleven technical papers describing 2017 project highlights.

A number of changes were made to the YGS website over the past year, and more significant changes will be coming early in 2018. Among the recent changes, field activities are now presented in an ESRI Story Map format, enabling users to see where field projects are located and read brief narratives on each study. The Facebook site initiated in 2016 continues to see regular postings; it is turning out to be an effective way to communicate with Yukon teachers and to share information of general interest to the public, such as the location and setting of the earthquakes felt across the territory in early May.

The "Footprints" web application, launched last year, was expanded beyond assessment reports to include YMEP and Placer reports. The database behind the application captures metadata such as claim owner, year and type of work, exploration expenditures and the physical footprint of work carried out, and the web application allows users to filter, query and discover information about exploration work using a map interface. The database currently contains 8777 reports, with roughly 160 Placer reports remaining to be captured. It is anticipated that the remaining placer reports will be online by spring. This work is supported in part with SINED funds.

Work on the MINFILE database included the addition of fifteen new mineral occurrences and updates to the work history and reference sections of sixty existing occurrences. YGS recognizes that there is thematic overlap between the MINFILE database and the information presented via the Footprints application, and discussions are underway on how to merge the databases to allow a single map-based interface to serve all mineral occurrence-related information.

YGS continues to make improvements to the digital bedrock geology geodatabase. The next update is scheduled for January 2018 and will include the incorporation of recently-compiled mapping in southeastern Yukon, revisions to Selwyn basin geology, new mapping in the Lake Laberge area, and detailed mapping in the Mount Freegold area. In addition, a number of minor errors will be corrected in the next update. YGS will also be releasing an updated and improved Yukon geochronology database in 2018. The new database is based on the model for the bedrock geology map, which allows for regular updates as/when new data are available.

In addition to the initiatives above, the Technical Services unit launched the YGS Map Gallery in 2017. The Gallery is a series of online maps that allow users to view, query (and in some cases, download) YGS' geoscience information. The different maps in the Gallery are intended to be user-friendly, enabling clients to learn about Yukon geology and access a variety of information based on their needs and interests.

2017 YGS FIELD ACTIVITIES

BEDROCK GEOLOGY PROJECTS

Bedrock Geology staff carried out field work on three projects in 2017 and undertook reconnaissance work to identify potential areas for future mapping. Locations of field activities are shown in Figure 2.

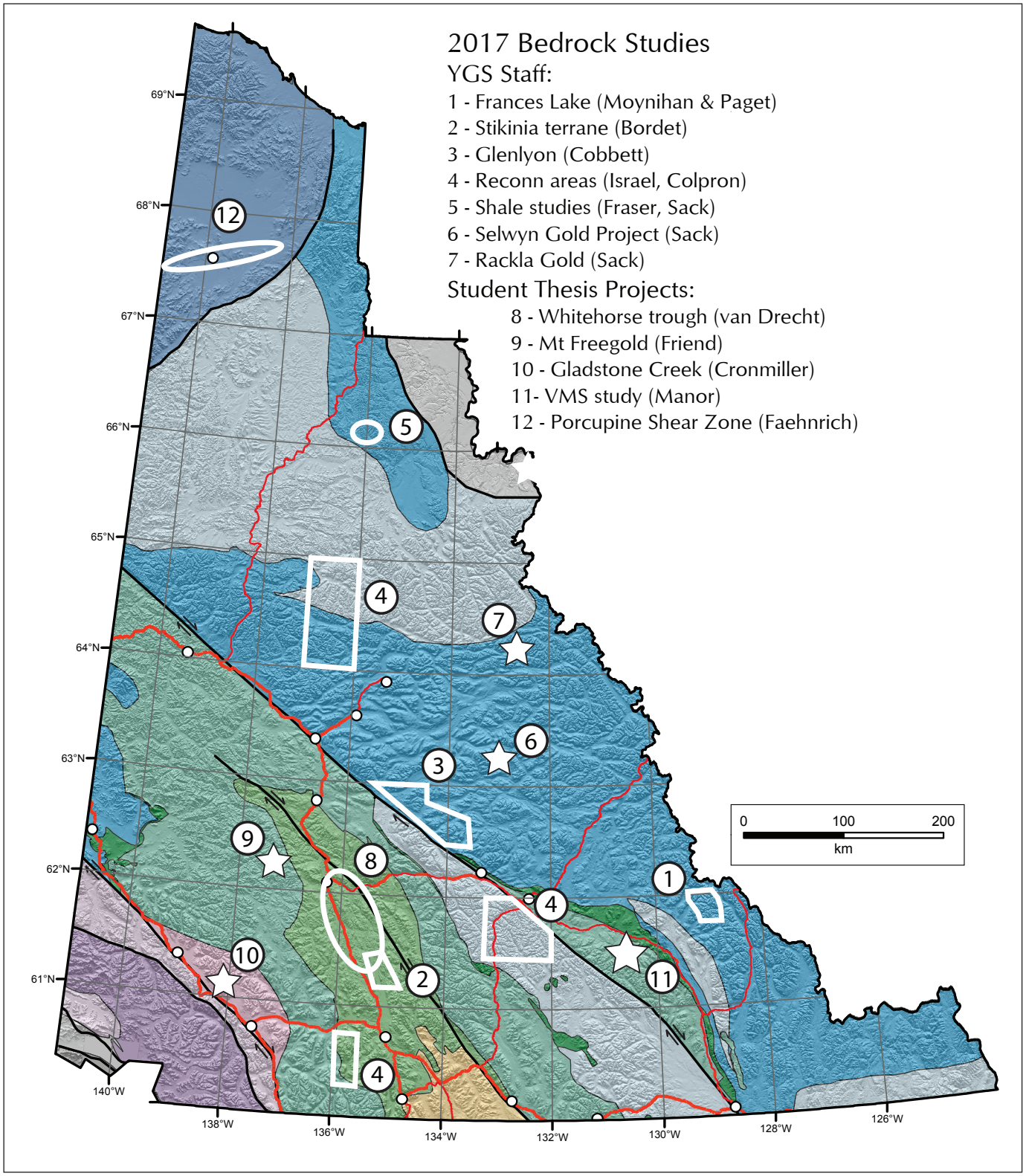

Figure 2. *Locations of 2017 bedrock geology and graduate student field projects.*

Frances Lake bedrock mapping

For the 2017 field season Geological Survey of Canada (GSC) and YGS planned a collaborative mapping project in the Frances Lake area under the GSC's Geo-mapping for Energy and Minerals (GEM) Program. The intent of the field project was to expand on the mapping that has been completed to date by Moynihan (2017) and resolve questions regarding the nature of the contact between Hyland Group rocks and lower Paleozoic strata of the McEvoy platform, a potential offset equivalent to Cassiar platform northeast of Tintina fault.

The planned project was to involve a field crew of ten mappers and a support crew (cook, camp manager, helicopter crew). During the YESAA assessment of the proposed camp, Ross River Dena Council and Liard First Nation expressed concerns with the project, noting that Frances Lake has significant cultural and spiritual values to both communities. Further consultation led to a decision to defer the project to 2018, allowing time to find an alternate campsite(s) and to engage the community more fully on the nature and impacts of the project.

In the interim, YGS undertook 2017 field work from two-person fly camps around the Anderson batholith, extending coverage westward from mapping previously completed in the upper Hyland River area (Moynihan, 2016; 2017). Mapping was carried out by David Moynihan and graduate student Colin Paget (University of Calgary). Their work identified the stratigraphic position and age of upper amphibolite facies rocks mapped in 2016, and documented connections between Neoproterozoic rocks of the underlying McEvoy and Cassiar platforms (Ingenika Group) and autochthonous Hyland Group strata of Selwyn basin. Details of the mapping results are presented in Moynihan (2018).

Stikinia bedrock mapping

Esther Bordet completed a third year of mapping in rocks of Stikinia east of Lake Laberge in 2017 (Fig. 2). Her work focused on stratigraphic revisions to Triassic units, dating of Cretaceous intrusive and volcanic overlap assemblages, and documenting structures in the map area.

New mapping has resulted in the subdivision of the Middle Triassic Joe Mountain Formation into five distinct units and a reinterpretation of the depositional sequence of units northwest of Teslin Mountain. The Upper Triassic Lewes River Group has been subdivided into nine units, and a sequence of clastic sedimentary rocks previously mapped as part of the Lewes River Group has been re-interpreted to be Middle Triassic in age and re-assigned to the Joe Mountain Formation.

Bordet has distinguished five post-accretionary plutonic suites in the map area that range in age from Middle Jurassic to Late Cretaceous, as well as a number of dike sets that transect the area (Fig. 3). In addition to intrusive rocks, detailed mapping of the Upper Cretaceous Open Creek volcanic complex was undertaken to characterize its volcanic setting and determine its relationship to the Teslin Mountain pluton. Preliminary geochronological and petrological data from these overlap sequences are presented in Bordet (2018).

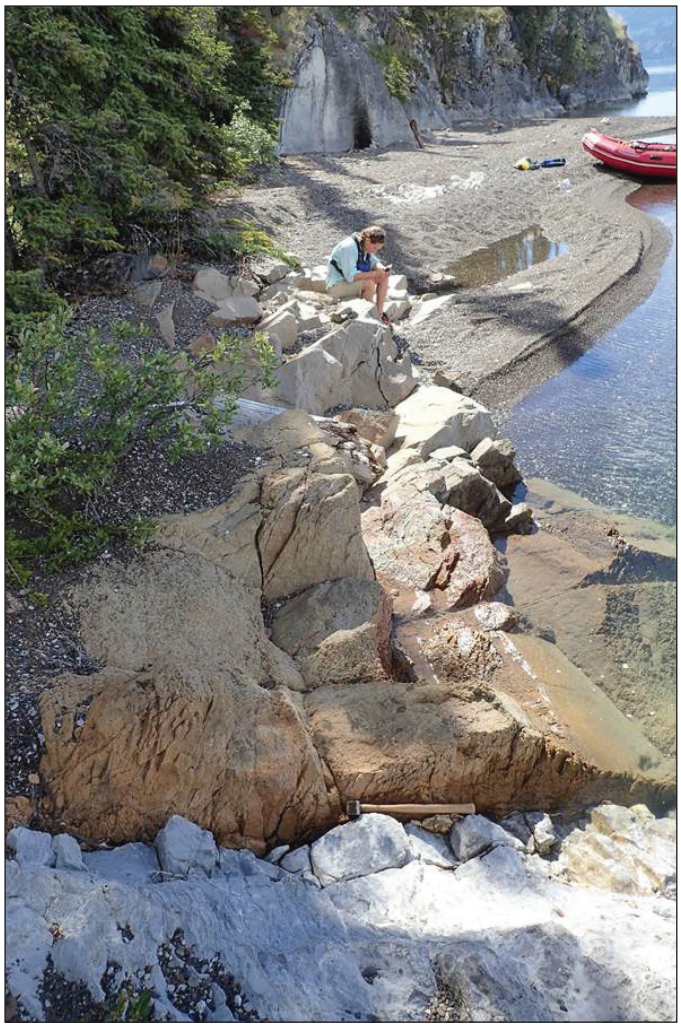

Figure 3. *Image of a 10 m wide Cretaceous rhyolite dike cutting pale grey massive limestone of the Upper Triassic Lewes River Group.*

Richardson trough shale studies

Tiffani Fraser completed a final field season in 2017 working with a team of colleagues (from St. Francis Xavier, Dartmouth and Stanford universities) studying shale of the Road River Group in the Peel River region (Fig. 2). The group has been studying a section that preserves a unique, near-continuous stratigraphic record from the late Cambrian to the Middle Devonian. Bio and chemostratigraphic data, coupled with U-Pb ages from ash beds, will enhance our understanding of Yukon's early Paleozoic history and paleoenvironment.

Based on her knowledge of early Paleozoic shale, Fraser was invited to participate in a new collaborative YGS-GSC project examining the contact between Road River Group and overlying Middle to Upper Devonian shale (Canol Formation in Richardson trough; Earn Group in Selwyn basin). Of particular interest to the group is the thin, Ni and Mo-enriched pyritic layer marking the contact between the two units known as the "Ni-Mo" horizon (Fig. 4).

The Ni-Mo horizon is currently the subject of a study by the GSC (under their Targeted Geoscience Initiative program) and YGS (*see* below), and Fraser's work is providing a sequence stratigraphic framework for the study.

A summary of both studies is presented in Fraser *et al.* (2018).

Reconnaissance for new mapping

Steve Israel and Maurice Colpron spent a few days conducting reconnaissance for potential future mapping projects (Fig. 2). One of the areas examined was east of Kusawa Lake (NTS 115A). Exposures there may provide an opportunity to resolve some uncertainties regarding the relationship between Yukon-Tanana and Stikinia terranes. Based on observations made in the area this summer, it is likely that Israel will map there in 2018 and seek answers to some of these outstanding questions.

In addition to the Kusawa Lake area, Israel and Colpron examined outcrops in the eastern Larsen Creek area (NTS 116A) northeast of Dawson City. The most structurally-complex (and therefore most interesting) geology lies in the northern part of the map sheet which is inside the Peel Watershed, making it a lower priority for mapping.

Figure 4. *Tiffani Fraser collecting a sample from the Ni-Mo horizon above the Road River Group.*

Quiet Lake area (NTS 105F) is also being considered for new mapping, although before new mapping projects are planned in Ross River Dena Council's Traditional Territory a clearer understanding of the community's interest and support will be needed.

METALLOGENY STUDIES

YGS has four metallogeny projects underway, three of which saw field work this summer (Fig. 2).

Metallogeny of Jurassic plutons

Patrick Sack and Maurice Colpron have initiated the final write-up of their atlas of Late Triassic to Jurassic plutons in south-central Yukon. The report, expected to be released in 2018, will provide comprehensive descriptions of the rocks, including their chemical characteristics, ages, petrology, depth of emplacement, physical rock properties, and metallogeny. An accompanying journal article is in preparation and will focus on the tectonic evolution of the Intermontane terranes during intrusion of these Jurassic plutons.

Selwyn Gold Project

Patrick Sack continued his Selwyn gold study, collecting samples from the Plateau South property (Fig. 2) to understand the paragenesis of gold-bearing quartz veins. The veins occur both as discrete quartz + carbonate + muscovite + albite veins, and as breccia infill; gold is associated with arsenopyrite + pyrite ± galena ± chalcopyrite in both settings. The veins are interpreted to have formed during a late extensional event that followed Mesozoic folding and thrusting. Work over the winter will include $^{40}Ar/^{39}Ar$ dating of muscovite (to bracket the timing of deformation and quartz vein formation); Pb isotope analysis of galena in gold-bearing quartz veins (to identify potential source(s) of metals); U-Pb zircon ages from plutonic rocks in the region; and petrography of mineralized veins. Preliminary results of the study will be presented at the Mineral Exploration Roundup in January 2018.

Carlin-style gold of the Rackla belt

In addition to the Selwyn gold project, Sack spent a week with GSC colleagues examining drill core and collecting samples as part of a GSC-led study of Carlin-style gold occurrences in the Rackla belt (under GSC's Targeted Geoscience Initiative; Fig. 2). Sack's contribution to the study involves characterizing ore-stage pyrite chemistry at Rackla and comparing it with ore-stage pyrite from the Carlin trend in Nevada. In the fall he spent two days working with Dr. Jean Cline at the University of Nevada in Las Vegas (UNLV), where he did reconnaissance analysis of ore samples from several gold occurrences in advance of undertaking more detailed microanalytical work this spring at the GSC's lab. The ore textures are relatively simple (Fig. 5) and bear a striking resemblance to pyrites from the Carlin trend; preliminary results of the project will be presented at Roundup 2018.

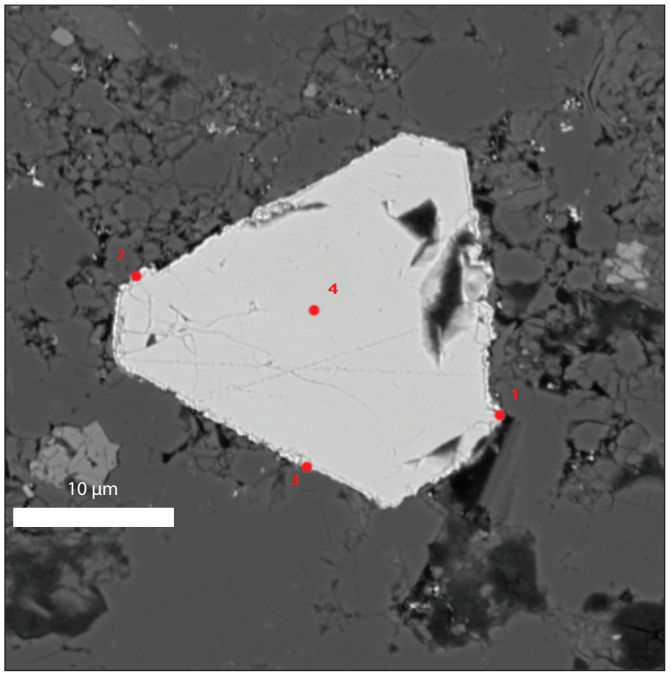

Figure 5. *Backscatter image of diagenetic pyrite from the Osiris/Sunrise gold occurrence (Rackla belt) with an ~0.5µm wide hydrothermal overgrowth of gold and arsenic-rich pyrite. Rim contains up to 3.34% As and 1960 ppm Au (based on three spot analyses). Numbered points indicate sites where quantitative analyses were taken using UNLV's electron microprobe.*

Ni-Mo horizon

The fourth metallogeny study involves re-examination of the pyrite-rich, Ni and Mo-enriched "Ni-Mo" horizon that characterizes the top of the Road River Group in the Richardson trough (Fig. 2). The project has a number of components. Tiffani Fraser is providing contextual information on the stratigraphic and sedimentological setting of the Ni-Mo horizon (*see* above) and Sack is working with a colleague at the University of Tasmania examining trace element compositions of syngenetic and early diagenetic pyrite from the Ni-Mo horizon.

The pyrite composition is being evaluated as a potential proxy for seawater chemistry (*see* Large *et al.*, 2017). At the same time, GSC colleagues are undertaking more traditional whole rock geochemical, chemostratigraphic and lithostratigraphic studies that will provide information on paleo-ocean conditions. The latter study is part of the GSC's Targeted Geoscience Initiative program.

GEOTHERMAL ENERGY RESEARCH

Radiogenic heat potential study

In 2016, YGS initiated a study to advance understanding of the potential for geothermal energy development in southern Yukon. Early in the 2017-18 fiscal year, a map and accompanying database documenting the heat-generating potential of Cretaceous and younger plutons was released by the survey (Friend and Colpron, 2017). The study used existing whole rock geochemical data to calculate the potential radiogenic heat production from the decay of naturally occurring radioactive elements (U, Th, K). The information is displayed on a map that shows the locations of plutons and their associated radiogenic heat potential.

Ground temperature monitoring

Over the summer, YGS established a partnership with Da Daghay Development Corporation (DDDC) to drill Yukon's first deep ground temperature monitoring well. The site selected is on a Ta'an Kwäch'än Council (TKC) Category A land parcel west of the Takhini Hot Spring. The 500 m deep well was drilled in November and is currently instrumented with a thermistor string that is generating a temperature profile (Fig. 6). The project is a first step in helping TKC determine whether business opportunities such as district heating or energy production are viable. SINED funds were used for this project.

Upon completion of the well, YGS initiated discussions with Ross River Dena Council about the possibility of drilling one or more geothermal targets in the Tintina trench near Ross River. This work, which will also be funded under the SINED program, is planned for winter/spring 2018.

SURFICIAL GEOLOGY PROJECTS

Staff from YGS' Surficial Geology unit undertook four field-based surficial geology studies in 2017 (Fig. 7) and initiated consultations for a fifth project (to start in 2018). In addition to field studies, Panya Lipovsky is working on a YGS Bulletin on the surficial geology of Stevenson Ridge map sheet, synthesizing the results of previously-released 1:50 000 maps (Bond and Lipovsky, 2015a,b; Lipovsky and Bond, 2012a-e, 2013a-f). The bulletin is anticipated to be released by late spring 2018.

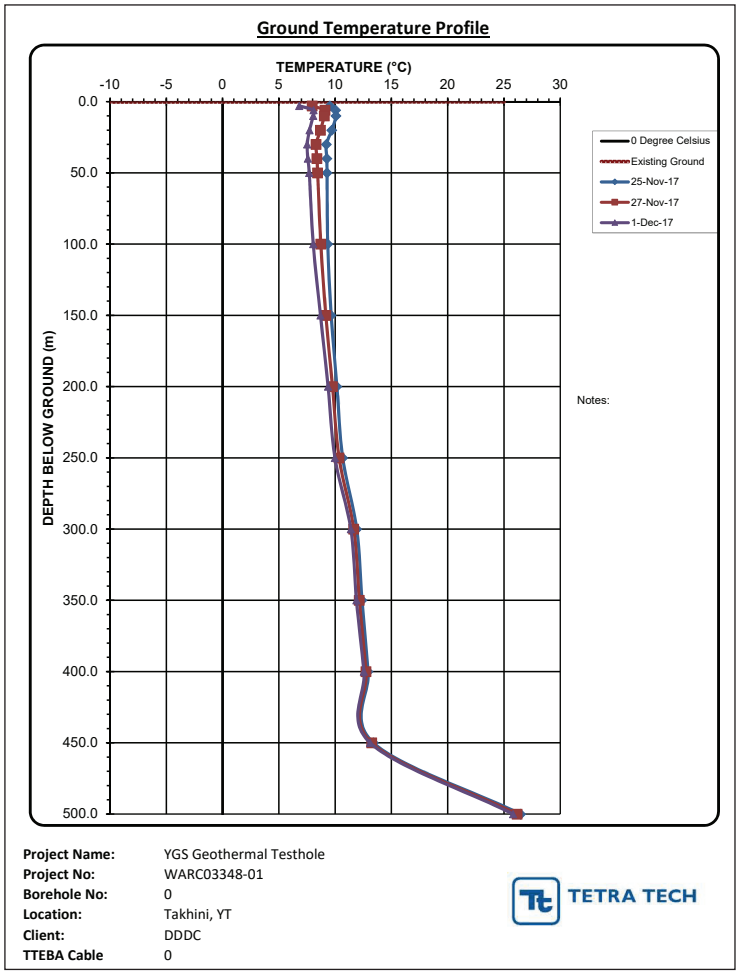

Figure 6. *Preliminary ground temperature profile from the well near Takhini Hot Spring. Profile shows data collected between November 25 and December 1, 2017.*

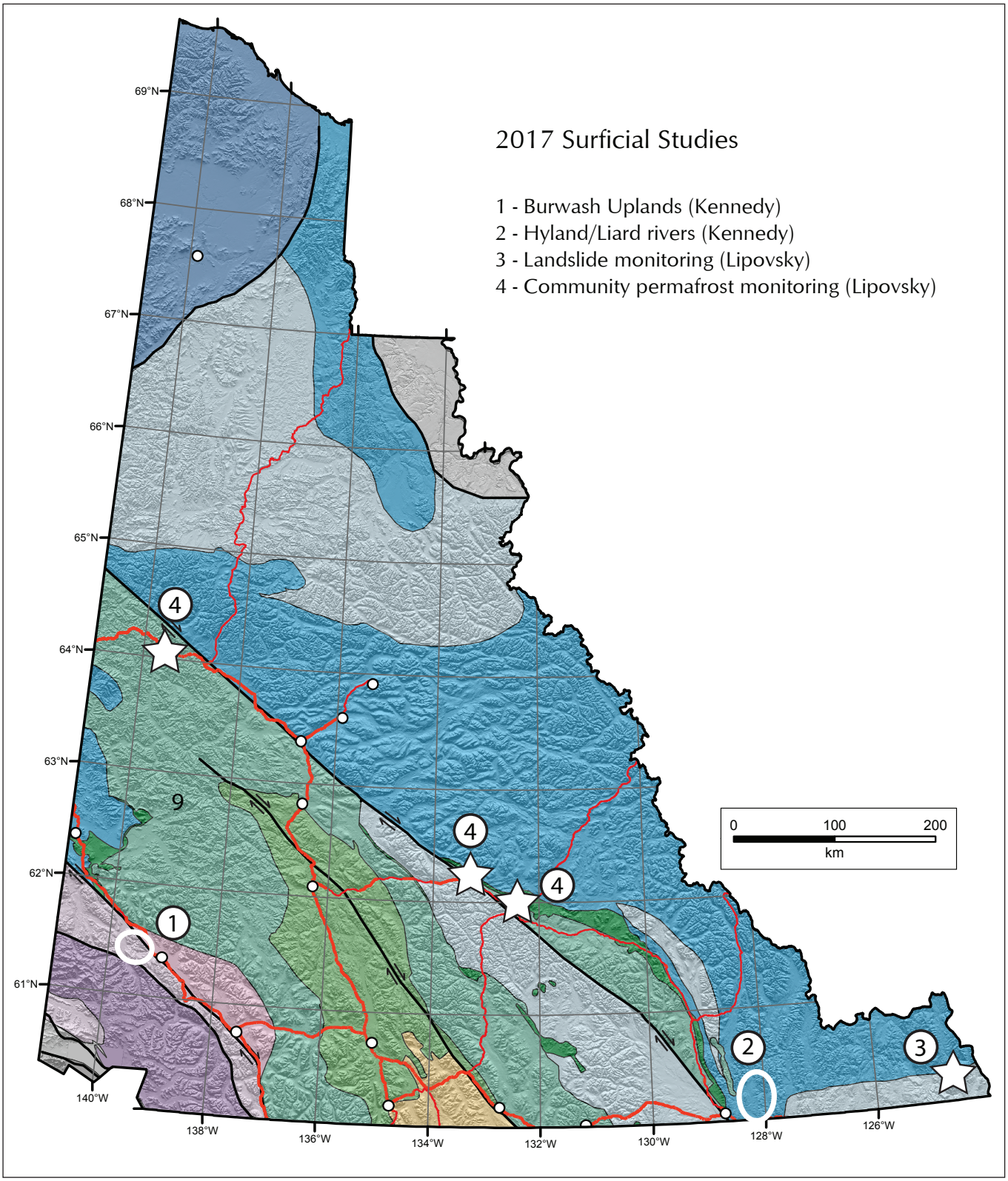

Figure 7. *Locations of 2017 surficial geology field projects.*

Burwash Uplands surficial mapping

Kristen Kennedy spent a month mapping surficial geology in the northern Kluane Range focusing on the Quill, Arch, Maple and Wade creeks drainages (Fig. 7). The purpose of the study was to characterize the area's glacial history and improve understanding of the placer potential of creeks in the area (Fig. 8). Mapping revealed that glacial incursion into the mountains in this area was much more restricted than previously thought. This has important implications for sampling strategies for mineral exploration, as much of the area is unglaciated. Preliminary results of the project are presented in Kennedy (2018).

Kluane First Nation is actively exploring their Category A Settlement Land in the Burwash Uplands area, and ongoing collaboration with Kennedy will continue to support their work as mapping moves into the Burwash Creek-Duke River area in 2018.

Liard River gravel study

Kristen Kennedy collaborated with Alberto Reyes and Britta Jansen (University of Alberta) and Nick Roberts (Simon Fraser University) in the Liard River area near Watson Lake in 2017 (Fig. 7). This is the second year of a study focused on a section of preglacial quartz pebble-rich gravels and overlying glacial sediments. The research involves Eocene climate reconstructions, as well as paleogeographic studies and glacial chronology. Preliminary data on the latter subject is presented by Ellis (2018) in this volume.

The preglacial gravels bear a striking resemblance to the White Channel gravels in the Dawson area, although to date their placer potential remains largely untested.

Landslide monitoring in Liard basin area

In 2016, Panya Lipovsky initiated a multi-year landslide-monitoring program in Liard basin at the site of the Kotaneelee gas field. The area is of interest because remediation is underway and roughly 25% of the area is overlain with relict landslide cover. An understanding of the risk of future slides is important for ensuring the abandoned wells will not be impacted by future ground movement.

In 2017 Lipovsky spent two days re-surveying the monuments that were installed in 2016. Differential GPS measurements revealed no ground movement has occurred at the sites in the last year. Paramount Resources provided logistical support for the field work.

Figure 8. *Kristen Kennedy examining a section of Amphitheatre Formation in the Burwash Uplands area.*

Permafrost Monitoring

Panya Lipovsky and Leyla Weston visited Dawson City, Faro and Ross River in September to collect data from, and undertake maintenance on, permafrost monitoring stations that were installed in the communities in 2007. While in the communities they visited schools to present information on permafrost and earthquakes as part of YGS' outreach program.

In addition to the permanent installations in communities, US Array personnel installed short-term permafrost monitoring stations at eight sites in northern Yukon this summer. The US Array project currently has 45 seismic stations deployed across Yukon as part of a broader array covering the northern Cordillera of Alaska-Yukon-NWT (*see* below). YGS provided instrumentation and built housings for the permafrost instruments; these installations will enable permafrost data to be collected for the next two to three years (until the seismic stations are removed), filling gaps in existing coverage.

Greater Whitehorse area permafrost study

In the spring of 2017, Lipovsky submitted an application for funding to Yukon's Climate Change Secretariat for a multi-year study of permafrost in the greater Whitehorse area. The funds are part of Indigenous and Northern Affairs Canada's 2017-2021 Climate Change Preparedness in the North Program, and YGS was successful in securing $243 176 over four years. Engagement of local residents will begin over the winter.

The intent of the greater Whitehorse area study is to document and characterize the geological environments where permafrost exists in order to identify areas at risk from permafrost degradation and support infrastructure development planning. The bulk of the funding will be transferred to the Northern Climate Exchange (Yukon College) to enable stakeholder engagement, field investigations and data compilation. Lipovsky's contribution to the project will be to map the surficial geology of the area and generate a geohazard map to underpin the study. Field work will be initiated in 2018.

STUDENT THESIS PROJECTS

In any given year, YGS provides logistical and financial support for one or more graduate student thesis projects. The studies add value to YGS' program by contributing analytical data and access to university-based expertise; they also give the survey a chance to contribute to the training of next-generation geoscientists. This year, YGS is supporting five graduate students who are working independently (Fig. 2), as well as a student from the University of Calgary (MSc candidate Colin Paget) who is working with David Moynihan in the Frances Lake area (*see* above).

Leigh van Drecht completed the second and final season of field work in 2017 for her MSc thesis on the stratigraphy and sedimentology of the upper part of the Whitehorse trough. Her thesis focuses on the provenance, depositional environment and stratigraphy of the lower Laberge Group. The study is being undertaken at Memorial University under the supervision of Luke Beranek. Results of her field work are reported in van Drecht and Beranek, 2018.

A second MSc student, Melissa Friend, carried out her first summer of field mapping and sampling in Mount Freegold district, where more than two million ounces of gold have been discovered to date. Her thesis will focus on the links between Cretaceous metallogeny and magma fertility. The study is being supervised by Murray Allan at the Mineral Deposits Research Unit at the University of British Columbia (Fig. 9). Results of 2017 field work are described in Friend *et al.*, 2018.

Figure 9. *Murray Allan examining mineralized granitic outcrop near Mount Freegold.*

A third MSc student, Derek Cronmiller, is studying the interaction between the Cordilleran Ice Sheet and local montane glaciers in the Gladstone Creek area of the Ruby Range (Fig. 10). The study involves surficial mapping and stratigraphic studies, including an examination of placer deposits in Gladstone Creek. Brent Ward (Simon Fraser University) is supervising the study. Results of the fieldwork were presented at the Placer Forum in November and will be featured on a poster at the Exploration Roundup in January.

Matt Manor, a PhD candidate at Memorial University, is examining the stratigraphy, petrology and age of host rocks to the Kudz Ze Kayah, Wolverine and Fyre Lake VMS deposits in the Finlayson district of Yukon. He is working under the supervision of Steve Piercey at Memorial University. Preliminary results of his research are presented in Manor and Piercey, 2018.

YGS contributed SINED funds to cover field and/or analytical expenses to the above four projects.

Karol Faehnrich, a PhD student at Dartmouth College, is studying the kinematics and displacement history of the Porcupine Shear Zone in the Old Crow area. The shear zone juxtaposes rocks of the North Slope terrane with the Yukon stable block. Maurice Colpron and Steve Israel spent five days in the area this summer, mapping with researchers from Dartmouth College and the University of Iowa and providing helicopter support to the field project.

DESKTOP STUDIES

Yukon digital bedrock geology map

Following the release of the Yukon digital bedrock geology map two years ago (Colpron *et al.*, 2016), Maurice Colpron has worked to generate regular updates for online release. The first update was released in January 2017, and a second update is planned for January 2018 (at the Exploration Roundup). The update will capture new geology compiled by YGS and GSC mappers since 2017 and will be available as shape files and in *.pdf format.

Figure 10. *Derek Cronmiller examining a surficial section in the Gladstone Creek area.*

Compilation of southwest Yukon bedrock geology

Steve Israel spent much of 2017 writing up final reports and papers related to the Kluane Ranges, the Bear Creek assemblage (in collaboration with Joel Cubley at Yukon College) and Paleocene magmatic rocks. A Kluane Ranges Bulletin is expected to be released sometime in the spring of 2018 and two or more journal articles will be submitted over the next few months.

Two MSc students co-supervised by Israel defended their theses at Simon Fraser University in 2017. Andy Clark investigated the structural and metamorphic history of the Aishihik Lake region and Lianna Vice studied the metamorphic, structural and detrital zircon characteristics of the Blanchard River area. Both of these theses are available at the EMR Library.

Glenlyon map area

In November, Rosie Cobbett resumed work on the Glenlyon mapping project following her maternity leave. Over the winter, she will finish compiling the geology of the Tay River and Glenlyon map sheets; this map will integrate the field work that she completed between 2013 and 2016 with geological data captured from YGS' collection of Cypress Anvil files.

Cobbett is planning one final summer mapping in the area; she will hold off releasing a final compilation map until her 2018 field data can be incorporated into the map. In the meantime, the geology she has compiled to date will be captured in the January 2018 update of the Yukon digital bedrock geology map.

In addition to the map, Cobbett plans to publish a paper describing Earn Group stratigraphy that will include new age data and its stratigraphic implications.

Dempster Highway Aggregate mapping

At the request of Yukon's Department of Highways and Public Works, Lipovsky completed a desktop study and generated an aggregate potential map for a portion of the Dempster Highway (Km 174-240; Fig. 11). This map will support ongoing maintenance efforts by the department, and is available to the public on request.

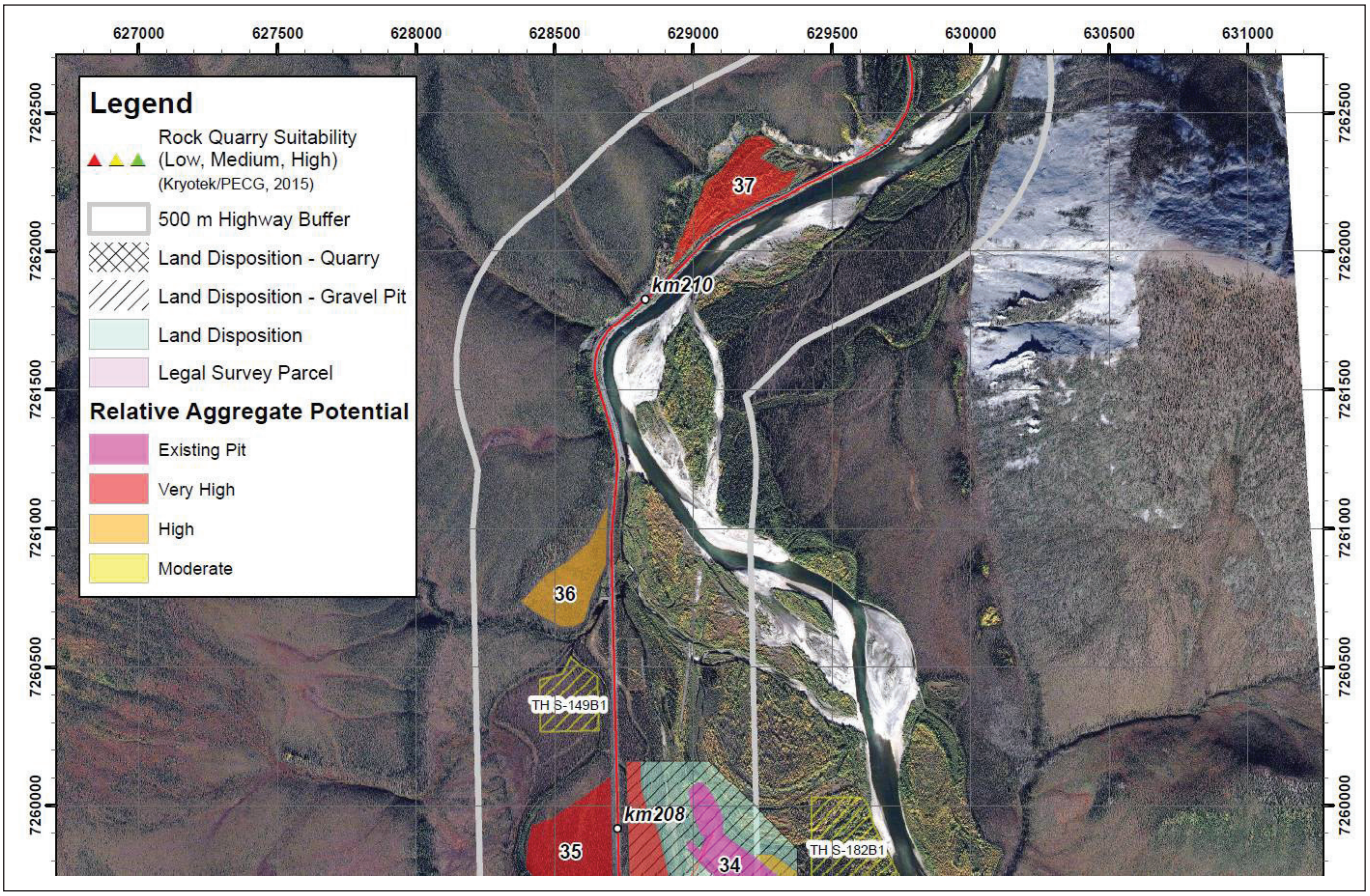

Figure 11. *Map showing locations of potential aggregate resources along the Dempster Highway between Km174 and 240.*

1:250 000 Magnetic map tiles

Last year YGS initiated a project to re-process the regional magnetic data from the Alaska-Yukon magnetic compilation map (Miles *et al.*, 2015). The project involved generating four derivative maps (residual total magnetic field; reduced-to-pole magnetic field; first vertical derivate reduced-to-pole magnetic field; and tilt derivative reduced-to-pole magnetic field) for each 1:250 000 map sheet in Yukon. The individual "tile" maps were re-leveled for each map sheet, revealing subtle magnetic features that are not immediately apparent on the regional compilation.

The contract to re-process the data was funded under the SINED program last fiscal year and the maps were released in July 2017. Each Open File includes Geosoft grid files, geotiffs and *.pdf files (Aurora Geosciences Limited and Bruce, 2017: YGS Open Files 2017-5 through 2017-59).

Ongoing capture of Yukon Consolidate Gold Corporation file data

Over the past couple of years, Sydney van Loon has generated maps and profiles across selected Klondike creeks, displaying data from the collection of Yukon Consolidated Gold Corporation (YCGC) files (van Loon, 2016; 2017). She will not be compiling any YCGC data this year, given the time commitment required to complete the Yukon Placer Industry Report (*see* below). However, YGS plans to work on geo-referencing data from the files this spring (*e.g.*, locations of shafts, gold grade data, *etc.*). This will provide her with digital data she can work with next winter, generating grade maps and cross sections from one or more creeks in 2018-19.

Mineral potential mapping

Following the ruling of the Federal Supreme Court on the Peel Land Use Plan, Yukon government has renewed its commitment to re-starting the land use planning process. YGS' role in this process will be to provide the mineral potential maps that will help to inform the Planning Commissions. While regional mineral potential maps exist for Yukon (Bradshaw and VanRanden, 2003), recent mineral discoveries and new geoscience research have rendered the assessments outdated for some parts of the territory. The time and resources required to update these assessments will depend on the areas identified for planning and the timelines set for the development of land use plans.

In anticipation of this work, YGS has invested time examining mineral potential mapping methodologies and expects to ramp up this work over the next year or so. To date, a few "trial" maps have been generated that assign mineral potential values for deposit types based on geologic attributes (such as lithology, age, structure, *etc.*) coupled with knowledge derived from MINFILE occurrences and stream sediment geochemical data. The maps incorporate both mineral potential values and "confidence" designations, which allow users to recognize the uncertainties associated with mineral potential values. The confidence values also serve to highlight areas that require additional research to ensure decisions are based on sound evidence.

Monitoring seismicity

In 2017, YGS provided logistical support for the deployment of several portable seismometers as part of the US Array project. There are now 45 passive seismometers installed across Yukon, collecting data that will enable imaging of the northern Cordillera's lower crust and lithosphere and enhance our understanding of earthquake hazards.

In addition to the US Array instruments, YGS retained four seismometers in the Liard basin area (southeastern Yukon). These instruments contribute data to both the US Array network and the BC seismic consortium, which monitors natural and induced seismicity in the region.

GEOSCIENCE OUTREACH

YGS continued to fulfill its commitment to public engagement and geoscience education this year. Leyla Weston led several Whitehorse-based classes on day trips to the Whitehorse Copper Belt and Miles Canyon, and brought hands-on activities to classes in Whitehorse and outlying communities (Haines Junction, Destruction Bay, Dawson City, Faro, Ross River and Watson Lake).

Weston also coordinated YGS' participation in student tours and activities for Mining and Geology Week in early May. The event attracted over 400 students from Whitehorse schools. In early August YGS hosted its 6th annual "Weekend on the Rocks" in Tombstone Park; a public event organized by Yukon Parks and Friends of Dempster Country. Weston and retired YGS geologist Don Murphy led interpretive hikes in the park (Fig. 12) and presented an evening lecture to participants. In November, YGS teamed up with the Prospectors and Developers Association of Canada to bring Mining Matters to the Geoscience Forum in November. The week included class tours and hands-on activities, including YGS' Augmented Reality sandbox. Following the Geoscience Forum Weston organized a geology workshop for Yukon teachers.

In addition to geoscience education initiatives, Weston spent time liaising between YGS geologists and First Nation governments in the Traditional Territories where YGS is carrying out research. Liaison efforts ensure that communities are aware of and understand the work YGS does, and that they have access to the information YGS generates.

Figure 12. *Don Murphy describing local geologic features to participants in the "Weekend on the Rocks" event in Tombstone Park.*

ONGOING YGS ACTIVITIES

MINERAL EXPLORATION INDUSTRY LIAISON

Scott Casselman, Patrick Sack, Lara Lewis and Derek Torgerson visited nineteen mineral exploration properties in 2017, capturing information on exploration results and tracking exploration expenditures. Highlights of 2017 exploration and development activities are summarized elsewhere in this volume (Lewis and Casselman, 2018) and were presented at the annual Geoscience Forum in November. An updated overview will be the subject of a talk by Casselman at Roundup in January 2018.

To support exploration efforts, YGS has been working to web-enable information on its drill core collection for the past couple of years. Over the summer, drill core data were cleaned and migrated to the drill core module of YGS' Oracle Enterprise database, and a map-based tool for querying the database was launched in the fall. To highlight drill core donations, Minerals Geology staff encourage companies to contribute papers to the Yukon Exploration and Geology volume. This year two such donations are highlighted: Sack *et al.* (2018), and Coulter *et al.*, 2018.

In addition to visiting exploration properties, YGS organized a two day workshop/field trip for prospectors and exploration companies in August, featuring field trips to the Mount Freegold and Klaza properties. The workshop, dubbed "Carmacks Rocks" was held in Carmacks and included an afternoon open house for community members (Fig. 13).

YGS also provided regional geology tours for companies with interests in Yukon in 2017. The tours provide a broad overview of the structural, stratigraphic and magmatic settings of mineral occurrences in a given region, and insights into the timing and mechanisms of mineralizing processes.

PLACER INDUSTRY LIAISON

Jeff Bond and Sydney van Loon visited 128 placer operations in 2017, monitoring activities, documenting information on gold production and characterizing the geology of the various creeks they visited. The information they collected is currently being compiled into the 2015-2017 Yukon Placer Industry Report, scheduled for release in May at the 2018 Gold Show in Dawson City. The report will synthesize the geology and production details of 150 placer mines. Some of the highlights of the 2017 season were presented at the annual Placer Forum in November.

In April Jeff Bond was invited by the Canadian International Resource Development Institute to participate in a workshop in Quito, Ecuador on artisanal and small-scale placer mining. The workshop brought together geological survey representatives from Latin America to identify ways to improve extraction practices and reduce environmental impacts of small-scale mining operations. Bond presented a talk on the information services and technical support provided to Yukon's placer mining sector, highlighting how the relationship has helped build a sustainable industry in Yukon.

Figure 13. *Scott Casselman and Melissa Friend show ore samples to residents during the Carmacks Rocks open house.*

SUMMARY

Regional mapping and targeted studies related to mineral deposits continued as core activities for YGS in 2017, while other areas of research such as permafrost studies and geothermal assessments grew. Areas of increasing focus over the next few years include mineral potential mapping and strengthening relationships with Yukon First Nations.

More than sixty publications were released, and staff are working on a number of synthesis volumes that will be published in the coming months (YGS bulletins on Kluane Ranges bedrock geology and Stevenson Ridge surficial geology; an Atlas of Jurassic plutons; and the 2018 Yukon Placer Industry Report). Additionally, an update to the digital bedrock compilation map will be released in January.

Significant changes to the YGS website are coming in 2018, although the web applications that provide access to publications and data will remain unchanged. Input on how to improve information services and ideas for new geoscience projects are always welcome.

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Yukon Placer Mining 2017 Development Overview

Jeffrey Bond* and Sydney van Loon
Yukon Geological Survey

Bond, J. and van Loon, S., 2018. Yukon Placer Mining 2017 Development Overview. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 19-32.

INTRODUCTION

The Yukon placer mining industry benefited from another season of strong gold prices bolstered by a favourable Canada-U.S. exchange rate. The average gold price during the 2017 mining season was (CDN)$1621.74, a reduction of 6% from 2016. The total number of sluicing operations was 156 and numerous exploration projects were conducted, including 19 Placer Module projects funded through the Yukon Mineral Exploration Program. The sustained gold price over the last few years is reflected in record claim and lease staking, with significant activity in the Coffee Creek and Little South Klondike areas. Regional production highlights include a strong season from the Indian and 60 Mile rivers, whereas the glaciated districts experienced a slight decline in production.

CLIMATE FOR MINING

Mining got off to a slightly slower start in 2017 due to unseasonably cooler temperatures in April and May across most districts. In Dawson City, the average low for the month of April was -6.7°C compared to -2.1°C in 2016. At mine sites in the Gustavus Range near Keno, sluicing did not commence until the middle of June. Through the month of July climate conditions were generally cooler and wetter in Burwash Landing and Carmacks. Burwash Landing recorded 22 days of precipitation in July amounting to 93 mm. The Klondike experienced warm and dry conditions throughout July and August resulting in a reduced rate of permafrost thaw caused by limited moisture. All districts were warm during the first half of August and Dawson City averaged 26.5°C during the first 13 days. The warm weather continued into fall with temperatures remaining favourable for mining until the middle of October. In Mayo, the average high during September was 14.2°C. Burwash Landing was very dry towards the end of the season with only 13.6 mm of precipitation recorded over a total of five days in September and October.

GOLD PRODUCTION AND VALUE SUMMARY

Yukon placer gold producers continued steady production and 67,810 crude ounces were reported from royalties for the period May 1st to November 30th, 2017 (Fig. 1). The value of the production is (CDN) $88 million using an average fineness of 80% and average summer gold price of (CDN) $1621.74 per fine ounce. In 2016 the value was (CDN) $95.7 million based on the final royalty-based production figure of 69,625 crude ounces for the season. Final production figures for the 2017 season, when the winter royalty reporting has finished, are expected to be similar to 2016.

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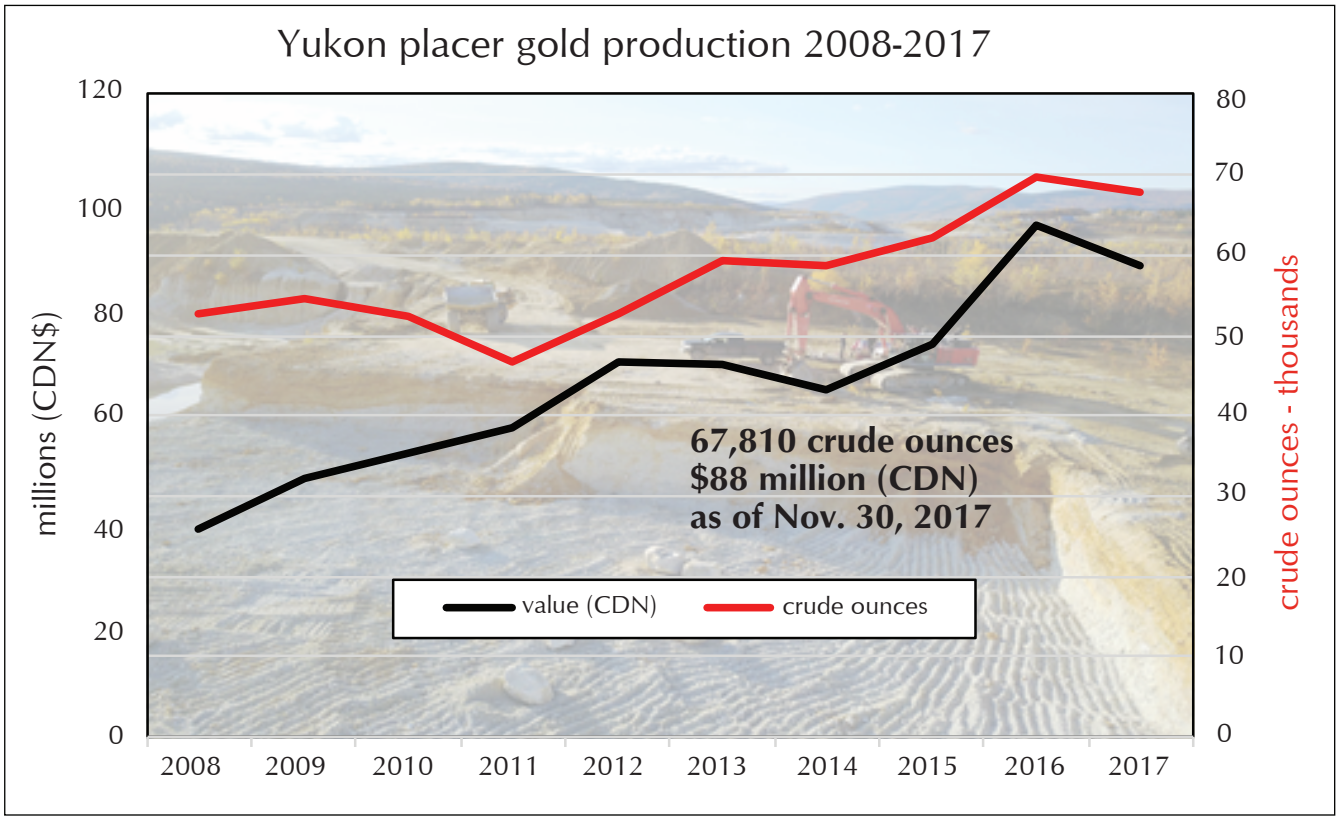

Figure 1. *A chart illustrating both Yukon placer gold production and the production value in Canadian dollars for the past 15 years. The total crude ounces reported from royalties in 2017 dropped slightly to 67,810 crude ounces, but is expected to continue climbing as more gold is reported from the mining season.*

PLACER CLAIMS AND LEASES

A measure of the momentum of the Yukon placer industry is reflected in staking and claims in good standing (Fig. 2). The total number of placer claims in good standing (as of September 2017) is 25219. This is the highest number of claims dating back to 1973, and likely in history. Claims in good standing have increased annually since 2004 when 16054 claims were active (Fig. 2). Interest in finding new ground is reflected by the number of placer leases in good standing. In 2017, 343 leases were active, which is the third highest number since 1990 when 345 placer leases were in good standing. In 2016, 368 placer leases were active. In 2017, 2269 placer claims were staked compared to the 43 year average of 1393 claims. This is the second highest number of claims staked in the last 30 years after 2016 when 2476 claims were staked.

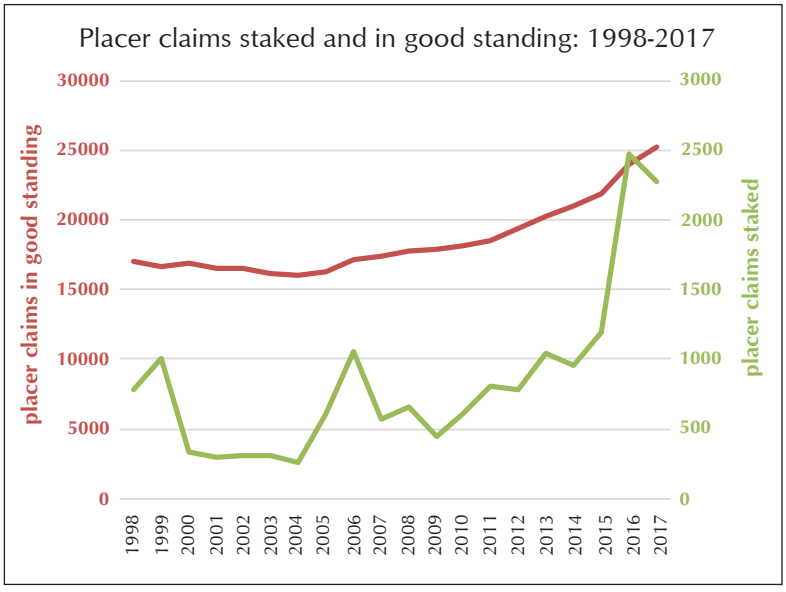

Figure 2. *A chart showing placer claims in good standing and placer claims staked for the years 1998 to 2017. A noticeable upswing in both claims held and claims staked has occurred since 2009.*

REGIONAL PRODUCTION SUMMARIES

Regional production summaries (Fig. 3) provide an overview of the various informal placer districts in Yukon. Production is reported in crude ounces from royalty figures reported between May 1st and November 27th, 2017.

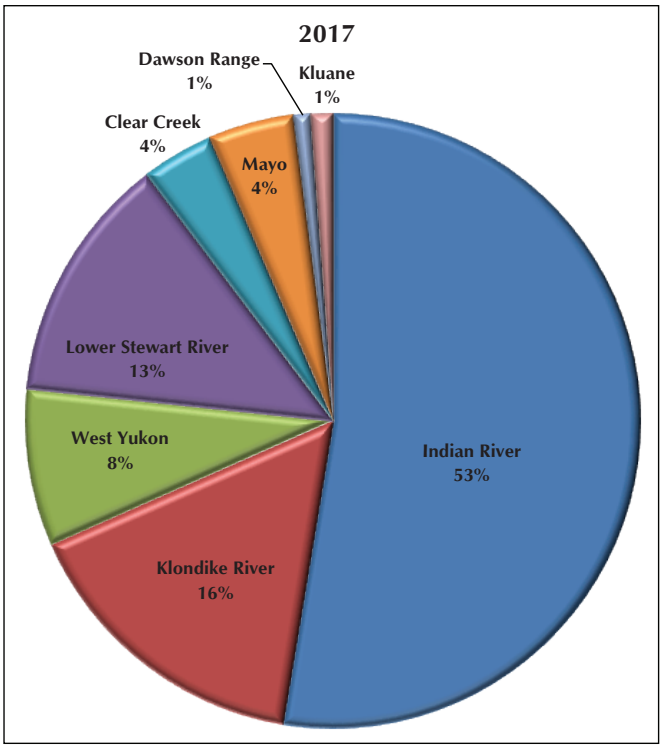

Figure 3. *A pie chart illustrating production from the various regional placer districts in Yukon. Production from the Indian River drainage increased by 4% in 2017 whereas production from the glaciated districts decreased by 4%.*

INDIAN RIVER

Production from the Indian River drainage, and Indian River specifically, increased in 2017. Total production from the drainage increased by 3496 crude ounces to a total of 35,291 crude ounces. A large part of this was due to more gold being mined from the Indian River which produced 13,914 crude ounces in 2017 compared to 8551 crude ounces in 2016 (Fig. 3). In 2017, mining specifically along the Indian River accounted for 20% of Yukon's total placer gold production.

Quartz Creek – Schmidt Mining

Schmidt Mining's project on the Quartz Creek bench continued as the top producing placer gold mine in Yukon. Progressive mining into the right limit bench has revealed a gravel section measuring 25 m (82 ft) in height (Fig. 4). Production was also reported from upper Quartz Creek on the right fork. Reclamation has been initiated farther downstream on the right limit bench near the mouth of Calder Creek and is expected to continue upstream as work on additional areas of the bench are completed.

Figure 4. *Schmidt Mining's wash plant on the Quartz Creek bench with the right limit Pliocene section exposed in the background. The wash plant is capable of processing 200 loose yd³ per hour.*

Dominion Creek – Adrian Hollis

Adrian Hollis continues to adopt innovative mining techniques along the middle reaches of Dominion Creek near the mouth of Jenson Creek. Much of the economic success at his mine is owed to reducing earth-hauling and water pumping costs (Fig. 5). Mr. Hollis employs a system of excavator-mounted conveyors equipped with hydraulic levelers and dump-box feeders. This system is capable of reducing stripping costs by approximately 5 times compared to traditional bulldozer pushing. The use of solar panels to power the dewatering pump in his cut also contributes to the mines overall economic efficiency.

Figure 5. *A view looking down on Adrian Hollis' 130 ft excavator-mounted conveyor on Dominion Creek. He has led the evolution of this tool and shares his expertise with other miners on new builds. Photo courtesy of A. Hollis.*

Gold Run Creek – T.D. Oilfields

T.D. Oilfields mined on lower Gold Run Creek focusing on previously mined ground and virgin side pay. Their work in the middle of the valley reworked dredged ground and targeted bedrock lows where pockets of virgin gravel were missed by dredging (Fig. 6).

Eureka Creek – Fine Gold Resources

Fine Gold Resources operated four wash plants in the Eureka Creek drainage and one on the Indian River. Two of the plants serviced cuts on the left limit Pliocene bench, one of the largest targets in the Klondike (Fig. 7). A third plant operated on the upper reaches of the left fork at the base of Eureka Dome where angular gold is being shed off a nearby source. Mining along the Indian River targeted low-level terrace gravel buried by thick accumulations of resedimented loess (silt).

Indian River – Little Flake Mine

Parker Schnabel had a successful year mining two locations on the upper Indian River near the mouth of Australia Creek (Fig. 8). They completed a stripping program near the mouth of Wounded Moose Creek on the left limit of the Indian River and employed a crew of 18.

Australia Creek – Fry Exploration and Mining

Fry Exploration and Mining, in collaboration with Bill Harris, continued work on their extensive group of claims and leases in the Australia Creek drainage (Fig. 9). The 2017 program consisted of resistivity geophysics and road building along the north side of the valley near the old ditch. This will provide access to the lower claim blocks and allow test mining to commence in 2018.

Indian River– M2 Gold Mines

M2 Gold Mines completed mining in the vicinity of their camp on the Indian River. This included a significant and timely reclamation effort (Fig. 10) that earned them the 2017 Robert E. Leckie award. Work also consisted of constructing a new road to their downstream claims. The camp will be moved in early 2018.

Figure 6. *T.D. Oilfields reworking former dredged ground on lower Gold Run Creek. The seagull on the hood of the haul truck was a permanent partner at the mine this year, enjoying heated flooring and a free lunch.*

Figure 7. *An aerial view looking down the right fork of Eureka Creek. Fine Gold Resources pit is excavated into the left limit Pliocene bench deposit and processed with a trommel in the adjacent valley bottom. The bench deposit underlies the continuous gently sloping surface that extends into the distance.*

Figure 8. *A view of the shaker deck plant and cut at the Little Flake Mine near the mouth of Dominion Creek.*

Figure 9. *A view looking up Australia Creek. Prominent benches are visible on the right side of the valley and make up just one of the many extensive targets in the valley.*

Figure 10. *M2 Gold Mines completing their last cut on the flats upstream from camp on the lower Indian River. Reclamation is evident in the foreground and was completed for the entire flat towards the end of the season.*

KLONDIKE RIVER

Production from the Klondike River and its tributaries continued to be steady with 10,589 crude ounces reported. The largest contributions were from Hunker, Bonanza and Last Chance creeks (Fig. 3).

Gold Hill – Dulac Mining

Dulac Mining moved operations onto Gold Hill from All Gold Creek in 2017. Work focused on mining the downstream-end of the hill where remains of the Pliocene paleo-channel are preserved (Fig. 11). The White Channel gravel is 33 m (108 ft) thick on the bench and the lower 3 m (10 ft) is processed as pay. The pay gravel has a light green colour and dense consistency due to a significant component of reworked decomposed bedrock. According to Dulac Mining the vast majority of the pay is contained right on the bedrock surface, therefore the sluice section may decrease in 2018 to avoid unnecessary processing costs.

Figure 11. *Dulac Mining on the north side of Gold Hill. Pay is excavated from the base of the steep cut in the background and delivered to the plant with the haul truck.*

Dome Road – Slinky Placer Mine and Treadstone Services

Two operations, Slinky Placer Mine and Treadstone Services, worked side-by-side on the Klondike River bench off the Dome Road. The intermediate-level terrace is younger than the White Channel terraces and contains an early Pleistocene record of interglacial and glacial river sedimentation (Fig. 12). The pay gravel varies between 0.4 and 2 m (1.3 to 6.6 ft) in thickness and lies on a channelized bedrock surface with undulations up to 2 m (6 ft). The pay gravel is overlain by 2 m (6.6 ft) of river sandy silt and 5.7 m (18.7 ft) of glacial outwash gravel.

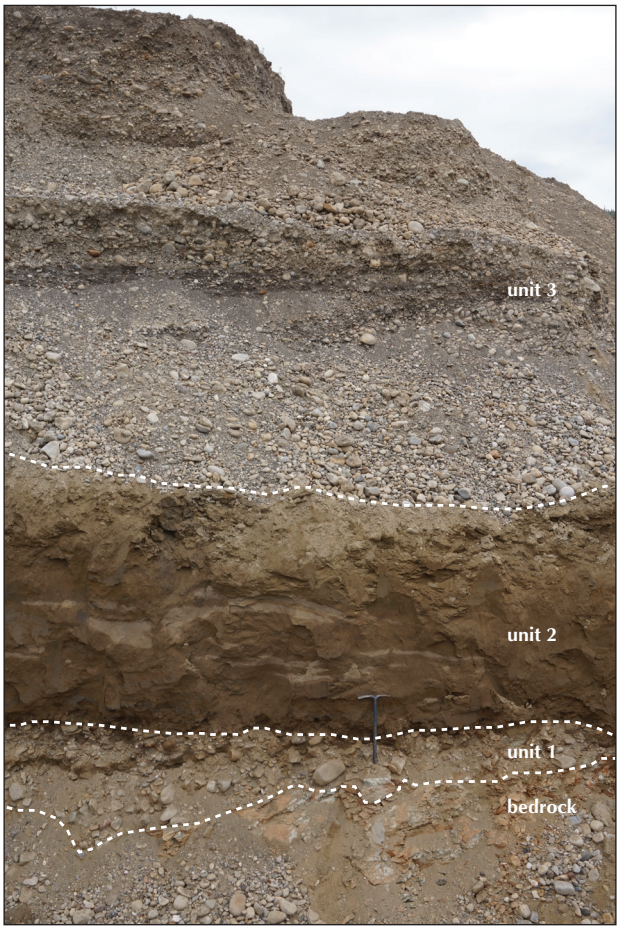

Figure 12. *The 2017 cut on the Klondike River bench at the Slinky Mine reveals a thin, coarse pay gravel on a highly fractured bedrock (unit 1). It is overlain by a bed of sandy silt (unit 2) and Klondike River glacial outwash gravel (unit 3).*

LOWER STEWART RIVER

Production from tributaries to the lower Stewart River remained steady. The total production, largely from Henderson, Black Hills, Kirkman, Maisey May and Scroggie, was 8726 crude ounces, down only 448 ounces from 2016 (Fig. 3).

Russian Gulch – Atlantia Gold Corporation

Atlantia Gold Corporation mined a small tributary of upper Henderson Creek. Deposits in narrow, unglaciated valleys are generally thin and accessible for smaller operators. In Russian Gulch the gravel unit is 2.4 m thick (8 ft) and is overlain by 2.4 m (8 ft) of colluvium (Fig. 13). The gold is distributed evenly across the valley floor and contained in coarse, poorly sorted gravel, consistent with high-energy flows.

Kirkman Creek - Fell Hawk Placers and Sager

Fell Hawk Placers and M. Sager were both active on Kirkman Creek in 2017. Testing occurred on an extensive right limit bench and valley bottom mining focused along the right limit where 33,500 year old floodplain sediments were targeted under a blanket of loess (silt) that has washed off the hill slopes into the valley bottom (Fig. 14).

WEST YUKON-FORTY MILE, SIXTY MILE AND MOOSEHORN

Production from the West Yukon placer creeks increased in 2017 due to expanded production from M2 Gold Mines operation on the Sixty Mile River. The total production was 5545 crude ounces for the district, up from 3767 crude ounces in 2016 (Fig. 3). Other significant contributions to the gold production of this area occurred in California and Cheryl creeks.

Figure 13. *A view of Atlantia Gold Corporations mine on Russian Gulch. Pay gravel from the full width of the valley bottom is being processed for placer gold.*

Figure 14. *Merrit Sager's wash plant on Kirkman Creek. A test cut into the bank in the background exposed pay gravel buried by silty overburden. The silt buried the floodplain margins between 33,000 and 25,000 years ago at a time heading into cooler conditions associated with the last glacial climate. The silt originates as wind-blown dust (loess) off the nearby Yukon River floodplain. The section is 10.7 m (35 ft) in height.*

Sixty Mile – M2 Gold Mines and K-1 Mining

M2 Gold Mines completed their second year of mining on the left limit bench of the Sixty Mile River near the mouth of 12 Mile Creek. A larger trommel wash plant was brought in and enabled production to increase. Development also occurred adjacent to the modern floodplain. Farther upstream, K-1 Mining moved their operation back into the Sixty Mile River valley from Glacier Creek (Fig. 15). Mining focused on reworking previously dredged ground and working two left limit bench locations.

Figure 15. *Exposure of a left limit bench deposit in the 60 Mile River valley near the mouth of Glacier Creek on K-1 Mining's property. The section is 5 m (16 ft) in height and the lower 1 m (3 ft) of light-coloured decomposed gravel is the target pay. Flow directions within the gravel indicate a flow out of Glacier Creek.*

10 Mile Creek - Johnson

Cam Johnson mined on the 10 Mile Creek left limit bench in 2017. This is a Pliocene bench equivalent to the White Channel gravel bench in the Klondike (Fig. 16). The total gravel thickness is 10.6 m (35 ft) and consists of two gravel units of similar thickness. Similar to the White Channel gravel, the upper unit

is sandier and better sorted whereas the lower unit is coarser and generally poorly sorted. The pay channel is contained in the lower gravel on the bedrock surface and is approximately 1.5 m (5 ft) thick. Gold grades marginal to the pay channel drop off abruptly and therefore close attention must be given to identifying both the sluice section and the lateral extent of the pay.

Moosehorn Range – Moosehorn Exploration

Moosehorn Explorations focused mining efforts on Kenyon Creek in an area that had been bulldozer mined in 1975 (Fig. 17). The high altitude site is underlain by decomposed intrusive bedrock resulting in a very sandy (grus) gravel. Minimal silt is present within the gravel and therefore limited washing is required when processing.

Figure 16. *An aerial view looking down 10 Mile Creek of Cam Johnson's mine and recent cuts on the left limit bench.*

Figure 17. *A view looking up Kenyon Creek towards the summit of the Moosehorn Range. Placers are being mined by Moosehorn Exploration very close to their bedrock or eluvial source.*

CLEAR CREEK AND MAYO

Production from Clear Creek climbed by 18% in 2017 mainly due to increased production reporting from Storm Structures on Barlow Creek and Scott and Son Mining on the middle reaches of Clear Creek (Fig. 3). In the Mayo district, placer gold production declined by 1000 crude ounces largely due to less reporting from Granite and Thunder creeks.

Clear Creek - Scott and Son Mining

Gordon Scott, a third generation miner/geologist on Clear Creek, re-mined ground that was formerly worked in the 1980s (Fig. 18). Bedrock ridges that crosscut the valley have helped sort the placer gold. Nuggets are found near the bedrock highs and the gold becomes progressively finer downstream. The original floodplain gravel was 2 m (6 ft) thick and the best pay is located on the right limit, below an extensive bench.

Granite - Davies

Jim Davies contracted Earth and Iron Inc. to assist with stripping and hauling on his Granite Creek claims. This unusual deposit consists of a placer gold-rich alpine till. In 2017, mining advanced upstream on the right limit to a location immediately upstream of the alpine end from the last glaciation (Fig. 19). A total of 1.8 m (6 ft) of till and 2.5 m (8 ft) of oxidized bedrock was being processed. Additional work consisted of geophysical exploration on the left limit below the alpine end moraine.

DAWSON RANGE

Production from the Dawson Range, including Mount Nansen and the Freegold Mountain placer camps, decreased from 1699 crude ounces in 2016 to 608 crude ounces in 2017 (Fig. 3). A significant percentage of this decrease is related to closure of the Back Creek mine.

Figure 18. *Gordon Scott's mine on Clear Creek where he is reworking previously mined ground.*

Figure 19. *Jim Davies mine on Granite Creek near Keno City. Three Caterpillar 740 haul trucks are used to haul pay to their derocker wash plant.*

Seymour - Dodge

Derek Dodge focused operations immediately downstream from the confluence of Bow and Seymour creeks on the right limit of the valley (Fig. 20). Gravel deposits are shallow in this area and consist of two units. The lower unit and primary pay gravel is 1.7 m (6 ft) thick and is interpreted as a periglacial stream gravel. The former floodplain surface of unit 1 is preserved in the section as a paleosol formed in silt-rich gravel with vertically oriented clasts. The paleosol is a highly compact layer that acts as a false-bedrock surface for the modern gravel overlying it. The modern creek gravel is in erosional contact with the paleosol surface and is 1.8 m (6 ft) thick. Placer gold is primarily contained in the lower gravel and in fractures within the bedrock. Some gold is found on the false bedrock surface. Two populations of gold are reported from the cut, including a coarser fraction from Seymour Creek and a finer, well-travelled fraction from Bow Creek.

Summit – McKay and Pishon Gold

Pishon Gold partnered with Bill and Sandy McKay on their Summit Creek property in the upper Nansen Creek valley. This mine is located immediately below Rockhaven Resources Klaza project (Fig. 21). Placer gold is being mined from a transitional (proluvial) deposit between an eluvial and alluvial setting. The gold has a rough character and is clearly derived from nearby sources. An innovative processing plant equipped with a sand screw that feeds the sluice is being used. This device provides greater feed-rate control and improved recovery of fine gold. A second sand screw is placed after the sluice box to remove sediment from the tailings water. The fines are stacked with a conveyor and made available for road top-coating and reclamation.

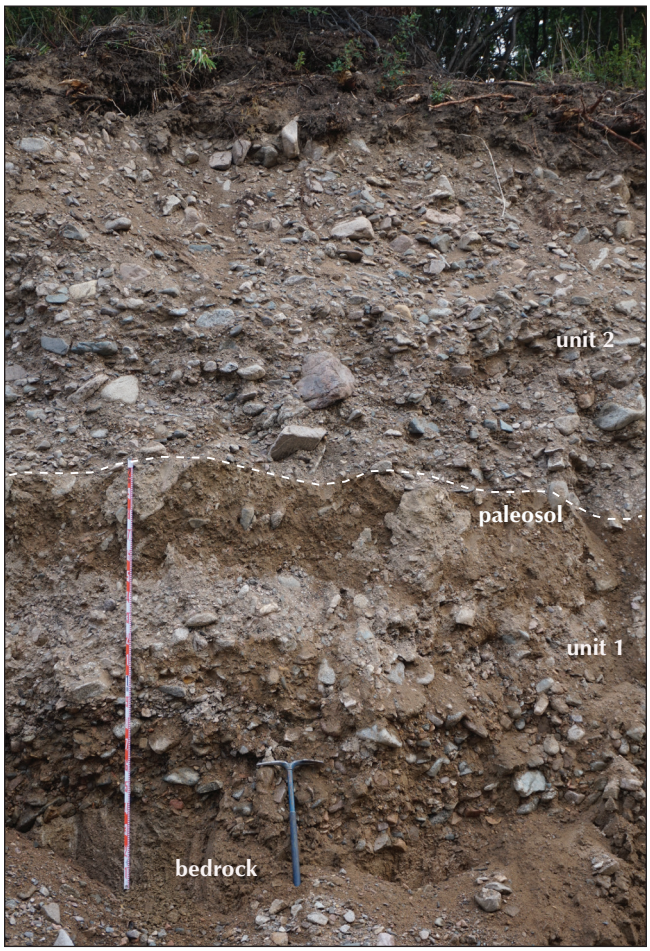

Figure 20. *A view of the cut at Derek Dodge's Seymour Creek mine. The contact between the lower, glacial-age gravel (unit 1), and upper, modern gravel (unit 2) is highlighted with the dashed line. The paleosol is situated at the top of unit 1.*

Coffee Creek – Ryanwood Exploration

Ryanwood Exploration began exploration on their extensive Coffee Creek area claims and leases. The 2017 program focused on resistivity geophysics, heli-portable RAB drilling, developing their sample processing strategy and camp construction (Fig. 22). Results from their Shovel Creek property were favourable and warrant a second phase of drilling prior to more comprehensive testing.

Figure 22. *Groundtruth Exploration's heli-portable rotary air-blast drill being used to explore a tributary to Coffee Creek.*

Figure 21. *A view of Bill McKay's wash plant and mine site on Summit Creek.*

KLUANE

Placer gold production from the Kluane district in southwestern Yukon declined from 1289 crude ounces in 2016 to 761 crude ounces in 2017 (Fig. 3). Fewer ounces were reported from Gladstone Creek, and limited production was reported from Burwash and Rabbit creeks.

Gladstone – Tic Exploration

Tic Exploration was once again the most productive placer mine in the Kluane district. Operations focused near the mouth Cyr Creek and immediately below the bedrock canyon on Gladstone Creek (Fig. 23). Gold is primarily targeted on a false-bedrock of compact till in poorly to moderately sorted boulder-rich gravel. Elevated pay zones are present in the gravel column and it requires persistent gold panning to identify the sluice section.

Bliss – Jabberwocky Exploration

Jabberwocky Exploration opened a small mine on Bliss Creek, a tributary on the Talbot Arm of Kluane Lake (Fig. 24). In 2016 Jabberwocky Exploration started mining at the top end of the canyon targeting relatively thin gravel on granodiorite bedrock of the active channel. Gravel thickness varies with undulations in the bedrock and the gold is primarily fine with a purity of 850.

Figure 23. *A view of Tic Explorations mine on the left limit of Gladstone Creek. Most mining takes place on low-level gravel bench deposits that lie on a false-bedrock of compact till.*

Figure 24. *Coarse gravel deposits being mined in Bliss Creek, a tributary to Kluane Lake. The measuring stick is 2 m in length.*

Yukon Mineral Exploration Program 2017 Update

Derek Torgerson
Yukon Geological Survey

Torgerson, D., 2018. Yukon Mineral Exploration Program 2017 update. *In*: Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 33-40.

PROGRAM SUMMARY

The Yukon Mineral Exploration Program (YMEP) is a funding program, administered by the Yukon Geological Survey (YGS), and designed to support individual prospectors, partnerships and companies by providing a portion of the risk capital required to locate, explore and develop mineral occurrences in Yukon. YMEP funding has consistently demonstrated its impact as an effective economic incentive by supporting exploration work that has led to numerous discoveries, which in turn, have provided significant long-term economic benefits to the territory.

YMEP funding supports placer and hard rock exploration projects by reimbursing a percentage of approved exploration expenditures. Funding is merit-based; a panel of geologists evaluate submissions using a ranking system designed to score a range of criteria, quantifying the quality of the target, the proposal, the work plan, and the applicant's previous YMEP performance. This scoring system is available from our website at http://www.geology.gov.yk.ca/ymep.html.

UPDATE FOR 2017

The Government of Yukon recognized that economic conditions in 2017 would likely continue to be challenging for the exploration sector, and enhanced the level of YMEP funding to $1.6M. Interest in the 2017 program was strong, and the YGS received 78 applications seeking more than $2.5M.

Due to increased interest from the placer mining industry, a placer specific module was added for the 2017 program. There are now four specific modules with different levels of funding available (Table 1).

Fifty-nine applicants were offered funding in 2017. Thirty-eight of the funded applications were for hard rock exploration projects (nine are Focused Regional, one is Grassroots, and twenty-eight are Target Evaluation); and twenty-one placer applications were funded. The majority of unfunded applications were considered eligible for funding, but budget constraints precluded them receiving support. The success rate for funding over the last seven years is shown in Table 2; the enhanced funding for this year allowed a higher than average success rate of over 75%.

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Table 1. *Summary of YMEP program guidelines. For more detailed information please reference the YMEP guidebook or* www.geology.gov.yk.ca/ymep.html.

	Grassroots	Focused Regional	Target Evaluation	Placer Module
Funding	max $15 000	max $25 000	max $40 000	max $40 000
Reimbursement rate	up to 100% of eligible expenses	up to 75% of eligible expenses	up to 50% of eligible expenses	up to 50% of eligible expenses
Scope of work	to generate new targets and advance existing ones	to generate new targets	to evaluate and advance already known targets	to evaluate and advance new and existing placer targets
Who is it for	individual prospectors only (no companies nor anyone working on behalf of a company)	prospectors, companies, partnerships	prospectors, companies, partnerships; projects with total exploration expenditures less than $300 000	
Work to proceed on	on claims, or crown land	on claims, or crown land	on claims, coal exploration licenses, not crown land	on claims, leases, or quarry leases and crown land
Field time requirements	minimum 30 person-days in field, daily log	no constraints on time in field, final technical report	no constraints on time in field, final technical report	no constraints on time in field, final technical report
Report requirements	daily log and final technical report	final technical report		
Holdback/reporting	15% holdback until submission of final reporting requirements			25% holdback until submission of final reporting
Reporting deadlines	Project proposal: March 31, Status Report: September 30, Final Financial Report and Final Summary/ Technical report and release of funds: January 31 of following calendar year			
Confidentiality	reports will be kept confidential for 5 years	reports will be kept confidential for 2 years		
Module-specific eligible expenses	applicant cannot draw wages but wages for one assistant are eligible		road building costs up to <25% of YMEP contribution if pre-approved, drilling	road building costs up to <10% of YMEP contribution if pre-approved, drilling, limited bulk sampling, test pitting, sample processing
Eligible expenses *(See Rate Schedule for details)*	conventional exploration work, travel within Yukon (truck, helicopter, etc.; up to 25% of eligible claim), assays, shipping, wages (applicant not eligible in grassroots module), WCB, contracts, equipment rental, daily field expenses, fuel, claim staking (up to 20% of eligible claim), reclamation			
Reimbursement rate guidelines	Expenses reimbursed according to YG guidelines. Private and commercial rates are provided. Private rates for heavy equipment are 75% of commercial rate as approved by YG.			
Staking	staking costs up to 20% of eligible contribution			
Travel	travel within Yukon (truck, helicopter, etc.) up to 25% of eligible contribution			
Eligible use of machinery	use of light equipment (<5 tons)		use of light or heavy equipment	
Non-eligible expenses	recording fees, management fees, costs of applying for permits or licenses, project planning and compilation, legal fees, promotional expenses, transportation outside Yukon, underground work, preparation for mining, mining, acquisitions, repairs			
Compliance	applicants must ensure that proper permitting is in place and that their work programs satisfy existing laws and regulations			

Table 2. *Summary of YMEP funding, application numbers and module funding levels.*

Historical funding	2010-11	2011-12	2012-13	2013-14	2014-15	2015-16	2016-17	2017-18
Available funding	$1.67M	$570 000	$570 000	$1.17M	$1.4M	$1.4M	$1.4M	$1.6M
No. of applications	165	83	79	81	111	103	100	78
Approved projects	83	34	29	55	51	62	57	59
Max funding level grassroots	$15 000	$15 000	$15 000	$15 000	$15 000	$15 000	$15 000	$15 000
Max funding level focused regional	$25 000	$15 000	$15 000	$15 000	$25 000	$25 000	$25 000	$25 000
Max funding level target evaluation	$50 000	$25 000	$25 000	$25 000	$50 000	$40 000	$40 000	$40 000
Max funding level placer	$0	$0	$0	$0	$0	$0	$0	$40 000

Figure 1 illustrates the location of funded YMEP projects. The majority of placer projects (eleven) are centered in the Klondike placer district, two projects are in the Mayo/Keno area, four are in the Mt Nansen area, and individual placer projects are located in the Sixy-Mile, Dawson Range, Clear Creek, and Hess River areas of Yukon. Hard rock projects are evenly distributed throughout the territory. Gold is the most sought-after commodity of hard rock projects, with thirty-one proponents exploring for structurally-controlled, epithermal, Carlin style, intrusion related and orogenic gold. Other targets include vein-hosted silver (two), porphyry copper (two), VMS style mineralization (one), jade (one), and magmatic massive sulphide copper/nickel/PGE prospects (one).

Twenty-six exploration projects focused on soil and silt sampling, and prospecting and geological mapping; six undertook ground-based or airborne geophysical surveys; twenty-five involved drilling and/or trenching; and two undertook hand shafting.

In 2017, hard rock projects accounted for 65% of the successful applications and placer projects accounted for the remaining 35%. Individual prospectors and private companies secured 55% of available funds, while public junior mining/exploration companies received 45% of the funds. The breakdown between the different modules and the demographics of the applicants over the past six years are outlined in Table 3. Over this period, the funding split between placer and hard rock sectors has been consistent. The biggest change has been the increase in the share granted to placer projects, from a historical average of around 25% to 35% this year. This increase was at the expense of funding to hard rock projects.

As part of the Yukon Geological Survey's footprint project, YMEP reports were added to the database in the summer of 2017(http://www.geology.gov.yk.ca/Web_map_gallery.html). This online application has been well received. When advanced and significant exploration projects are plotted on a map (Fig. 2) in conjunction with YMEP footprints an argument can be made that the program has generated numerous legitimate exploration projects. Many significant exploration projects have at some point been able to utilize YMEP funding to advance their programs and to leverage additional expenditures.

As of mid-December, most YMEP projects had been successfully completed and preliminary results suggest there are several potentially significant discoveries resulting from the work.

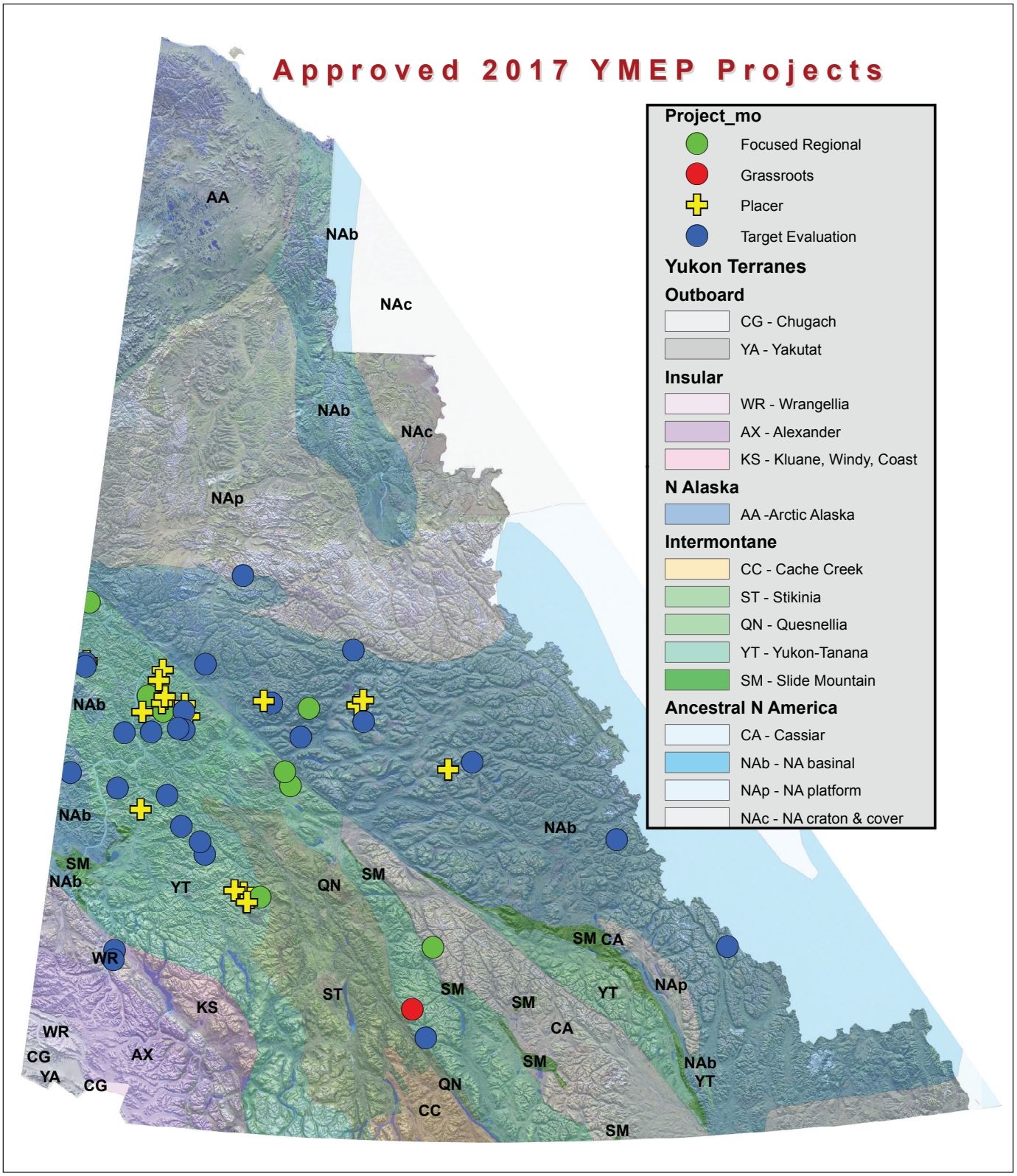

Figure 1. *Location of approved YMEP 2017 projects.*

Table 3. *Allocation of YMEP funds between sectors for the last 6 years.*

	2012-13		2013-14		2014-15		2015-16		2016-17		2017-18	
	No. of projects	% of funding	No. of projects	% of funding	No. of projects	% of funding	No. of projects	% of funding	No. of projects	% of funding	No. of projects	% of funding
Placer	7	28%	7	15%	14	22%	15	28%	15	26%	21	35%
Hard rock	22	72%	48	85%	29	78%	47	72%	34	74%	38	65%
Total projects	29		55		51		62		57		59	
Prospectors/ individuals	17	59%	28	36%	20	30%	24	34%	24	39%	18	29%
Private companies	8	27%	16	33%	12	29%	21	32%	16	30%	22	26%
Public companies	4	14%	13	31%	19	41%	17	34%	17	31%	19	45%

YMEP plays a very important role in helping to advance grassroots programs, to de-risk early stage exploration and to support exploration in financially lean years. The mandate of YMEP is to keep a variety of projects at various stages of advancement operating in Yukon. A number of projects have progressed through YMEP and have advanced beyond the intended scope of the program. Three of the main projects that now have deposit resource estimates are the Coffee, Andrew and Red Mountain projects. These projects standout as having stimulated significant investment beyond their initial YMEP-funded expenditures. Collectively the projects represent a total investment in excess of $147M; they have combined resources of 7.14 M oz. gold, 990 M lb zinc, and 238 M lb lead with a contained value in excess of $12.1B. The total YMEP investment in these projects was $396K, corresponding to a leveraging ratio of 371:1.

A number of high profile projects have recently benefited from YMEP investment and have now generated enough success and momentum to secure financing on equity markets. These projects include the 3 Aces, Plateau and Wellesley Lake projects.

GOLDEN PREDATOR: 3 ACES PROJECT

The 3 Aces project received YMEP funding between 2001 and 2014 (2001-017, 2010-118, 2014-010). Work included prospecting, geological mapping, soil sampling, airborne geophysics, and bulk sampling. In 2010 chip sampling at the Main zone returned extremely high gold values of up to 1013 g/t Au with 50.19 g/t Ag across 1.1 m. Chip sampling on the Sleeping Giant zone returned numerous high grade gold values to 11.34 g/t Au across 6.0 m. Work in 2010 by Golden Predator Mining initiated and completed metallurgical tests on three large volume samples collected from the Sleeping Giant vein zone (600-800 kg). The program was designed to help understand the coarse gold in the vein system. Results from the 2014 program provided very important data regarding appropriate assay techniques, gold recoverability, and detailed mineralogy of the free gold grains. Results to date from subsequent drilling and sampling programs has yielded numerous high grade gold discoveries throughout the 3 Aces claim package.

Since the 2014 YMEP program Golden Predator has invested in excess of $12M for exploration on the 3 Aces property. In 2017 Golden Predator completed a $17.25M financing to continue to advance the project towards commercial production (http://www.goldenpredator.com/).

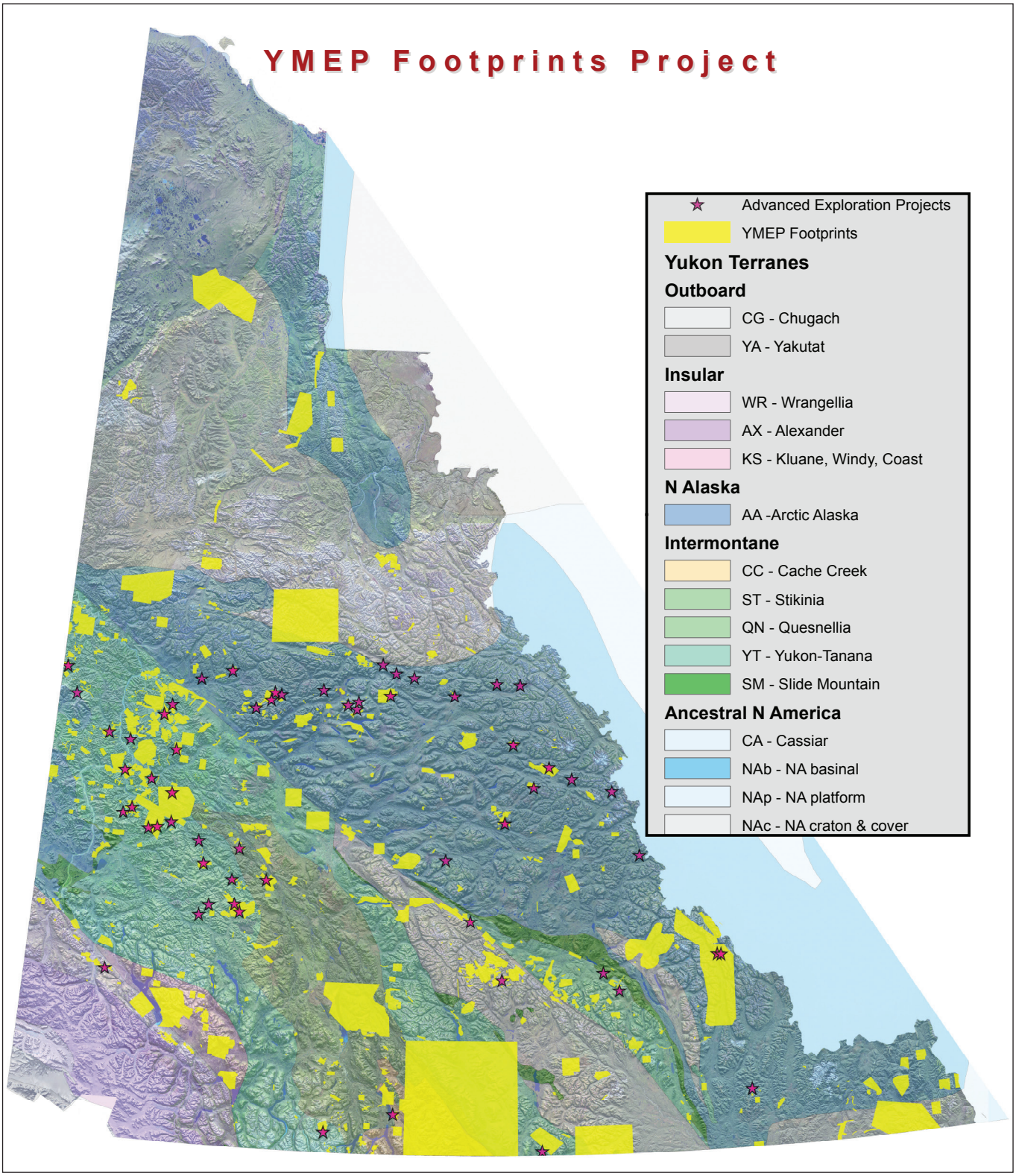

Figure 2. *YMEP report footprints.*

GOLDSTRIKE RESOURCES: PLATEAU PROPERTY

Goldstrike Resources received a YMEP grant (2014-014) for its Plateau property in 2014 to conduct 3D resistivity and chargeability surveys, and to gather samples from the VG, Ben and SW zones for rock physics measurements. Results of the field work indicate that the resistivity structure in the near-surface zone consists of a strong NW-SE lineament defined by alternating bands of conductive and resistive rock. A crosscutting secondary structure is observed to offset the NW-SE lineament. Chargeability is generally low in the upper zone but areas of moderate chargeability correlated strongly with anomalous geochemistry. The conclusion is that zones of gold and arsenic corresponded to high resistivity, and low to moderate chargeability and low magnetic susceptibility.

Since the 2014, YMEP grant the Plateau project has seen exploration expenditures in excess of $10.2M. In March of 2017, Goldstrike announced that it had formed a strategic alliance with Newmont Mining to acquire the Plateau property in a deal worth $53M. Newmont has recently announced it will conduct a 10000 m drill program at the Plateau property in 2018 (http://www.goldstrikeresources.com/main/home.php?page_id=1).

K2GOLD: WELLESLEY LAKE GOLD

The Wellesley Lake project received YMEP funding between 2011 and 2015 (2011-046, 2012-024, 2014-006, 2015-083). During this time, YMEP helped to fund programs of soil sampling, prospecting, geological mapping, airborne geophysics, trenching and diamond drilling. The first pass of this work outlined a 1250 by 200 m east-west trending gold + arsenic + antimony + silver + tungsten in soil anomaly with values ranging from 34.6 to 3082 ppb Au. Follow up trenching and prospecting returned grab sample values up to 149.5 g/t Au and trench samples of 9.15 g/t Au over 40.5 m. The first diamond drilling campaign on the property was in 2015. Significant results included 97.5 m of 0.76 g/t Au, including 3.11 g/t Au over 19.5 m and 5.71 g/t Au over 9 m. In 2016, the project was optioned to West Melville Metals, which became K2Gold. In 2017 K2Gold conducted a $1.2M exploration program which included prospecting and additional diamond drilling which returned intercepts of 28.5 m of 2.37 g/t Au, 12.5 m of 5.08 g/t Au and 144 m of 0.28 g/t Au. It was noted that visible gold was logged in 3 of the 10 drillholes. K2Gold has recently conducted additional staking to help solidify its land package (http://k2gold.com/).

YMEP PROGRAM REVIEW

In 2014, YGS undertook a client survey to measure how applicants perceive the program. Sixty-seven responses were received from both successful and unsuccessful applicants. Responses indicated that the program has a significant impact on exploration, with a majority of recipients (91%) indicating that their grant contributed to their exploration success. The majority of respondents felt the funding levels and the proportion of matching funds required for each module were appropriate, and that evaluation criteria were fair. Responses varied regarding "fair share" between sectors, with placer sector respondents suggesting that placer applicants should receive an equal share (50%) of the funds.

As a follow up to the client survey, YGS is compiling statistics on YMEP to allow the comparison of survey results to actual data (funding levels, success rates, and applicants by sector, *etc.*). The compilation covers the last sixteen years, which is the period for which robust statistics exist. Since 2000, YMEP has invested $16.02M in 854 projects leveraging $40.7M of additional exploration expenditures in the year the grants were awarded. The breakdown of grants by module between 2010 and 2016 are presented in Figure 3.

YMEP is designed to meet the needs of users of the program and to act as an engine for stimulating economic development. Significant effort has been expended to improve the program for clients. Development of the Placer module, creation of YMEP footprints app and the redesign of YMEP forms and guidebooks were done to improve the client experience.

Dollars leveraged, new discoveries and option agreements entered are indicators used to measure success (Table 4). In 2017, YMEP recipients committed ~$4.8 M in exploration investment, corresponding to a leveraging ratio of 3:1. While easily measured, leveraging ratios are relatively modest indicators of success. Discoveries made, and the further investments they trigger in the medium to long term are of greater impact. While results are pending for the majority of programs it is anticipated that a number of encouraging YMEP discoveries were made in 2017. These discoveries will continue to stimulate exploration expenditures in the years ahead.

YGS intends to carry out further analysis of YMEP data over the next year, to determine whether there are potential adjustments that could improve the program. Updated application forms, scoring criteria and hard rock and placer program guidelines are available for download at http://www.geology.gov.yk.ca/ymep.html.

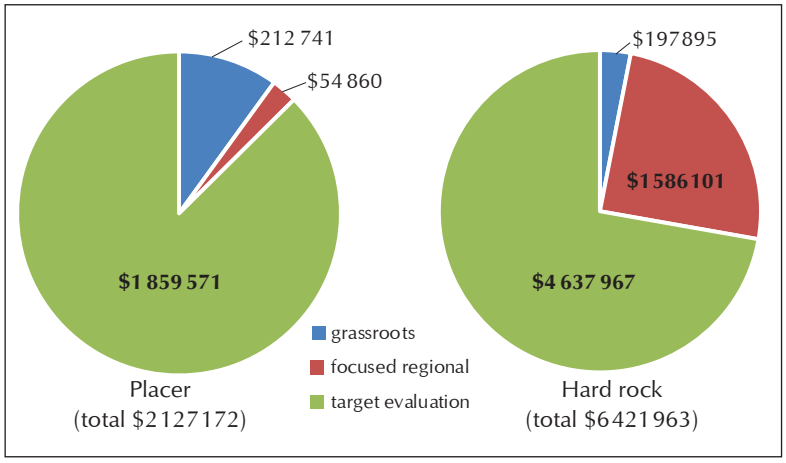

Figure 3. *Allocation of YMEP funds from 2010 to 2016.*

Table 4. *Successful YMEP options from 2000 to 2017.*

YMEP#	Property Name	Total YMEP Contribution(s)	Optioned by	Company investment or work commitment
01-011 and 15-030	Ice/Red Mountain	$52 500	AM Gold	~$7.7M
03-079	White Gold	$10 000	Underworld/Kinross	~$35.2M
04-072 and 05-043	Blende	$30 000	Blind Creek Resources	$5M
05-058	Andrew	$14 400	Overland Resources	~$16M
06-054	Antimony Creek	$10 000	Logan Resources/ Golden Predator	~$0.35M
04-041 and 07-043	Coffee	$35 000	Kaminak Gold Corp.	~$144M
07-056, 08-012 and 09-112	Toni/Sixty Mile	$33 000	Radius Gold	~$4.5M
03-023, 06-033 and 09-137	Scheelite/Gold Dome	$75 000	Golden Predator	~$1.4M
09-015	Clear Creek	$10 450	Golden Predator	~$4.1M
09-016 and 017	Ten Mile Creek	$25 600	Radius Gold	~$0.63M
09-158	Prospector Mountain	$30 750	Silverquest Resources	~$3.85M
09-116	Cynthia	$15 350	Golden Predator	~$1.7M
10-118 and 14-010	3ACES	$93 130	Northern Tiger Golden Predator	~$20M
10-097	Portland	$14 320	Taku Gold	~$1.25M
00-069, 06-005, 06-006 and 15-014	Mariposa	$76 000	Pacific Ridge	~$4.9M

Yukon Hard Rock Mining, Development and Exploration Overview 2017

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Lewis, L.L. and Casselman, S., 2018. Yukon Hard Rock Mining, Development and Exploration Overview 2017. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 41-63.

INTRODUCTION

The 2017 exploration season saw renewed optimism in investment in Yukon's mineral resources. Junior explorers were increasingly able to raise money for their exploration programs, and the year saw a series of successful options and acquisitions. There were 135 hard rock exploration projects (Fig. 1). Exploration spending was a healthy (CAN)$90 million, 60% more than spending in 2016 (Fig. 2). Gold continues to be the most sought-after commodity; more than 80% of exploration dollars targeted gold. The remainder of the projects involved exploring for lead-zinc, copper, silver, or nickel-PGEs. More than half of all hard rock projects were drilled: 30 were diamond-drilled and 27 were reverse-circulation or rotary-air-blast drilled (Fig. 3). Development dollars topped out at $68 million (Fig. 2), primarily for mine development of the Eagle deposit at Victoria Gold Corp.'s Dublin Gulch property, and advancement of the following properties: Goldcorp's Coffee project, Alexco Resources' Keno Hill silver properties, BMC Minerals' Kudz Ze Kayah property and Wellgreen Platinum's Wellgreen property.

Claim staking for the year increased by 40% over the number in 2016, with more than 11 000 new hard rock claims staked. The overall number of claims in good standing remains high at 187 000 claims (Fig. 4). The Yukon Mineral Exploration Program (YMEP) fund was up slightly to $1.6 million for 2017/18, and helped 38 hard rock and 21 placer exploration projects offset exploration costs (*see* Torgerson, 2018 in this volume for more information).

In September 2017, the Yukon Resource Gateway Project was announced. The project involves a $360 million investment from the Yukon and Federal governments for upgrading more than 650 km of road infrastructure to access mineral-rich areas of Yukon (Fig. 5).

The activities and results presented in this report are a summary rather than a comprehensive list of Yukon exploration, development and mining projects. Some results are still pending at the publication deadline of this volume. Summary statistics and analytical results are based on technical reports and news releases by companies, and personal communication with company representatives.

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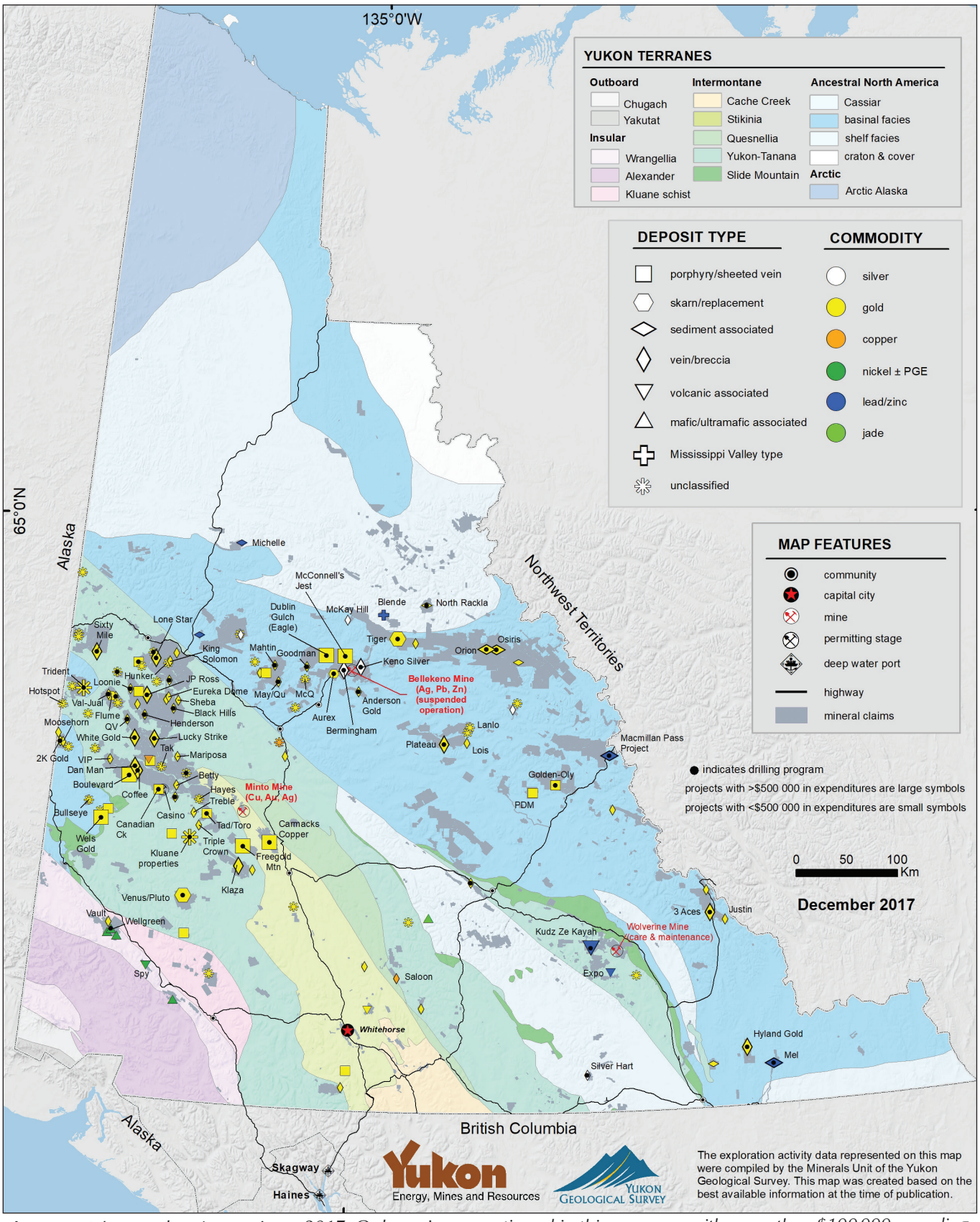

Figure 1. *Yukon exploration projects, 2017. Only projects mentioned in this paper, or with more than $100 000 spending are labelled.*

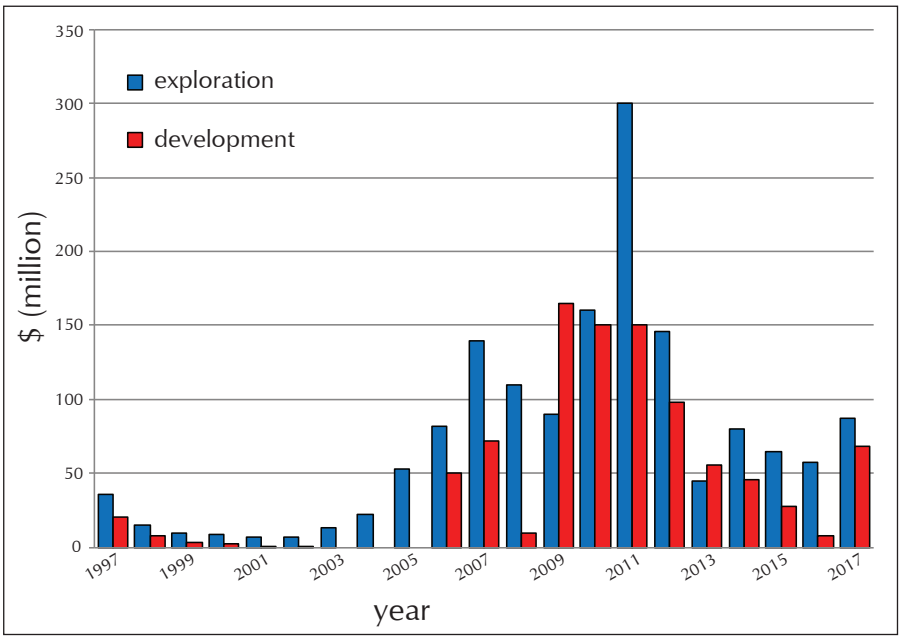

Figure 2. *Estimated exploration and development expenditures on hard rock projects, 1997-2017.*

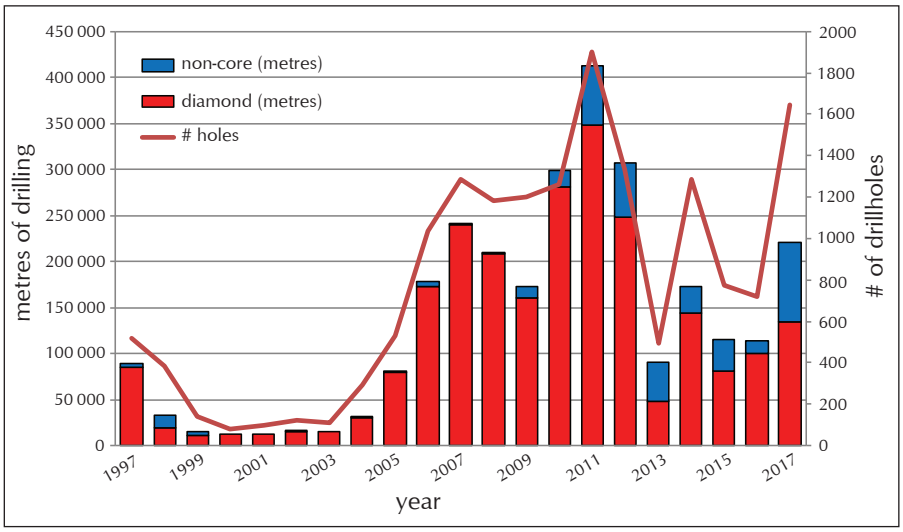

Figure 3. *Diamond drilling and reverse-circulation or rotary air blast drilling, 1997-2017.*

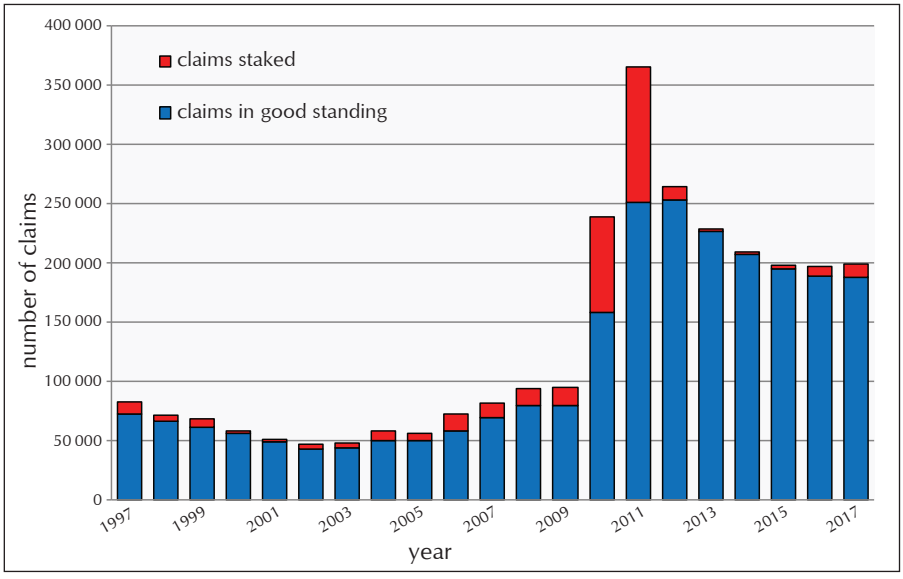

Figure 4. *Hard rock claims staked and in good standing, 1997-2017.*

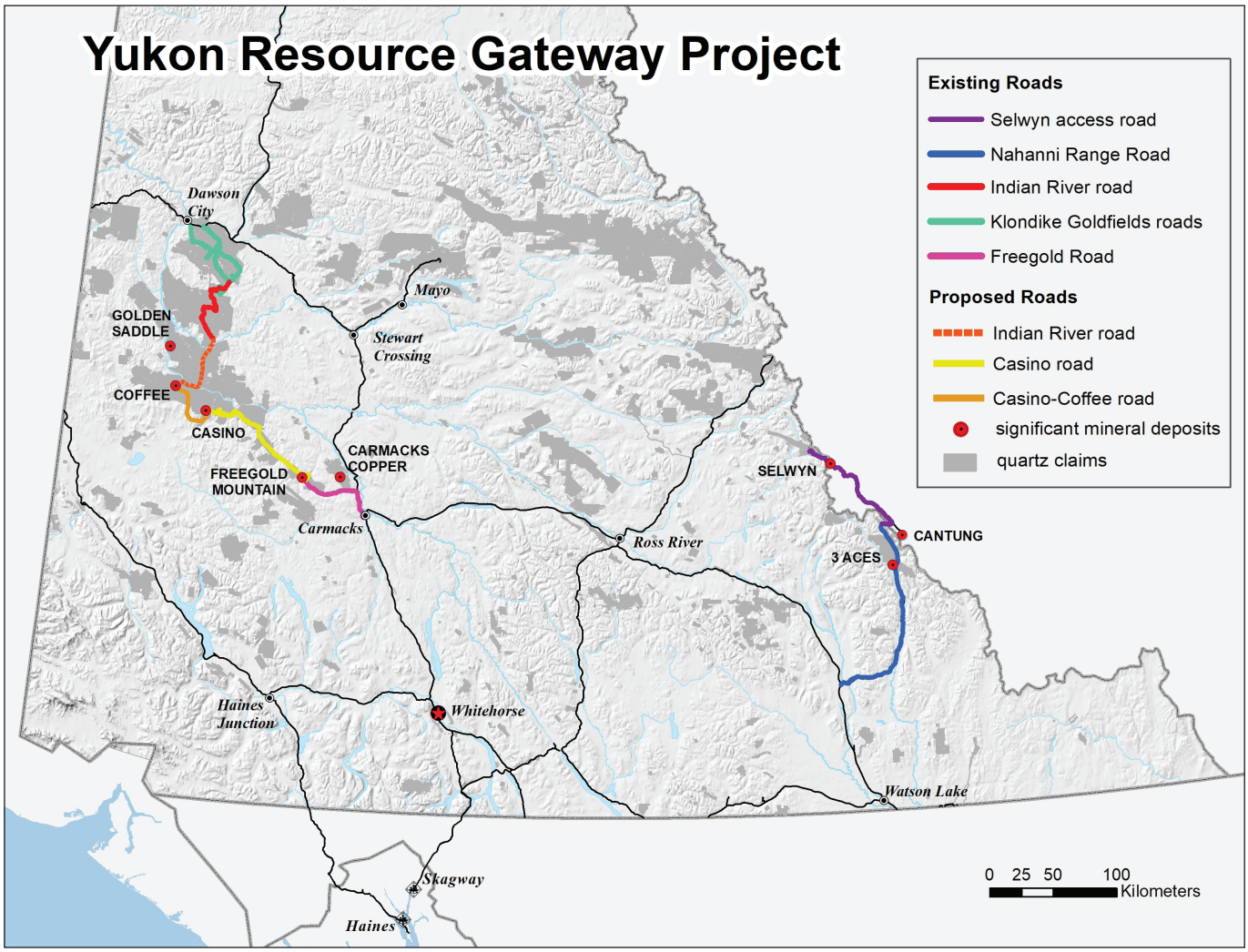

Figure 5. *Yukon Resource Gateway Project – existing and proposed roads.*

MINING

Yukon's sole operating hard rock mine is Capstone Mining Corp.'s (www.capstonemining.com) **Minto** copper-gold-silver mine. Minto produced 29,374,912 lbs of copper, 22,093 ounces of gold and 140,814 ounces of silver in the first nine months of 2017. With the rise in the price of copper, Capstone announced an extension of the mine life to 2020. The company will evaluate other deposits on the site for possible re-inclusion into its reserves, which could extend the life beyond 2020.

Alexco Resources Ltd. (www.alexcoresource.com) is advancing three of its deposits in the Keno Hill silver district. The 2017 exploration program focused on drill-definition of the high-grade **Bermingham** deposit (37 holes, 13 832 m); DDH K-17-0658 intersected 5.15 m of 1547 g/t Ag. A 580 m decline at Bermingham and a 965 m decline for the **Flame & Moth** deposit were both initiated (Fig. 6). The company is planning 5000 m of underground drilling and expects production to begin at Bermingham and the Flame & Moth deposits and to restart at the **Bellekeno** mine by late 2018. An updated resource was announced in January 2017, increasing the district indicated mineral resource approximately 22% to 67.5 million ounces of silver.

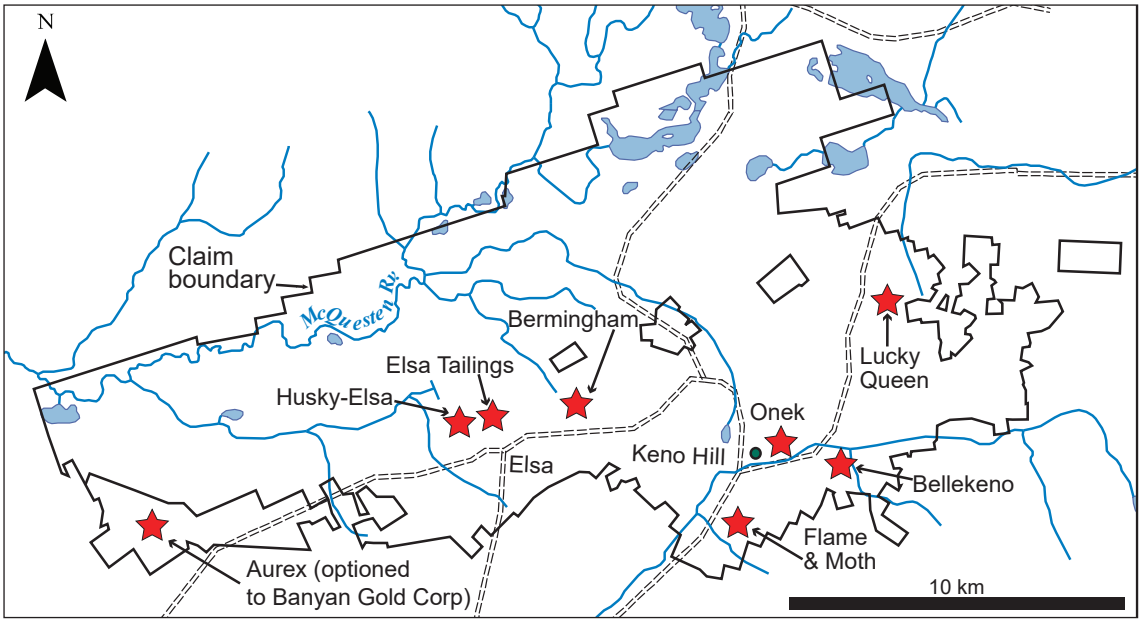

Figure 6. *Sketch of main deposits of Alexco's Keno Hill property.*

The inactive **Wolverine** mine of Yukon Zinc Corporation (www.yukonzinc.com) has been on care and maintenance since January 2015. The company completed an updated National Instrument (NI) 43-101 mineral resource and preliminary economic assessment (PEA) in September 2017 (both unreleased). In October, the company announced that it was seeking new investment partners to restart the mine.

MINE DEVELOPMENT

Victoria Gold Corp. (www.vitgoldcorp.com) began mine development at the **Eagle** intrusion-related gold deposit, within its Dublin Gulch property in central Yukon. Capital Expenditures are estimated at $369 million. Once in full production, the company expects to produce 200,000 ounces of gold per year from the open pit operation. Continued exploration on the property has met with success. Exploratory drilling (14 drillholes) was completed adjacent to and below the proposed Eagle mine pit. Highlights include 607.8 m of 0.56 g/t Au in core from drill hole DG17-930C. The new drill results offer potential for Eagle pit expansion. Overall, exploration on the property included soil sampling, airborne and ground geophysics, trenching and 33 650 m of diamond drilling in 205 holes (Fig. 7).

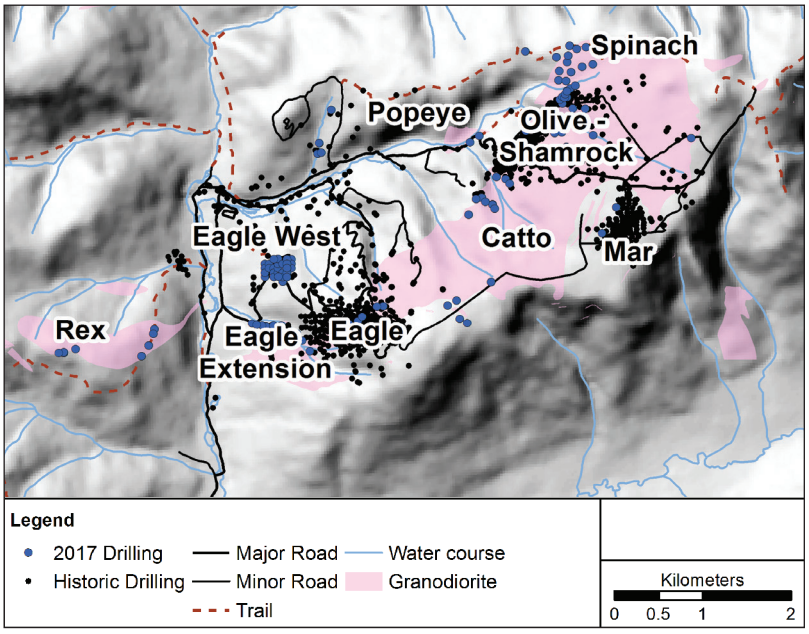

Figure 7. *Plan map of Victoria Gold's Dublin Gulch property, indicating current and historic drilling.*

ADVANCED PROJECTS

Goldcorp Inc. (www.goldcorp.com) continued to advance the **Coffee** gold property in western Yukon. The high-grade gold project is envisioned as a heap leach, open-pit operation. Goldcorp's 2017 exploration program involved more than 68 000 m of reverse circulation and diamond drilling (602 holes). Reported drill highlights include 20.3 m of 7.24 g/t Au in reverse circulation hole CFR1452 at the new AmeriKona zone. Goldcorp also conducted drilling to test the sulphide potential, and is undertaking sulphide metallurgical studies. An application for permitting for the Coffee project was submitted to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) in the spring of 2017. The review board determined that consultation with the First Nations was inadequate. The company is currently in discussions with YESAB and the involved First Nations to determine next steps.

BMC Minerals Ltd. (http://bmcminerals.com), a private company, continued to advance its **Kudz Ze Kayah** volcanogenic massive sulphide (VMS) copper-zinc-lead property in the Finlayson district of east-central Yukon. The 2017 work program included soil sampling, geological mapping, a 3D seismic survey and drilling: 4235 m of diamond drilling in 19 holes and 616 m of RC drilling for geotechnical purposes in 25 holes. Exploration results are pending. An application to develop the ABM deposit on the property was submitted to YESAB in March 2017 and is in the adequacy review stage. A positive pre-feasibility study on the ABM deposit was released in May, 2017. The study envisions an open pit and small underground mine, processing 2 million tonnes per year, and a nine year mine life. In January, BMC acquired the nearby Wolf and Fyre Lake (Kona) VMS deposits, and completed reconnaissance mapping and prospecting on these properties.

Western Copper and Gold Corp. (www.westerncopperandgold.com) delayed its re-submission to the Yukon Environmental and Socioeconomic Assessment Board for its **Casino** copper-gold porphyry deposit in western Yukon. The one-year delay allows the company to work on a redesign of the tailings management facility to address concerns raised during community consultation meetings. In addition, there were concerns about how the access road would impact the Klaza caribou herd. The company continues to carry out environmental baseline work. The project is expected to enter the panel review process at the end of 2018.

PRECIOUS METALS EXPLORATION – GOLD

ATAC Resources (www.atacresources.com) explored its extensive **Rackla Gold** project (Fig. 8) along the northern margin of Selwyn basin. Within the Carlin-style eastern Osiris cluster, the company completed 11 214 m of diamond drilling in 29 holes: DDHOS-17-249 returned two intersections of high-grade gold - 15.24 m of 13.52 g/t Au and 10.42 m of 7.97 g/t Au, extending the Sunrise zone at depth. At the carbonate replacement Tiger gold deposit in the western Rau project, diamond drilling (1371 m in 12 holes) tested for mineralization outside the proposed pit shell. Diamond drill hole RAU-17-156 intersected 56.77 m of 4.08 g/t Au. ATAC received a positive recommendation from YESAB for an access road to the site, and is awaiting final approval for road construction.

In April 2017, Barrick Gold Corp. (www.barrick.com) optioned ATAC Resources Ltd.'s **Orion** block, in the central part of the Rackla Gold property (Fig. 8). Barrick committed to a $4.9 million exploration program at Orion in 2017. Exploration work included soil and rock geochemistry, trenching, mapping and drilling: 2503 m of diamond drilling in 4 holes and 1555 m of reverse circulation drilling in 32 holes. No results have been released to date.

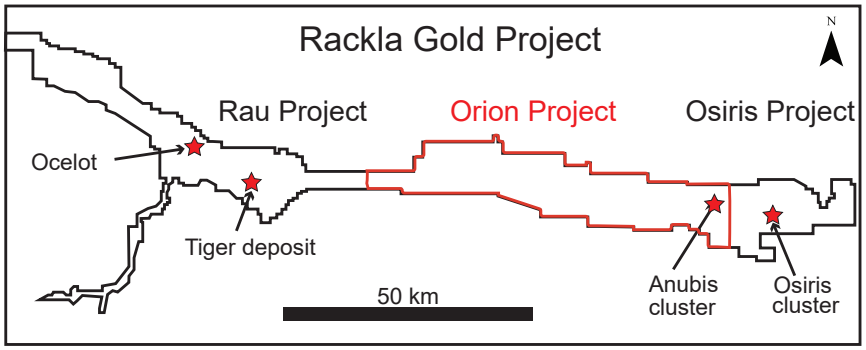

Figure 8. *Map of the Rackla Gold property.*

White Gold Corp. (WGC; www.whitegoldcorp.ca) acquired a substantial land package in the White Gold district from Wildwood Exploration Inc. and Shawn Ryan in 2016. In May 2017, WGC expanded its holdings by acquiring five properties from Kinross Gold, including the **Golden Saddle** (Fig. 9), the original White Gold district discovery. The entire claim package currently includes more than 19 400 claims. In December 2016, Agnico Eagle Mines Ltd. invested $14.5 million in WGC, for a 19.9% interest in the company. WGC completed work on 29 of its properties including the following activities: soil sampling, IP/resistivity surveys, airborne DIGHEM surveys, geological mapping and drilling. Diamond and reverse-circulation drilling at the Golden Saddle deposit focused on twinning holes (for quality assurance and testing for footwall mineralization below historic drilling), as well as infill and step-out drilling. Infill hole WTGS17DD-1070 returned 4.57 g/t Au over 34 m from 155 m depth. Reverse circulation drilling at the nearby Arc extended the deposit strike length by 250 m: WHTARR17RC-002 returned 12.19 m of 1.52 g/t Au. RAB drilling at the Loonie Property returned 4.6 g/t Au over 7.6 m from hole 17LO025. At the JP Ross property, core from diamond drill hole 17JPR002 returned 21.87 g/t Au over 3.05 m.

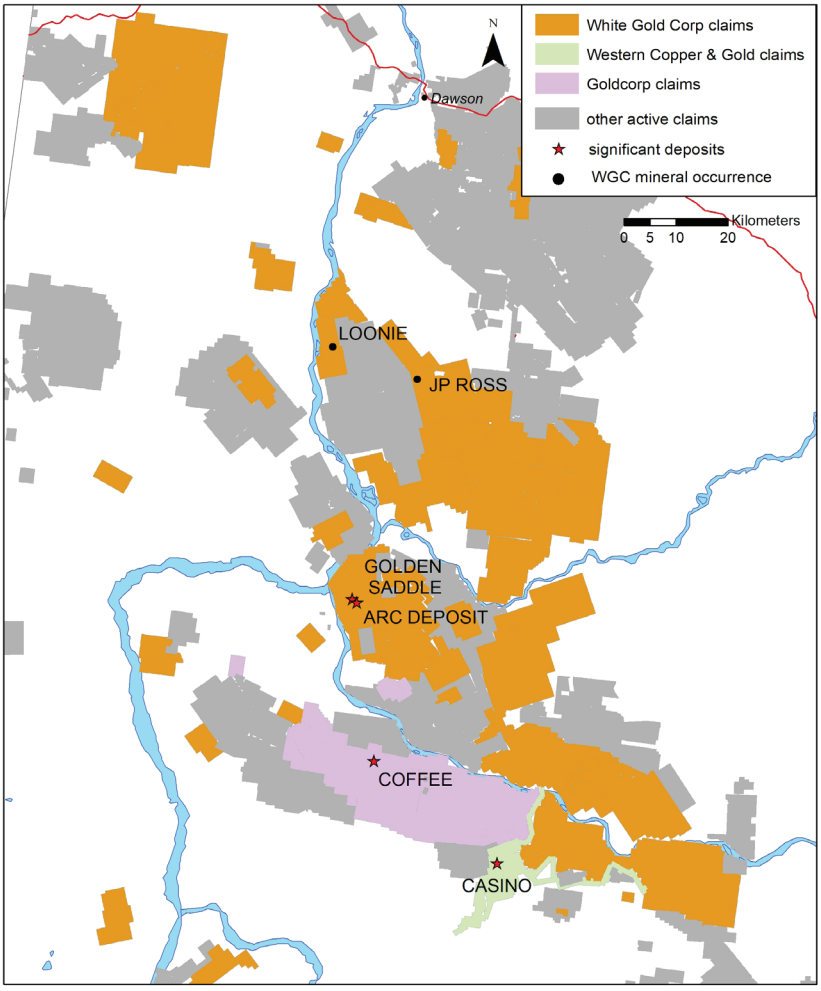

Figure 9. *White Gold Corp. claim holdings.*

Golden Predator Mining Corp. (www.goldenpredator.com) completed an extensive drill program on its **3 Aces** property (Fig. 10) beginning in March 2017: 1905 m of diamond drilling in 20 holes, 17 394 m of reverse circulation drilling in 189 holes, and 115.8 m of rotary air blast (RAB) drilling in one hole. Other work at this property in southeastern Yukon included soil and rock sampling, trenching, geological mapping and road construction. The extensive work uncovered two new gold veins at the Hearts and Clubs zones. Drilling at the Ace of Hearts doubled the known strike length of the vein and increased the length of the Hearts-Clubs corridor to 1.6 km. Drill highlights within the corridor include hole 3A17-203 with a drill intersection of 19.81 m of 3.32 g/t Au. Other highlights include 13.26 g/t Au over 39.63 m in core from 3A17-098, a step-out hole at the Ace of Spades vein.

Rockhaven Resources Ltd. (www.rockhavenresources.com) welcomed an investment from Coeur Mining ($675 000) in March, 2017, for its **Klaza** property in southwestern Yukon. The company continued to advance its flagship epithermal gold-silver property. The company's diamond drill program (15 922 m, 96 holes) included infill, step-out, and drilling for metallurgical studies. Drill highlights include 17.80 g/t Au, 257 g/t Ag, 1.28% Pb and 1.81% Zn over 6.54 m in Hole 398. The company also undertook trenching and geophysics, and conducted engineering studies.

Goldstrike Resources Ltd. (www.goldstrikeresources.com) continued working its flagship **Plateau** gold property. Goldstrike Resources Ltd. struck a deal with Newmont Mining in March of 2017 for the property, in central Yukon. The deal involves cash payments and share purchases totaling $53 million over 10 years and a completed feasibility study to earn 75%. The Phase 1 commitment of the deal requires cash payments and exploration expenditures totaling $14 million in the first 2 years. The exploration program at Plateau

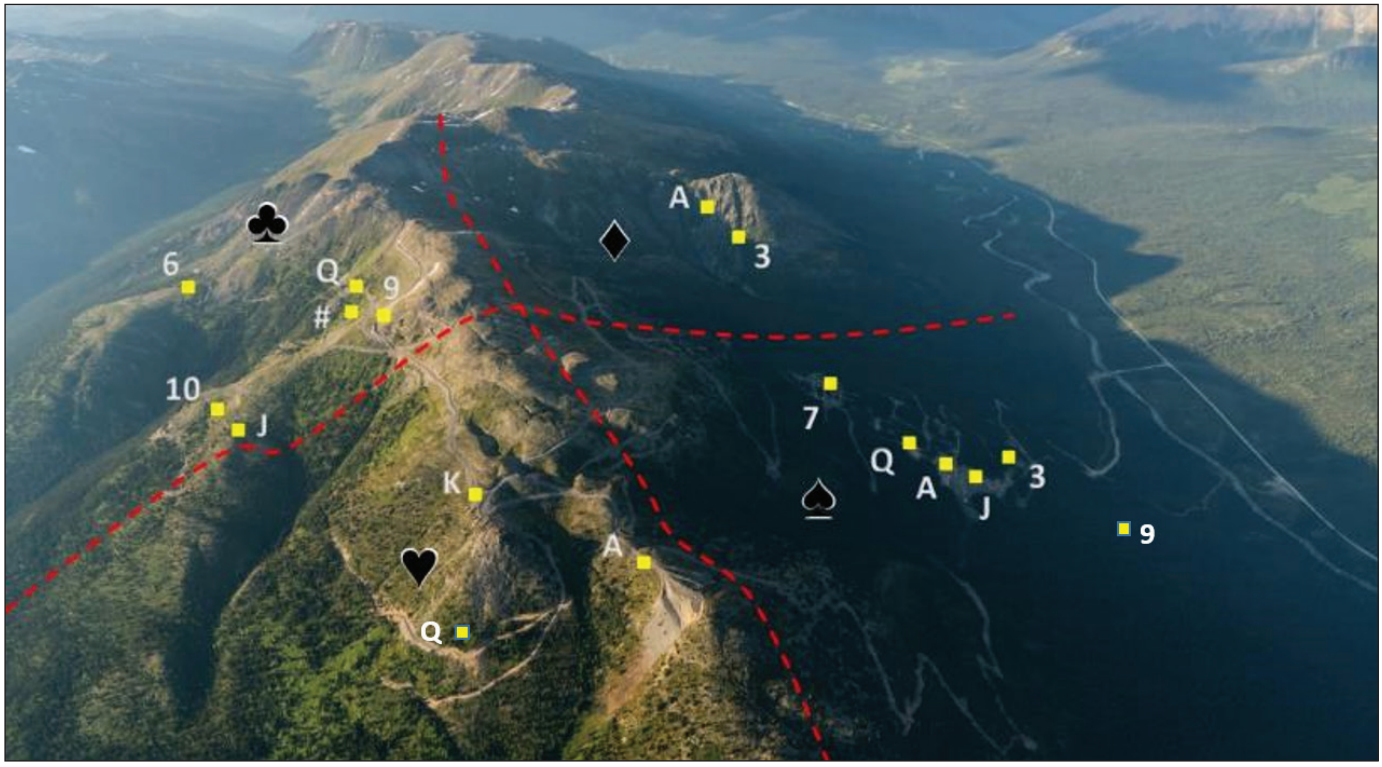

Figure 10. *Annotated aerial photo of 3 Aces property identifying zones and known veins, view looking north. Photo: Golden Predator Mining Corp.*

included 2972 m of diamond drilling in 23 holes, staking, airborne and ground geophysics, remote sensing acquisition, sampling and mapping. Drill hole PBSZ-17-02 intersected multiple mineralized intercepts at the Bonanza zone: 0.5 m of 1.2 g/t Au, 2.0 m of 1.00 g/t Au and 0.5 m of 3.08 g/t Au near surface.

The **Lucky Strike** property of Goldstrike Resources Ltd., in the White Gold district, was drilled for the first time in 2017. The nine hole (1032 m) diamond drilling program at the Monte Carlo zone returned 5.36 g/t Au over 22 m in core from DDLS-17- 09 (Fig. 11). Drilling targeted a 450 by 1450 m geochemical anomaly and coincident magnetic anomaly thought to represent a regional scale shear zone. The company also completed 1091 m of mechanized trenching and a ground magnetic survey.

Goldstrike Resources also staked claims adjacent to the Wels Gold property in southwestern Yukon in 2017 and explored this new property (**Bulls Eye**) with soil sampling and prospecting. The soil survey outlined a 250 by 200 m gold-in-soil anomaly with values up to 215 ppb Au. In addition, the company staked new claims in the Moosehorn area of western Yukon (**Hot Spot** property) and explored with a soil survey and hand pitting. The soil survey outlined a 150 by 150 m gold-in-soil anomaly with values up to 4110 ppb Au.

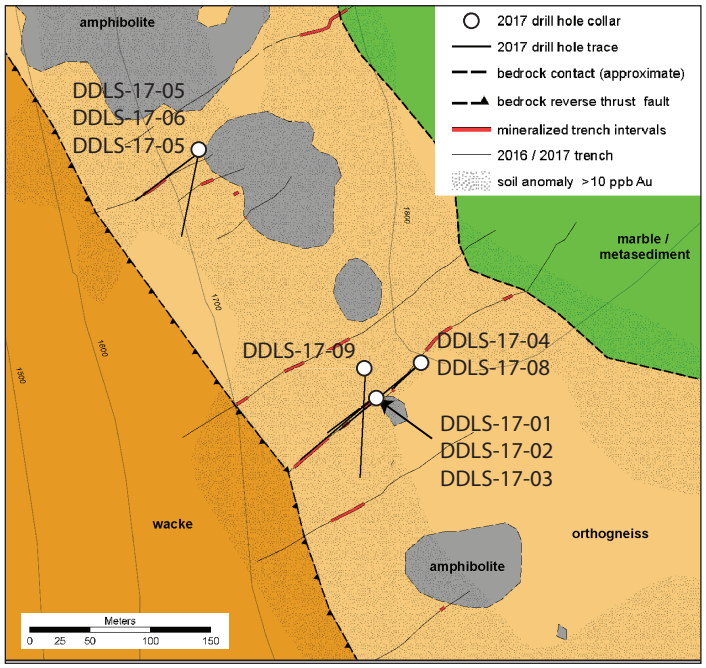

Figure 11. *Lucky Strike drillhole map with geology, modified from Goldstrike image accessed December 7, 2017.*

Triumph Gold Corp. (www.triumphgoldcorp.com) completed a substantial program on its **Freegold Mountain** property: Tinta Hill, Nucleus and Revenue deposits. The company welcomed a $6.3 million investment by Goldcorp which earned Goldcorp a 19.9% interest in Triumph. Work on the property included 35 diamond drillholes (12 904 m) at Revenue and Nucleus, and more than 600 m of trenching and extensive soil sampling at Tinta Hill. Step-out drilling at Revenue demonstrated that the Revenue diatreme is part of a larger porphyry system. East of the Revenue diatreme, at the Blue Sky zone, 57 m of 1.08 g/t gold and 0.285% copper were intersected in diamond drill hole RVD17-13. The company also performed soil sampling and geological mapping at its Severance gold and Tad/Toro copper properties in west-central Yukon.

Klondike Gold Corp. (www.klondikegoldcorp.com) explored its **Klondike Goldfields** property. The company completed 70 diamond drillholes (8620 m) at the Lone Star zone of its Klondike project, targeting the Bonanza, Nugget and Eldorado faults. Diamond drill hole LS17-81 intersected 41.1 m of 2.1 g/t Au. KGC also completed 250-line-kilometres of ground magnetics and VLF-EM surveys between the Lone Star and Quartz Creek showings (Fig. 12).

Banyan Gold Corp. (www.banyangold.com) explored its **Hyland Gold** project in southeastern Yukon with drilling, trenching and soil sampling. The 2017 diamond drill program (3847 m, 25 holes) was designed to expand the defined resource of the Main Zone deposit, but also included drilling for metallurgical studies. Drill hole HY17-062 intersected 27.4 m of 1.26 g/t Au and 4.11 g/t Ag. Banyan also completed a 10 hole diamond drill program (1422 m) at its newly optioned Aurex-McQuesten property, 15 km south of the Dublin Gulch property. At McQuesten, drill hole MQ17-026 intersected 157 m of 0.6 g/t Au and 1.1 g/t Ag, starting from surface. At Aurex, drill hole AX17-028 intersected 1.0 g/t Au over 1.32 m. Soil sampling, trenching and an airborne geophysical survey were also carried out.

Arcus Development Group Inc. (www.arcusdevelopmentgroup.com) completed a 20-hole reverse circulation drill program (2880 m) at its **Dan Man** gold property adjacent to the Coffee gold project. Drilling tested gold-in-soil anomalies and structural zones interpreted from a magnetic survey. Results include 7.62 m of 2.13 g/t Au in hole RC-RB-17-05 at the Rooibos Zone (Fig. 13).

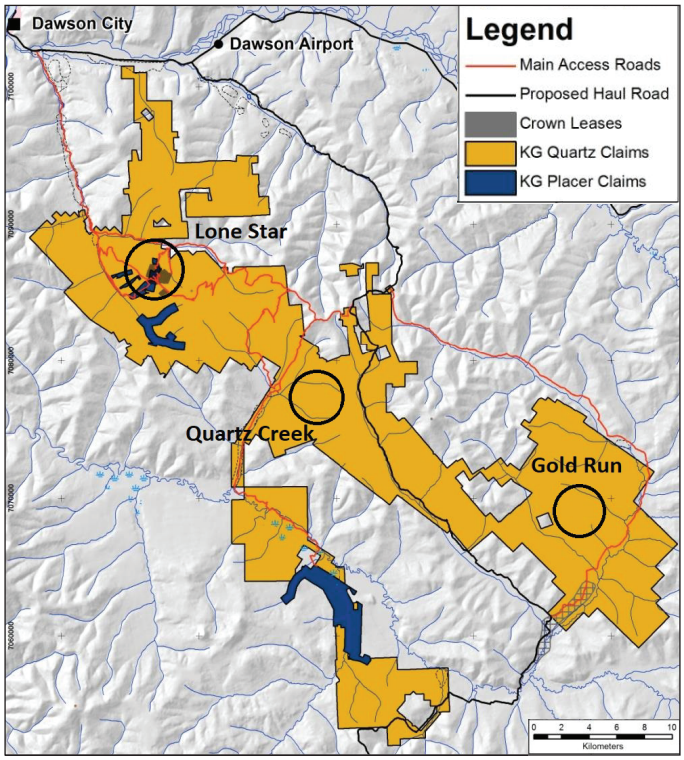

Figure 12. *Claim map of Klondike Goldfields property of Klondike Gold Corp., modified from Klondike Gold Corp. corporate presentation, December, 2017.*

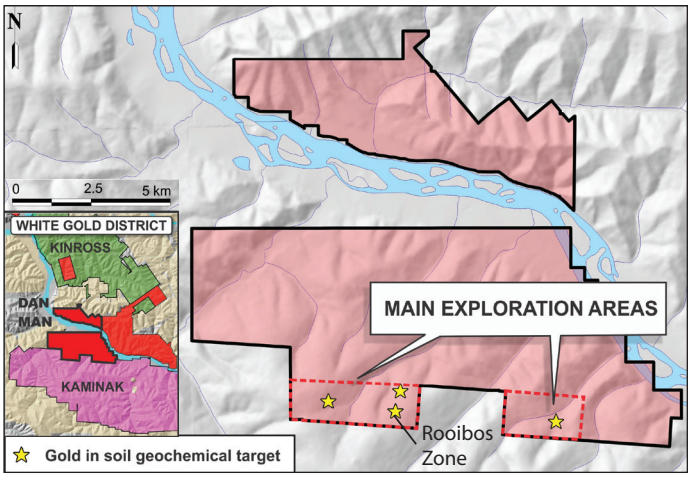

Figure 13. *Main exploration areas at the Dan Man property of Arcus Development Group. Modified from Arcus Development Group graphic accessed December 7, 2017.*

Comstock Metals Ltd. (www.comstock-metals.com) explored its **QV** gold property (11 km north of the Golden Saddle deposit in the White Gold district) with a 1500 m diamond drill program. The program tested the along-strike potential of the VG deposit. The company also completed detailed soil sampling grids. Results are pending.

Provenance Gold Corp. (http://provenancegold.com) optioned claims in the Moosehorn Range of western Yukon in 2016. The company performed soil and rock geochemical surveys, geological mapping and diamond drilling in 2017. The soil program covered an area of gold-bearing quartz veins uncovered during road construction located near the intersection of a large north-trending structural zone and an interpreted northeast-southwest trending lineament. A 1.8-m chip sample uphill of the trenches returned a value of 122.5 g/t Au. The drill program (1836 m in 13 holes) focused on the Kenyon Creek headwaters area, and on a potential lode gold source area of the Great Bear Creek placer operations. Assay results are pending.

K2 Gold Corp. (http://K2gold.com) completed infill and step-out diamond drilling (1232 m, 11 holes) at its **Wels** intrusion-related gold property in southwestern Yukon, extending the discovery Saddle zone. Highlights include 2.37 g/t Au over 28.50 m in DDH17-06. The company discovered a new mineralized zone (Southwest Spur) through prospecting 1.2 km southwest of the Saddle zone, which is hosted in highly altered and fractured mafic rock. K2 Gold also explored the Flume and Storck projects in west Yukon. The Storck program involved ridge and spur soil sampling (peak values of 144.6 ppb gold). The Flume program involved soil sampling, prospecting and trenching. The company outlined a 1.2 by 3 km soil anomaly with assays up to 247 ppb Au. Prospecting returned mineralized samples, including one sample up to 4.76 g/t Au.

Independence Gold Corp. (www.ingold.ca) worked its **Boulevard** property, which is contiguous with Goldcorp's Coffee property in the White Gold district. The company completed 977.5 m of drilling in nine diamond drillholes along the 2.4 km long Sunrise-Sunset zone. In diamond drill hole BV17-60 drilling intersected 2.97 g/t Au over 4.5 m (Fig. 14). Extensive sampling outlined five new gold-in-soil trends on the property and extended the Kahiltna

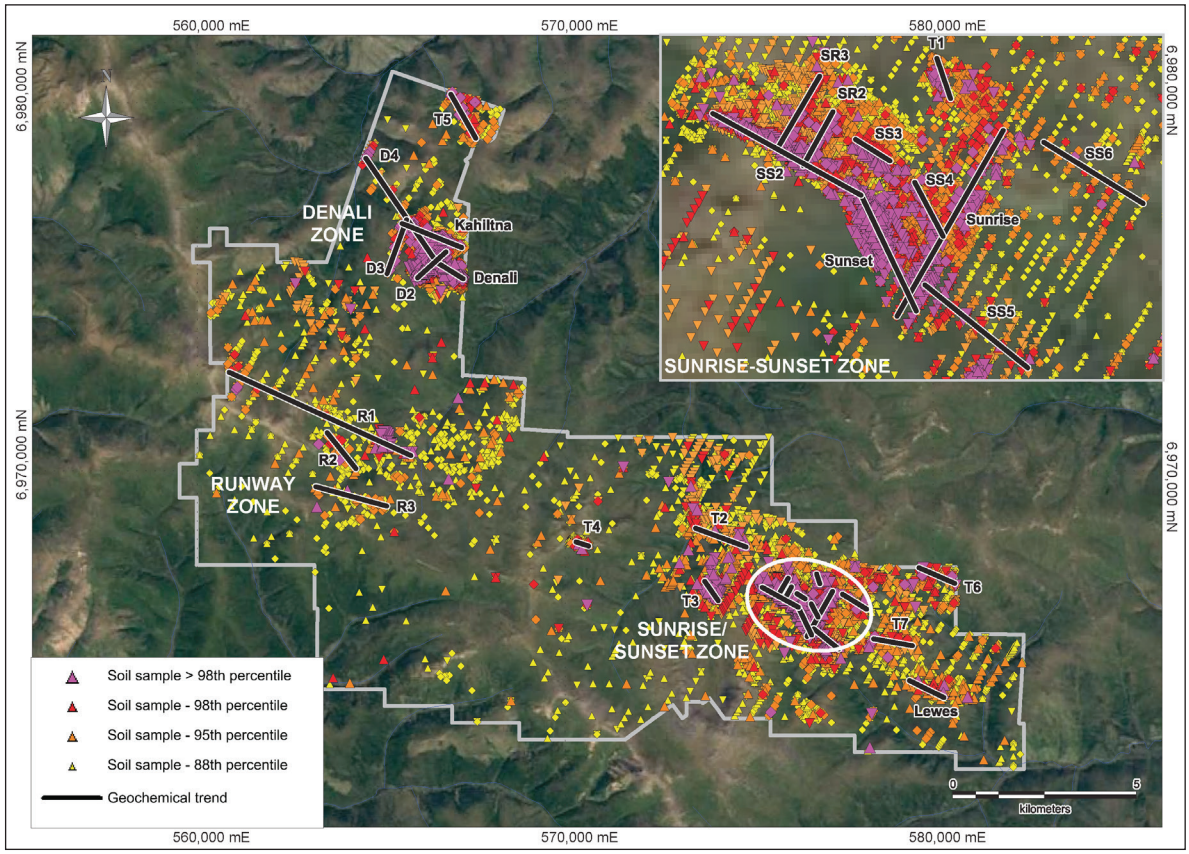

Figure 14. *Zones and soil geochemistry at the Boulevard property of Independence Gold, modified from Independence Gold graphic accessed December 7, 2017.*

gold-in-soil anomaly. Independence also performed prospecting, geological mapping and trenching on its Moosehorn property in west-central Yukon and soil sampling and geoprobe testing at its Henderson Property in the White Gold district.

Kestral Gold Inc. (http://www.kestrelgold.com) drilled the **Val-Jual** property south of Dawson City in west-central Yukon (13 reverse circulation holes, 922 m). Drilling intersected anomalous gold mineralization hosted in granite; drill hole 17RC-01 intersected 13.7 m of 0.93 g/t Au. Drill hole 17RC-11, returned low-grade gold throughout most of its length, returning an intercept of 0.205 g/t Au over 59.13 m.

Zonte Metals Inc. (http://www.zontemetals.com) diamond drilled its intrusion-related **McConnell's Jest** gold project (Fig. 15), 15 km east of Victoria Gold's Eagle gold deposit. This newly discovered property underwent a modest five-hole drill program (1027 m). Drill highlights include 29.6 m of 0.53 g/t Au in hole MJ-04.

Strikepoint Gold Inc. (www.strikepointgold.com) worked its extensive claim packages in the Mayo, Kluane and North Canol regions. At the Mayo properties, the company completed 630 m of diamond drilling in six holes at **Mahtin** and **May-Qu**. Mahtin drilling highlights included 1.80 g/t Au over 3.05 m and 1.62 g/t Au over 4.57 m in hole 17MAH02. At May-Qu, hole 17MAY03 intersected 0.68 g/t Au over 3.05 m. At the North Canol properties, surface grab samples at **Golden Oly** returned up to 10.65 g/t Au, up to 364 g/t Ag and up to 0.52% Cu. At **PDM**, surface grab samples returned up to 9.8 g/t Au, 2.8% Cu and 245 g/t Ag. In the Kluane region, at the **Pluto** property, 12 RAB drill holes were completed (1294 m), along with geological mapping and prospecting. Highlights include intersecting 15.24 m of 1.05 g/t Au in hole 17-CRN-02.

Trifecta Gold Ltd. (www.trifectagold.com) explored its road-accessible **Trident** property in the White Gold district. The company carried out a soil sampling program and diamond-drilled five holes (546.5 m) to extend mineralization intersected in 2013 drilling. Highlights include drill hole SE-17-001 which intersected several mineralized zones: 2.13 m of 1.425 g/t Au, 5.00 m of 0.665 g/t Au and 2.45 m of 1.048 g/t Au. Grassroots programs were undertaken at its **Treble, Triple Crown** and **Eureka** properties. Soil sampling, prospecting and hand trenching were carried out at Treble and Triple Crown in west-central Yukon. At Treble, peak soil sample values were 135 ppb; the highest rock sample result was 0.885 g/t Au from a limonitic hydrothermal breccia. At Triple Crown, one grab sample assayed 1465 g/t Ag, 52.5% Pb and 0.176 g/t Au. At Eureka, in the White Gold district, grid soil samples returned values up to 545 ppb Au.

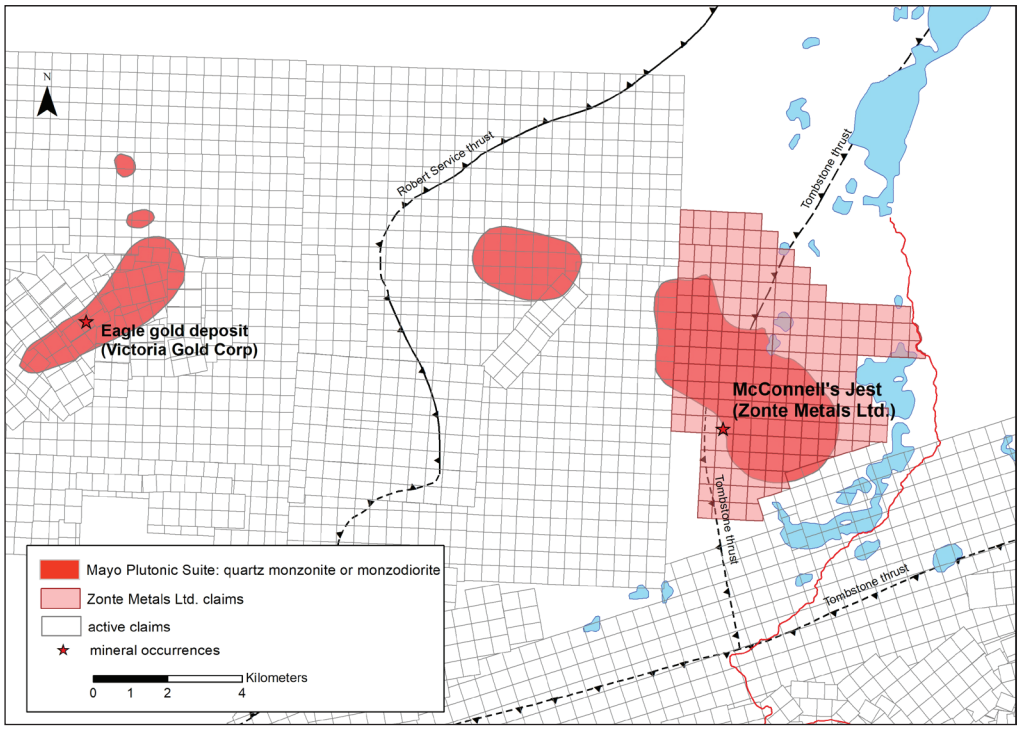

Figure 15. *Location of Zonte Metals' McConnell's Jest property with respect to Victoria Gold Corp.'s Dublin Gulch property.*

Mayo Lake Minerals (www.mayolakeminerals.com), a private company, drilled its **Anderson Gold** property in central Yukon for the first time in 2017 (Fig 16). The reverse circulation program comprised 640 m of drilling in 8 holes on two separate sections, 50 m apart. The program revealed a new bedrock vein gold system with two mineralized structures correlated across both fences. The gold is associated with arsenic, antimony and mercury. Drill hole RCH MLM17-005 intercepted 0.77 g/t Au over 6.1 m starting at 3.0 m depth.

Four Nines Gold Inc. (www.fourninesgold.ca) undertook exploration on the **Mariposa** property in the White Gold district. A total of 15 trenches were completed over Hackly, Skookum Main and Skookum West. The focus of the trenching was to establish controls and trends of mineralization on strike between zones. The gold-bearing, structurally controlled targets remain open in all directions, and Four Nines has refined the overall geological setting in planning for a 2018 drill program. Several access trails were also established in the area, and road improvements were completed on the property that will facilitate future work. Significant results from trenching include 4.5 m of 1.68 g/t Au in TR17-13.

Nevada Zinc's (www.nevadazinc.com) majority-owned subsidiary (Generic Gold Corporation) worked the **VIP** gold property in western Yukon. The field program included trenching, soil sampling, prospecting, geological mapping and geoprobe sampling. Excavator trenching on the 700-m-long Big Creek soil anomaly identified strong oxidation and alteration. Results are pending.

A newly formed company - Territory Metals Corp. (www.territorymetals.com) - acquired several claim blocks from Strategic Metals Ltd. in central Yukon: the gold-silver **Hinton, Plata** silver and **Lanlo** gold properties. The company worked the Lanlo gold prospect, contiguous with Goldstrike's Plateau property in central Yukon, conducting geological mapping, prospecting and soil sampling. Results are pending.

Cantex Mine Development Corp. (www.cantex.ca) focused on its **North Rackla** property with a planned diamond drill program of five holes targeting a gold-lead-zinc-silver mineralized dolomite unit. Results are pending.

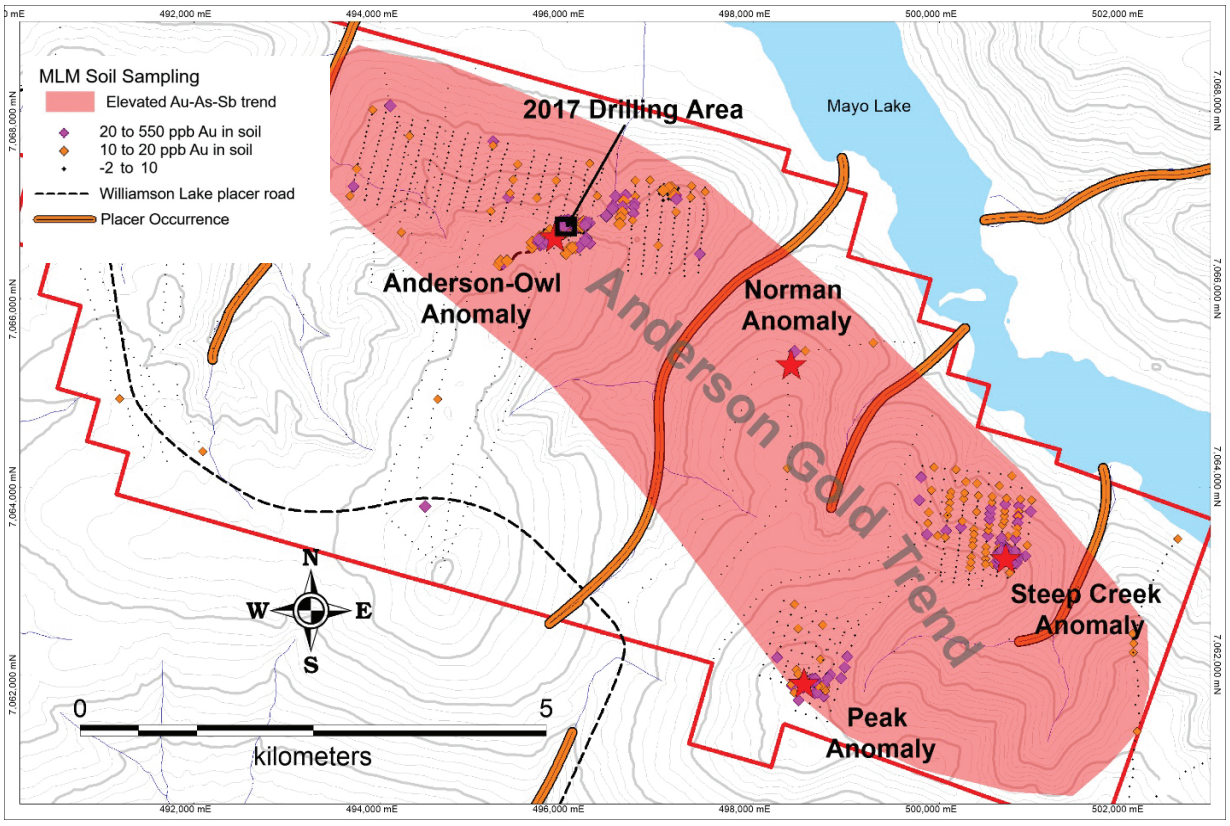

Figure 16. *Location of drilling at Mayo Lake Minerals' Anderson Gold property. Orange lines denote placer producing streams. Graphic accessed November 16, 2017.*

Taku Gold Corp. (www.takugold.com) soil sampled its newly acquired **McQ** property in the Mayo region; results returned up to 260 ppb Au. The gold-in-soil anomaly extends 300 m in a westerly direction. Gold is correlated with arsenic values up to 1682 ppm.

PRECIOUS METALS EXPLORATION – SILVER

Metallic Minerals Corp. (www.metallic-minerals.com) explored its **Keno Silver** project in the historic Keno Hill silver district. The company identified 12 exploration targets over the winter and conducted soil sampling, mapping, trenching and VLF/magnetic geophysical surveys prior to drilling. Metallic drilled 1320 m in 14 holes, intersecting 407 g/t Ag, 0.834 g/t Au, 6.35% Zn and 3.39% Pb over 2.65 m in hole CH17-021 and 1 405 g/t Ag, 0.282 g/t Au, 3.72% Zn and 25.98% Pb over 1.6 m in hole CH17-23 at the Caribou target area. At the McKay Hill property (Fig. 17), the program consisted of prospecting and geological mapping. Assays from 13 grab and chip samples were between 372 and 988 g/t Ag, and between 0.18 and 24.4 g/t Au. Other results include up to 77.8% Pb, a peak of 14.7% Zn, and up to 7.97% Cu.

The **Silver Hart** property of CMC Metals Ltd. (www.cmcmetals.ca) in southern Yukon was drilled with 14 shallow holes for a total of 843 m. Drilling was designed to confirm and infill historic results and extend known mineralization. Drill results from CMC17-01 intersected 2 m of 117 g/t Ag, 4.03% Pb and 5.11% Zn. The property is approximately 60 km north of the Silvertip mine in British Columbia, which was bought by Coeur Mining in September, 2017.

The **Michelle** property of Silver Range Resources Ltd. (www.silverrangeresources.com) underwent prospecting, geological mapping and hand trenching (Fig. 18). At the Prairie Dog showing, 18 out of 31 grab samples assayed greater than 1% zinc, with a peak value of 46.43% Zn. Mineralized float from the Cirque Showing returned up to 30.5% Zn and 172 g/t Ag.

NICKEL-COPPER-PLATINUM GROUP METALS EXPLORATION

Wellgreen Platinum Ltd. (www.wellgreenplatinum.com) continued to advance its mafic/ultramafic intrusion-hosted nickel-copper-PGM (platinum group metals) **Wellgreen** deposit in southwestern Yukon. A new preliminary economic assessment (PEA) was released in the spring of 2017; it envisions capital costs of $586 million for the mine and a 25 year mine life. Wellgreen also released an updated mineral resource for the project; it estimates a measured and indicated mineral resource of 362 million tonnes hosting 2.08 billion pounds of nickel, 6 million ounces of PGMs plus gold, 1.1 billion pounds of copper and 121 million pounds of cobalt, as well as a significant inferred resource. The company conducted 2720 m of diamond drilling in 15 holes, focusing on a combination of infill and metallurgical holes. Results are pending. The program also included surface mapping and rock chip sampling to test the extension of mineralization to the east and north of the main deposit. In addition to metallurgical testing, the company is conducting flowsheet optimization and pilot plant testing.

Figure 17. *Lauren Blackburn, project geologist with Metallic Minerals at the McKay Hill silver property.*

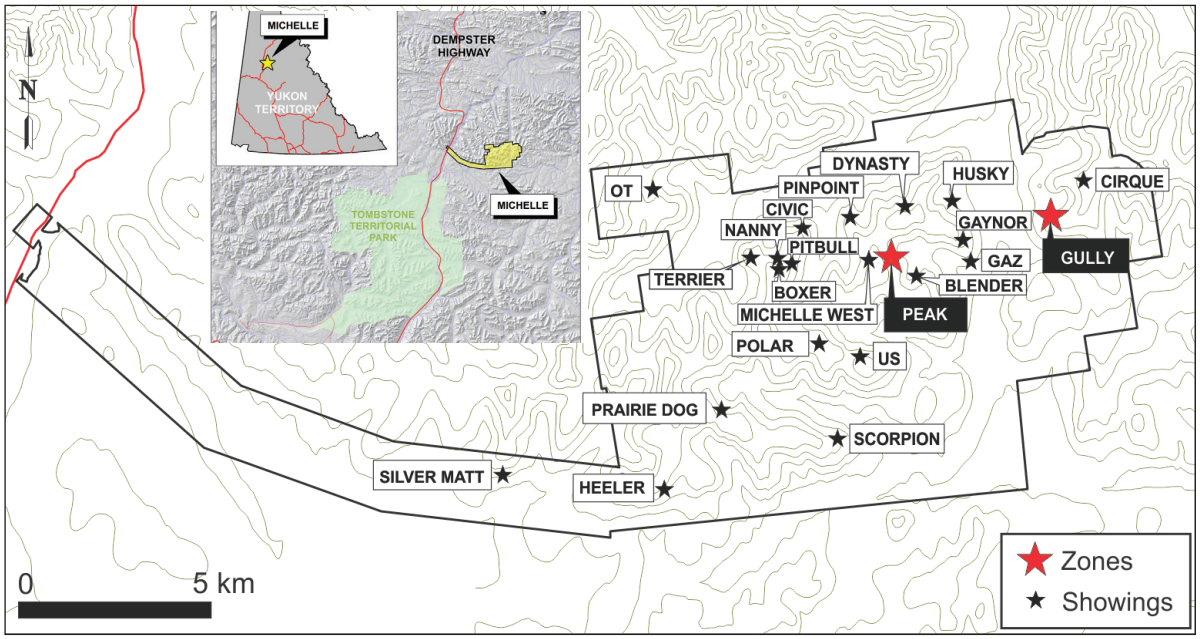

Figure 18. *Map indicating the location of Silver Range Resources' Michelle property and the location of showings on the property, modified graphic accessed from Silver Range December 11, 2017.*

Group Ten Metals Inc. (www.grouptenmetals.com) worked its Kluane area Ni-Cu-PGE properties: **Catalyst, Spy** and **Ultra**. The 2017 exploration program included prospecting, geological mapping and rock sampling. Results are pending.

BASE METALS EXPLORATION

Copper North Mining Corp. (www.coppernorthmining.com) conducted a drill program on its **Carmacks Copper** copper-gold-silver property in central Yukon. The company completed 4000 m of diamond drilling in 32 holes. Zone 2000s and zone 13 were drill-tested. As well, the company drilled 3 "wildcat" holes. Assay results are pending.

Newly formed company Fireweed Zinc (http://www.fireweedzinc.com/) acquired the **Tom** and **Jason** sedimentary exhalative lead-zinc deposits comprising the Macmillan Pass project in December 2016 from Hudbay Minerals (Fig.19). Their 2017 program included 2202 m of diamond drilling in 14 holes, helicopter-borne VTEM/magnetics, LiDAR, aerial photography, geochemical sampling and geological mapping. The drill program was designed to verify historic results, step-out from the defined resource and produce samples for metallurgical studies. Highlights include drill hole TS17-03 which intersected 10.2% Zn, 6.3% Pb and 87.7 g/t Ag over 24.4 m; and drill hole JS17-06, which returned 13.2% Zn and 3.4% Pb over 26.3 m. An updated 43-101 resource incorporating drill results is expected by the end of 2017.

Cariboo Rose Resources Ltd. (www.caribooorose.com) completed reverse-circulation drilling (2142 m in 24 holes) on its Canadian Creek copper-gold project, sandwiched between the Coffee and Casino properties. The drill program tested a multi-kilometre soil geochemical anomaly. Many of the holes returned low-grade gold intersections. The most significant intersection returned 4.46 g/t Au over 1.52 m at the Kana target in hole CCRC17-23. The company also carried out ground geophysics and infill soil sampling within a multi-kilometre long gold-arsenic± antimony geochemical anomaly.

Newcomer Benz Mining Corp. (www.benzmining.com) worked the **Mel** property in southeastern Yukon, performing trenching and diamond drilling. Benz Mining Corp. acquired the strata-bound zinc-lead-barite property in March, 2017 (Fig. 20). The work program for the season included infill diamond drilling (nine drillholes, 2114 m) at the Mel Main zone and mapping, excavator trenching and a metallurgical study. Drilling highlights include 6.0% Zn, 0.1% Pb, 1.1 g/t Ag over 5.65 m in hole MEL-17-052 and 12.90 m of 8.45% Zn and 0.26% Pb in hole MEL-17-058.

Strategic Metals (www.strategicmetalsltd.com) conducted modest programs on 11 of its properties, including the **Vault** in southwestern Yukon where impressive gold-in-soil anomalies up to 10000 ppb were returned. At the copper-silver Saloon prospect, in south-central Yukon, which was drilled for the first time in 2016, geochemical

Figure 19. *Stacks of historic core at the Macmillan Pass project of Fireweed Zinc. Photo: Yukon government.*

surveys expanded the soil anomaly to 1.8 km along trend. At **Meloy**, in west-central Yukon, sampling and mapping has outlined a porphyry target with high copper-in-soil values (up to 4520 ppm) within a 7 by 3 km area. Rock sampling returned up to 8.7% Cu, 560 g/t Ag, 1.47% Mo, 1.06 g/t Au, 3.51% WO_3 and more than 1% Zn. **Sawbuck**, a new silver occurrence in central Yukon near Keno Hill, returned rock values from 105 to 3160 g/t Ag.

The original exploration plan at the **Blende** lead-zinc-silver Mississippi Valley-type property was scaled back. Blind Creek Resources Ltd. (www.blindcreekresources.com) completed a short program of sampling historic drill core for metallurgical studies at this property in central Yukon.

For further up-to-date information on all 2017 projects, please see the online Exploration Activity ArcGIS map at http://yukon2.maps.arcgis.com/home/index.html.

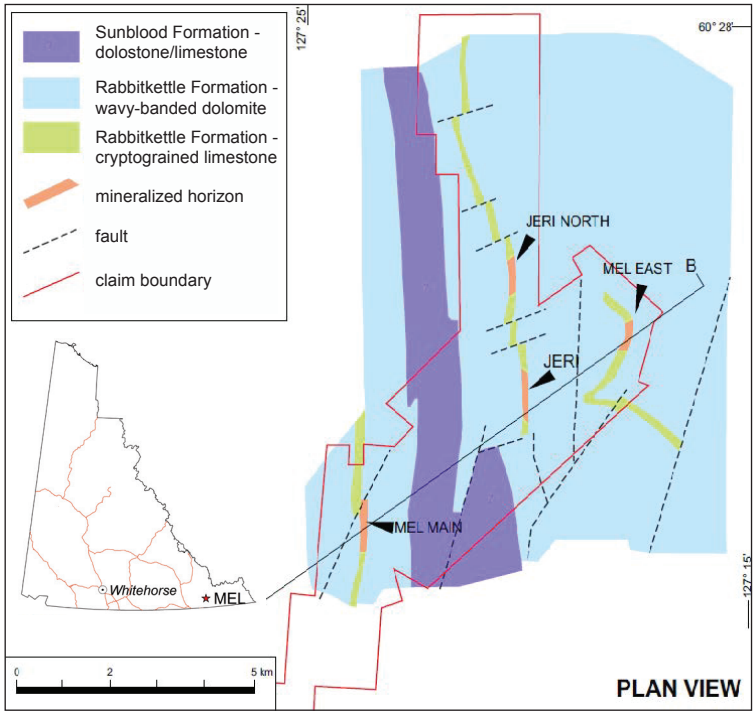

Figure 20. *Geological map of Benz Mining Corp.'s Mel property, modified from graphic accessed from Benz Mining December 11, 2017.*

APPENDIX 1. EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
2K Gold	Provenance Gold Corp.	115N 024	Gold	vein/breccia	grassroots - never drilled
3 Aces	Golden Predator Mining Corp.	105H 066	Gold	vein/breccia	diamond drilled
Anderson Gold Trend	Mayo Lake Minerals	-	Gold	vein/breccia	R/C drilled
Aurex-McQuesten	Banyan Gold Corp.	105M 060	Gold	skarn/replacement	diamond drilled
Ballarat	Stakeholder Gold Corp.	115J 061	Gold	porphyry/sheeted vein	diamond drilled
Barker	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Bent	Richards, Gord	-	Copper	unclassified	grassroots - never drilled
Bermingham	Alexco Resource Corp.	105M 086	Silver	vein/breccia	43-101 defined deposit
Betty	White Gold Corp.	115J 070, 074	Gold	vein/breccia	R/C drilled
Black (Tombstone)	Strategic Metals Ltd.	-	Gold	vein/breccia	grassroots - never drilled
Black Hills	White Gold Corp.	-	Gold	vein/breccia	grassroots - never drilled
Blende	Blind Creek Resources Ltd.	106D 064	Zinc-Lead	Mississippi Valley-type	43-101 defined deposit
Bonanza	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Boulevard	Independence Gold Corp.	115J 050	Gold	porphyry/sheeted vein	diamond drilled
Bulls Eye	Goldstrike Resources Ltd.	-	Gold	unclassified	grassroots - never drilled
Canadian Creek	Cariboo Rose Resources Ltd.	115J 101	Copper	multiple	diamond drilled
Carmacks Copper	Copper North Mining Corp.	115I 008	Copper	porphyry/sheeted vein	43-101 defined deposit
Carmacks	Prior, Glen	-	Gold	vein/breccia	grassroots - never drilled
Catalyst	Group Ten Metals Inc.		Nickel-PGE	mafic/ultramafic associated	grassroots - never drilled
Clear Creek	Kestrel Gold Inc.	115P 023	Gold	vein/breccia	diamond drilled
Cliff	Berdahl, Scott	-	Gold	unclassified	grassroots - never drilled
Coffee	Goldcorp Inc.	115J 110, 111	Gold	vein/breccia	43-101 defined deposit
Copper	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Dabb	Strategic Metals Ltd.	-	Gold	unclassified	grassroots - never drilled

APPENDIX 1 (continued). EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
Dan Man	Arcus Development Group Inc.	115J 112	Gold	vein/breccia	diamond drilled
Dime	White Gold Corp.	-	Gold	vein/breccia	RAB drilled
Dublin Gulch (Eagle)	Victoria Gold Corp.	106D 025	Gold	porphyry/sheeted vein	mine development
Eureka	Trifecta Gold Ltd.	115O 057	Gold	vein/breccia	diamond drilled
Eureka Dome	Pacific Ridge Exploration Ltd.	-	Gold	vein/breccia	grassroots - never drilled
Expo	Berdahl, Ron	-	Zinc-Lead	volcanic associated	grassroots - never drilled
Flume/Storck	K2 Gold Corp.	115N 110	Gold	skarn/replacement	diamond drilled
Freegold Mountain	Triumph Gold Corp.	105I 042, 058, 107	Gold	multiple	43-101 defined deposits
Gladman	Mann, Bill	-	Gold	unclassified	grassroots - never drilled
Gold Source	Goldstrike Resources Ltd.	-	Gold	unclassified	grassroots - never drilled
Golden Culvert	Stratabound Minerals Corp.	105H 067	Gold	vein/breccia	grassroots - never drilled
Golden-Oly	Strikepoint Gold Inc.	-	Gold	porphyry/sheeted vein	grassroots - never drilled
Goodman	Nevada Zinc Corp.	106C 025	Gold	vein/breccia	grassroots - never drilled
Grabben Gold	Kreft, Bernie	-	Gold	unclassified	grassroots - never drilled
Grew Creek	Quantum Cobalt Corp.	105K 009	Gold	vein/breccia	43-101 defined deposit
Ham (Tombstone)	Strategic Metals Ltd.	-	Gold	unclassified	grassroots - never drilled
Hartless Joe	Strategic Metals Ltd.	105D 203	Gold	volcanic associated	grassroots - never drilled
Hayes	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Henderson	Independence Gold Corp.	-	Gold	vein/breccia	RAB drilled
Hess	Anthill Resources Ltd.	-	Gold	unclassified	grassroots - never drilled
Hess River	Bluenose Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Hotspot	Goldstrike Resources Ltd.	-	Gold	unclassified	grassroots - never drilled
Hunker	White Gold Corp.		Gold	unclassified	grassroots - never drilled
Hyland Gold	Banyan Gold Corp.	095D 011	Gold	vein/breccia	43-101 defined deposit

APPENDIX 1 (continued). EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
Ike	Argus Metals Corp.	-	Gold	sediment associated	grassroots - never drilled
Ind	White Gold Corp.	-	Gold	porphyry/sheeted vein	diamond drilled
JP Ross	White Gold Corp.	-	Gold	vein/breccia	diamond drilled
Justin	Aben Resources Ltd.	105H 035	Gold	vein/breccia	diamond drilled
Kamatash	AKG Exploration Inc.	-	Jade	mafic/ultramafic associated	grassroots - never drilled
Keno Silver	Metallic Minerals Corp.	-	Silver	vein/breccia	diamond drilled
King Solomon	Kestrel Gold Inc.	-	Gold	vein/breccia	diamond drilled
Kings Ransom	Goldstrike Resources Ltd.	-	Gold	unclassified	grassroots - never drilled
Klaza	Rockhaven Resources Ltd.	115I 067	Gold	vein/breccia	43-101 defined deposit
Klondike Goldfields (Lone Star)	Klondike Gold Corp.	115O 072	Gold	vein/breccia	43-101 defined deposit
Kluane properties (Sapphire, Kilo, Agate, Garnet/Topaz, Pluto)	Strikepoint Gold Inc.	-	Gold	unclassified	grassroots - never drilled
Kryptos	Mieras, Jeff	-	Gold	vein/breccia	grassroots - never drilled
Kudz Ze Kayah	BMC Minerals	105G 117	Zinc-Lead	volcanic associated	43-101 defined deposit
Ladue	K2 Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Lance	Territory Metals Corp.	105N 009	Gold	vein/breccia	grassroots - never drilled
Lanlo	Territory Metals Corp.	-	Gold	unclassified	grassroots - never drilled
Leota	Goldbank Mining Corp.	115O 074	Gold	vein/breccia	grassroots - never drilled
Line	White Gold Corp.	-	Gold	vein/breccia	grassroots - never drilled
Lois	Territory Metals Corp.	-	Gold	vein/breccia	grassroots - never drilled
Loonie	White Gold Corp.	-	Gold	vein/breccia	diamond drilled
Lucky Joe	Taku Gold Corp.	115O 051	Copper	porphyry/sheeted vein	diamond drilled
Lucky Strike	Goldstrike Resources Ltd.	-	Gold	vein/breccia	diamond drilled
Luxor (Sheba, Ophir, Hav)	Eureka Resources Inc.	-	Gold	vein/breccia	grassroots - never drilled
Mahtin	Strikepoint Gold Inc	115P 007	Gold	vein/breccia	diamond drilled

APPENDIX 1 (continued). EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
Mariposa	Four Nines Gold Inc.	115O 075	Gold	vein/breccia	diamond drilled
Mars	Strategic Metals Ltd.	-	Gold	vein/breccia	diamond drilled
May/Qu	Strikepoint Gold Inc.	-	Gold	vein/breccia	diamond drilled
McConnell's Jest	Zonte Metals Inc.	106D 055	Gold	porphyry/sheeted vein	diamond drilled
McKay Hill	Metallic Minerals Corp.	-	Silver	vein/breccia	diamond drilled
McQ	Ryan, Shawn	-	Gold	unclassified	grassroots - never drilled
McQ (Taku)	Taku Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Mel	Benz Mining Corp.	095D 005	Zinc-Lead	sediment associated	43-101 defined deposit
Meloy	Strategic Metals Ltd.	115G 070, 071	Copper	porphyry/sheeted vein	grassroots - never drilled
Michelle	Silver Range Resources Ltd.	116A 016	Zinc-Lead	sediment associated	diamond drilled
Midas Touch	Strategic Metals Ltd.	-	Gold	sediment associated	diamond drilled
Miller Creek	Hulstein, Roger	-	Gold	unclassified	grassroots - never drilled
Miller Creek/Wy Gulch	Murtagh, Jayce	-	Gold	unclassified	grassroots - never drilled
Moosehorn	Independence Gold Corp.	-	Gold	vein/breccia	grassroots - never drilled
Moosehorn	Provenance Gold Corp.	115N 024	Gold	vein/breccia	diamond drilled
Mount Anderson	Apex Resources Inc.	105D 029	Gold	vein/breccia	grassroots - never drilled
Osiris	ATAC Resources Ltd.	106C 045	Gold	sediment associated	diamond drilled
North Rackla	Cantex Mine Development Corp.	106C 108	Gold	volcanic associated	diamond drilled
Ogi	Pacific Ridge Exploration Ltd.	116B 165	Zinc-Lead	sediment associated	grassroots - never drilled
Orion	Barrick Gold Corp.	-	Gold	sediment associated	diamond drilled
ORTRA	Kreft, Bernie	-	Gold	unclassified	grassroots - never drilled
PDM	Strikepoint Gold Inc.	-	Gold	porphyry/sheeted vein	grassroots - never drilled
Pedlar	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Pilot	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Plateau	Goldstrike Resources Ltd.	105N 034, 035, 036	Gold	vein/breccia	diamond drilled

APPENDIX 1 (continued). EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
Pluto	Strikepoint Gold Inc.	-	Gold	skarn/replacement	RAB drilled
Queen	Strategic Metals Ltd.	-	Gold	unclassified	grassroots - never drilled
QV	Comstock Metals Ltd.	115O 004	Gold	vein/breccia	43-101 defined deposit
Rau (Tiger)	ATAC Resources Ltd.	106D 005	Gold	skarn/replacement	43-101 defined deposit
Rawgeef	Bachynski, Ryan	-	Gold	unclassified	grassroots - never drilled
RC	Pacific Ridge Exploration Ltd.	-	Gold	porphyry/sheeted vein	grassroots - never drilled
Red Ridge	Apex Resources Inc.	105D 100	Gold	porphyry/sheeted vein	grassroots - never drilled
Rice	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Rod	Strategic Metals Ltd.	-	Gold	vein/breccia	diamond drilled
Rosebute	Taku Gold Corp.	115O 179	Gold	vein/breccia	diamond drilled
Rosy	ATAC Resources Ltd.	-	Gold	vein/breccia	diamond drilled
Rude Creek Gold	0890763 B.C. Ltd.	115J 022	Gold	vein/breccia	grassroots - never drilled
Saloon	Strategic Metals Ltd.	105E 003	Copper-Silver-Gold	vein/breccia	diamond drilled
Samp	Kluane Drilling Ltd.	-	Gold	vein/breccia	grassroots - never drilled
Sawbuck	Strategic Metals Ltd.	-	Silver	vein/breccia	grassroots - never drilled
Severance	Triumph Gold Corp.	-	Gold	porphyry/sheeted vein	grassroots - never drilled
Sheba	Eureka Resources Inc.	-	Gold	vein/breccia	grassroots - never drilled
Silver Hart	CMC Metals Ltd.	105B 021	Silver	vein/breccia	43-101 defined deposit
Sixty Mile	White Gold Corp.	-	Gold	vein/breccia	grassroots - never drilled
Spy	Group Ten Metals Inc.	-	Nickel-PGE	volcanic associated	grassroots - never drilled
Sulphur	Taku Gold Corp.	-	Gold	vein/breccia	diamond drilled
Tad/Toro	Triumph Gold Corp.	115I 031	Copper	porphyry/sheeted vein	diamond drilled
Tak	Eureka Resources Inc.	-	Gold	unclassified	grassroots - never drilled
Tobi	Group Ten Metals Inc.	-	Nickel-PGE	mafic/ultramafic associated	grassroots - never drilled
Tom/Jason	Fireweed Zinc Ltd.	105O 001, 019	Zinc-Lead	sediment associated	43-101 defined deposit

APPENDIX 1 (continued). EXPLORATION PROJECTS 2017

Project	Owner/Optioner	Yukon MINFILE	Commodity	Deposit type	Level of Advancement
Toonie	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled
Touleary	Arcus Development Group Inc.	115O 176	Gold	volcanic associated	diamond drilled
Treble	Trifecta Gold Ltd.	-	Gold	vein/breccia	diamond drilled
Trident	Trifecta Gold Ltd.	-	Gold	unclassified	grassroots - never drilled
Triple Crown (OOO)	Trifecta Gold Ltd.	115J 005	Gold	vein/breccia	grassroots - never drilled
Ultra	Group Ten Metals Inc.		Nickel-PGE	mafic/ultramafic associated	grassroots - never drilled
Val-Jual	Kestrel Gold Inc.	-	Gold	vein/breccia	diamond drilled
Van Gogh East	Van Kirchbaum, Everett	-	Gold	unclassified	grassroots - never drilled
Vault	Strategic Metals Ltd.	-	Gold	vein/breccia	grassroots - never drilled
VIP	Generic Gold Corp.	-	Gold	vein/breccia	grassroots - never drilled
Wellgreen	Wellgreen Platinum Ltd.	115G 024	Nickel-PGE	mafic/ultramafic associated	43-101 defined deposit
Wells	White Gold Corp.	-	Gold	porphyry/sheeted vein	grassroots - never drilled
Wels Gold	K2 Gold Corp.	115J 039	Gold	porphyry/sheeted vein	diamond drilled
White Gold (Golden Saddle/Arc)	White Gold Corp.	115O 165, 166	Gold	vein/breccia	43-101 defined deposit
Wolf	White Gold Corp.	-	Gold	unclassified	grassroots - never drilled

APPENDIX 2. DRILLING STATISTICS BY PROJECT, 2017

Property	Optioner/Owner	# of drill holes	# of metres
Diamond Drilling			
2K Gold	Provenance Gold Corp.	13	1836
Aurex	Banyan Gold Corp.	10	1422
Bermingham	Alexco Resource Corp.	37	13832
Boulevard	Independence Gold Corp.	9	978
Canadian Creek	Cariboo Rose Resources Ltd.	24	2142
Carmacks Copper	Copper North Mining Corp.	32	4000
Coffee Project	Goldcorp Inc.	74	17698
Dublin Gulch (Eagle)	Victoria Gold Corp.	205	33650
Freegold Mountain Project	Triumph Gold Corp.	35	12904
Hyland Gold	Banyan Gold Corp.	25	4000
Keno-Lightning	Metallic Minerals Corp.	14	1320
Kudz Ze Kayah	BMC Minerals	19	4235
Lone Star	Klondike Gold Corp.	70	8620
Lucky Strike	Goldstrike Resources Ltd.	9	1033
McConnell's Jest	Zonte Metals Inc.	5	1027
Mel	Benz Mining Corp.	9	2114
Nadaleen Trend	ATAC Resources Ltd.	29	11214
Plateau	Goldstrike Resources Ltd.	23	2972
QV	Comstock Metals Ltd.	6	904
Silver Hart	CMC Metals Ltd.	14	843
Tiger	ATAC Resources Ltd.	12	1371
Trident	Trifecta Gold Ltd.	5	547
Wellgreen	Wellgreen Platinum Ltd.	15	2720
Wels Gold	K2 Gold Corp.	11	1232
White Gold	White Gold Corp.	4	1295

APPENDIX 2 (continued). DRILLING STATISTICS BY PROJECT, 2017

Property	Optioner/Owner	# of drill holes	# of metres
Rotary Air Blast/Reverse Circulation			
3 Aces	Golden Predator Mining Corp.	190	17 510
Anderson Gold	Mayo Lake Minerals	8	650
Coffee Project	Goldcorp Inc.	528	50 813
Dan Man	Arcus Development Group Inc.	20	2880
Dime	White Gold Corp.	24	1898
JP Ross	White Gold Corp.	14	905
Kluane properties	Strikepoint Gold Inc.	12	1294
Kudz Ze Kayah	BMC Minerals	25	616
Loonie	White Gold Corp.	30	1970
Mahtin	Strikepoint Gold Inc.	6	630
May/Qu	Strikepoint Gold Inc	3	300
Orion	Barrick Gold Corp	32	1535
Val-Jual	Kestrel Gold Inc.	13	922
White Gold	White Gold Corp	31	4432

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Osiris cluster Carlin-type gold, east-central Yukon

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Coulter, A.B., Lane, J. and Steiner, A., 2018. Osiris cluster Carlin-type gold, east-central Yukon. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 65-74.

ABSTRACT

The Nadaleen trend is located in east-central Yukon, 400 km north-northeast of Whitehorse. Carlin-style gold mineralization was discovered on the property in 2010 and exploration has been ongoing since. The Nadaleen trend is a 25 km long trend of gold mineralization focused into two major clusters, from west to east: the Anubis cluster and the Osiris cluster. Four significant zones of gold mineralization have been identified in the Osiris cluster and are known as the Conrad, Osiris, Sunrise and Ibis zones. Gold mineralization is most commonly hosted in structurally controlled, decarbonatized and silicified silty limestone. Many characteristics of the Carlin-style deposits of Nevada are shared with the Osiris cluster, such as: decarbonatization, silicification, gold hosted within arsenian pyrite, spatial association with realgar, orpiment, calcite and fluorite and elevated As, Tl, Hg and Sb trace element geochemistry.

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INTRODUCTION

The Nadaleen trend is a 25-km-long cluster of recently discovered Carlin-style gold occurrences located in east-central Yukon. It is centered at 64°12′64″ N latitude and 132°54′94″ W longitude, 400 km north-northeast of Whitehorse and 180 km east-northeast of Mayo (Fig. 1). Exploration by ATAC Resources Limited (ATAC) started in 2007 on the western part of the Rackla Gold property with the discovery of the Tiger gold deposit (Fig. 2). Results from diamond drilling between 2008 and 2010 led to the release of a measured and indicated resource of 485,700 ounces gold at an average grade of 2.66 g/t and an additional inferred resource of 188,500 ounces gold at an average grade of 1.81 g/t (Ghaffari *et al.*, 2016).

Continued reconnaissance soil sampling and prospecting by ATAC between 2008 and 2010 focused along a 15-km-long ridge system of Paleozoic carbonate rocks near the Tiger deposit, which resulted in the identification of nine gold exploration targets known as the Rau trend (Fig. 2). In 2009, ATAC identified an area ~100 km east of the Tiger deposit where five of six stream-sediment samples in a government stream-sediment database were highly anomalous in arsenic (Héon, 2003). Follow-up stream-sediment sampling identified several anomalous areas; one 2 km long tributary returned a stream-sediment gold value of 1.78 g/t. Subsequent prospecting in the headwaters of this creek in 2010 revealed gold mineralization across a widespread area and grid soil sampling returned values up to 18.2 g/t gold. The core of the gold and arsenic geochemical anomaly covers an area of approximately 3.5 by 2 km that defines the Osiris cluster.

Follow-up drill testing by ATAC late in the summer of 2010 resulted in the discoveries of Osiris and Conrad. Further drilling, prospecting, and soil sampling in 2011 resulted in the discovery of Ibis. In 2012, Sunrise was discovered through trenching and drilling; soil sampling and prospecting 10 km to the west revealed the Anubis cluster mineralization. An alignment of the Carlin-style gold prospects, together with several gold and arsenic occurrences, collectively comprise the Nadaleen trend (Fig. 2), named for its proximity to the headwaters of the Nadaleen River. Exploration to date has identified abundant gold mineralization within the Nadaleen trend, although the full potential of this region is far from being determined.

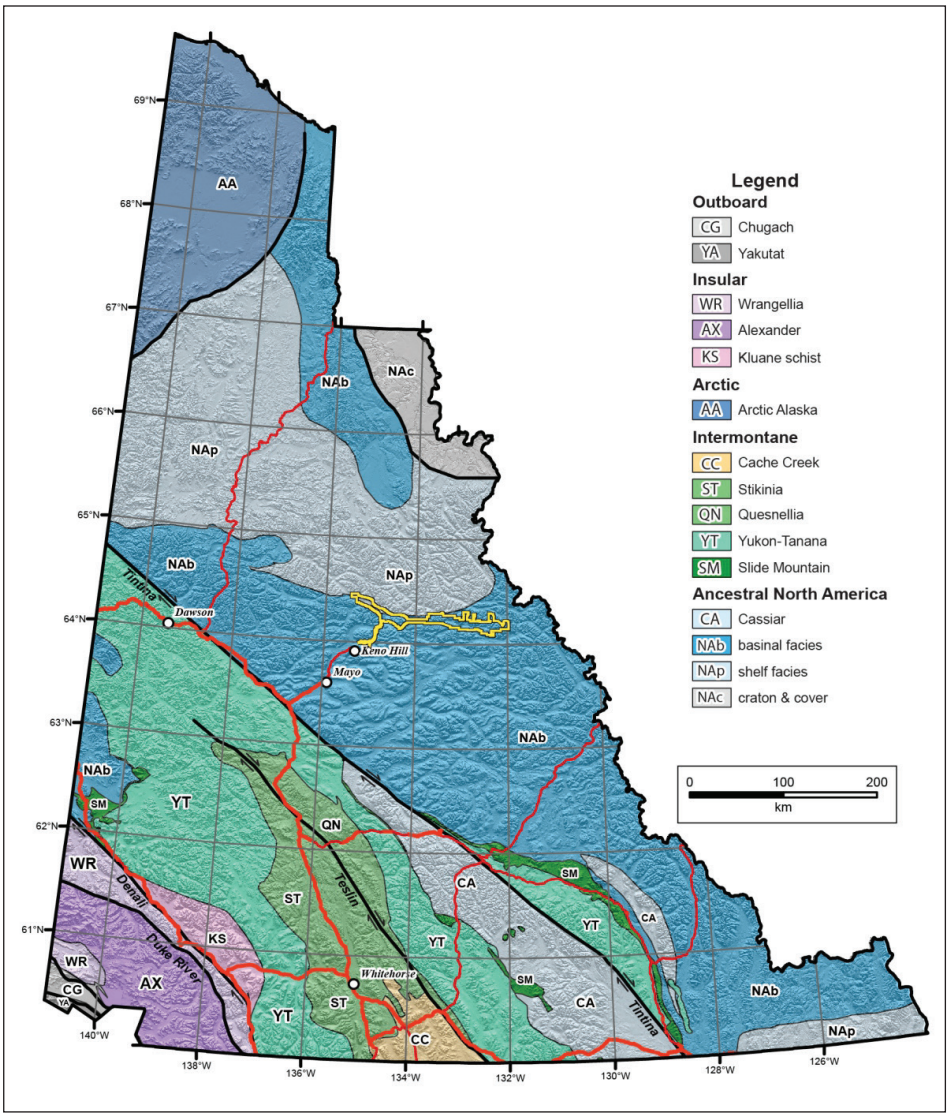

Figure 1. *Rackla Gold property location highlighted in yellow on Yukon terrane map (modified from Colpron and Nelson, 2011).*

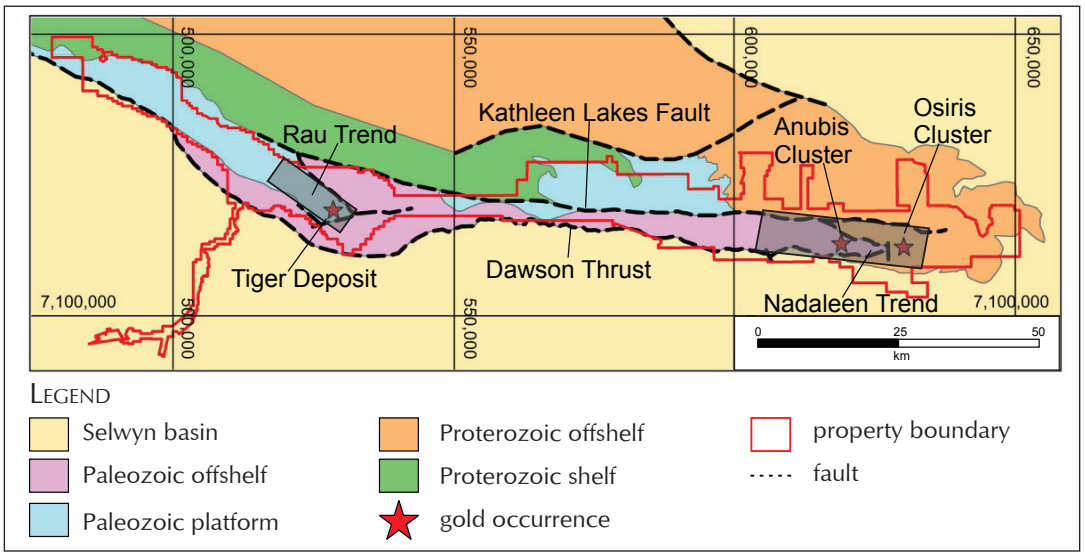

Figure 2. *Summary of major facies domains, major structures and mineral occurrences in the Rackla Gold property after Colpron et al. (2013). Coordinates are displayed in UTM NAD83.*

REGIONAL GEOLOGY

The Rackla Gold property (Property) is situated on the boundary between the deep water clastic rocks of the Selwyn basin to the south and shallower water shelf strata of the Ogilvie platform to the north (Fig. 2). The Dawson fault juxtaposes rocks of Selwyn basin against rocks of Ogilvie platform and marks a crustal break that dates back to late Neoproterozoic rifting and reactivated as a north directed thrust in the Cretaceous (Abbott, 1997). The eastern part of the Property contains the Nadaleen trend which hosts numerous Carlin-style gold prospects and is the focus of this paper (Fig. 2).

In the southern part of the Property, Selwyn basin strata in the hanging wall of the Dawson fault consist of Neoproterozoic-Cambrian Hyland Group, which is further subdivided into lower coarse clastic sedimentary rocks of the Yusezyu Formation, carbonate rocks of the Algae Formation, and an upper mudstone comprising the Narchilla Formation (Gordey and Anderson, 1993; Abbott, 1997; Roots, 2003). In the western two-thirds of the Property, these rocks were thrust northward over Paleozoic shelf and slope rocks deposited along the southern edge of the Ogilvie platform (Fig. 2).

In the eastern part of the Property, the Dawson fault loses stratigraphic displacement and coeval Neoproterozoic rocks of the Hyland Group and upper parts of the Windermere Supergroup are juxtaposed across the fault. The carbonate rocks of the Algae Formation and mudstone of the Narchilla Formation provide ties between the two successions; they are lateral equivalent of the Risky and Ingta formations of the Mackenzie Mountains (Moynihan, 2014, 2016). Strata of the Windermere Supergroup include fine-grained clastic and carbonate sequences that can be correlated in part with strata described elsewhere in the Mackenzie Mountains (*e.g.*, Narbonne and Aiken, 1995). In the Nadaleen area, Windermere strata beneath the Algae/Risky formation are assigned to the Nadaleen, Gametrail, and Blueflower formations (Moynihan, 2014, 2016).

DEPOSIT GEOLOGY

The Nadaleen trend is located near the eastern end of the Dawson fault, where coeval siliciclastic and carbonate rocks of the upper Windermere Supergroup and Hyland Group are juxtaposed, and where Paleozoic platform to slope facies carbonate rocks end (Fig. 2; Colpron *et al.*, 2013). The Nadaleen trend hosts two major clusters of Carlin-style gold mineralization known as the Osiris and Anubis (Fig. 2). The more easterly Osiris cluster occurs mostly within the Windermere rocks and the more westerly Anubis cluster is mainly hosted within Paleozoic carbonate rocks. The Paleozoic rocks terminate to the east towards the Osiris cluster across a series of north-trending faults. The Osiris cluster hosts 4 significant zones of Carlin-style gold mineralization discovered to date: the Conrad, Osiris, Sunrise and Ibis zones (Fig. 3).

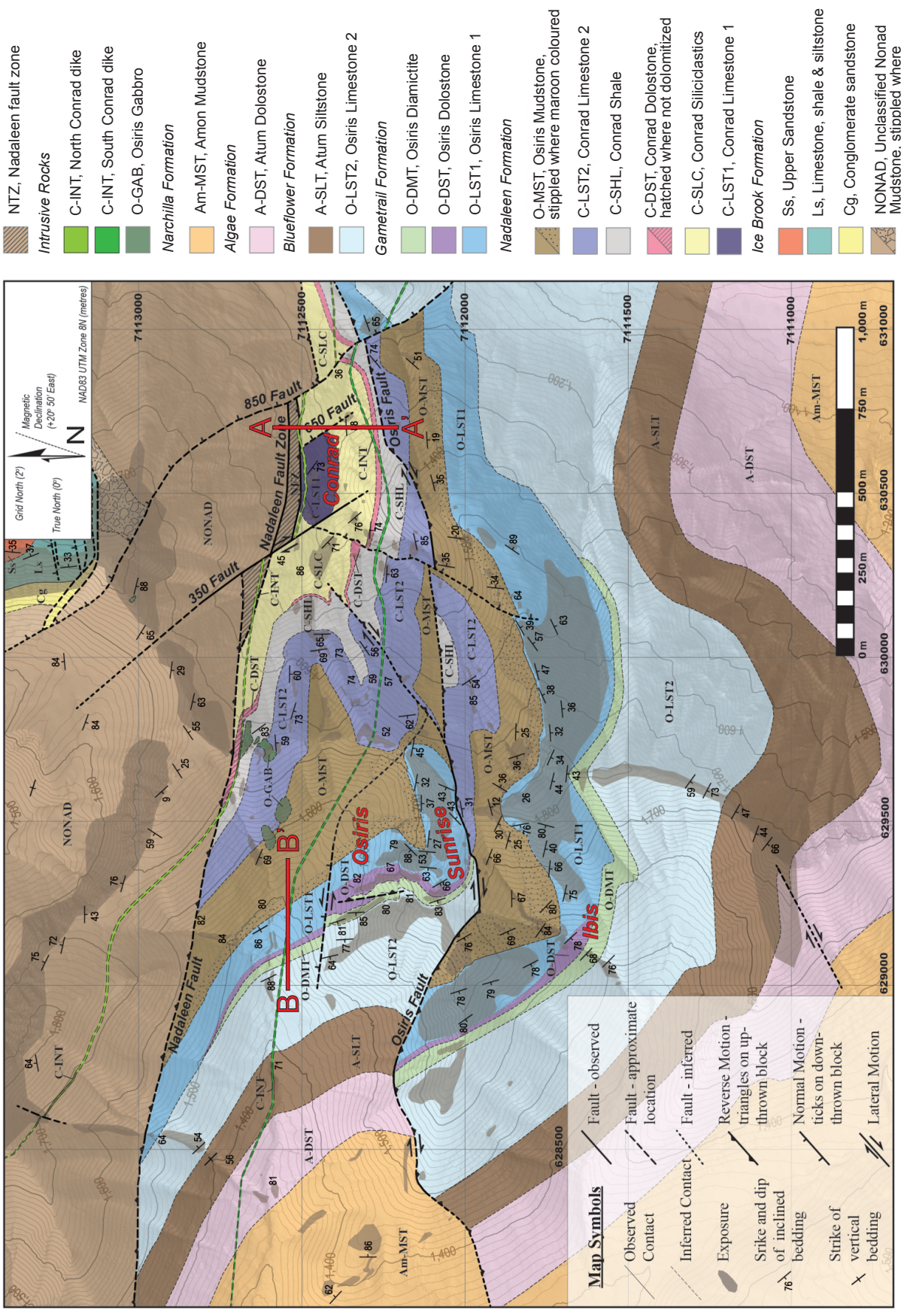

Figure 3. *Bedrock geology map of the Osiris Cluster from Steiner et al., 2018. Sections A-A' and B-B' highlighted in red.*

The geology of the Osiris cluster consists of a southward and westward-younging sequence of Neoproterozoic to Cambrian slope facies sedimentary rocks that are part of the Windermere Supergroup. The local geologic units, as described below and observed in the stratigraphic column (Fig. 4), have been correlated with the more regional Formations and map units by Colpron *et al.* (2013) and Moynihan (2016). From oldest to youngest, these include:

NONAD: The North of Nadaleen mudstone is part of the upper Ice Brook Formation and is a light teal-green to maroon and brown mudstone with minor interbedded quartz pebble conglomerate. The mudstone displays distinctive rusty brown weathering.

C-LST1: The Conrad limestone 1 is part of the lower Nadaleen Formation and is a light grey, silty laminated clastic limestone with cone-in-cone and beef calcite, and wispy, fine quartz sand layers (Fig. 5A).

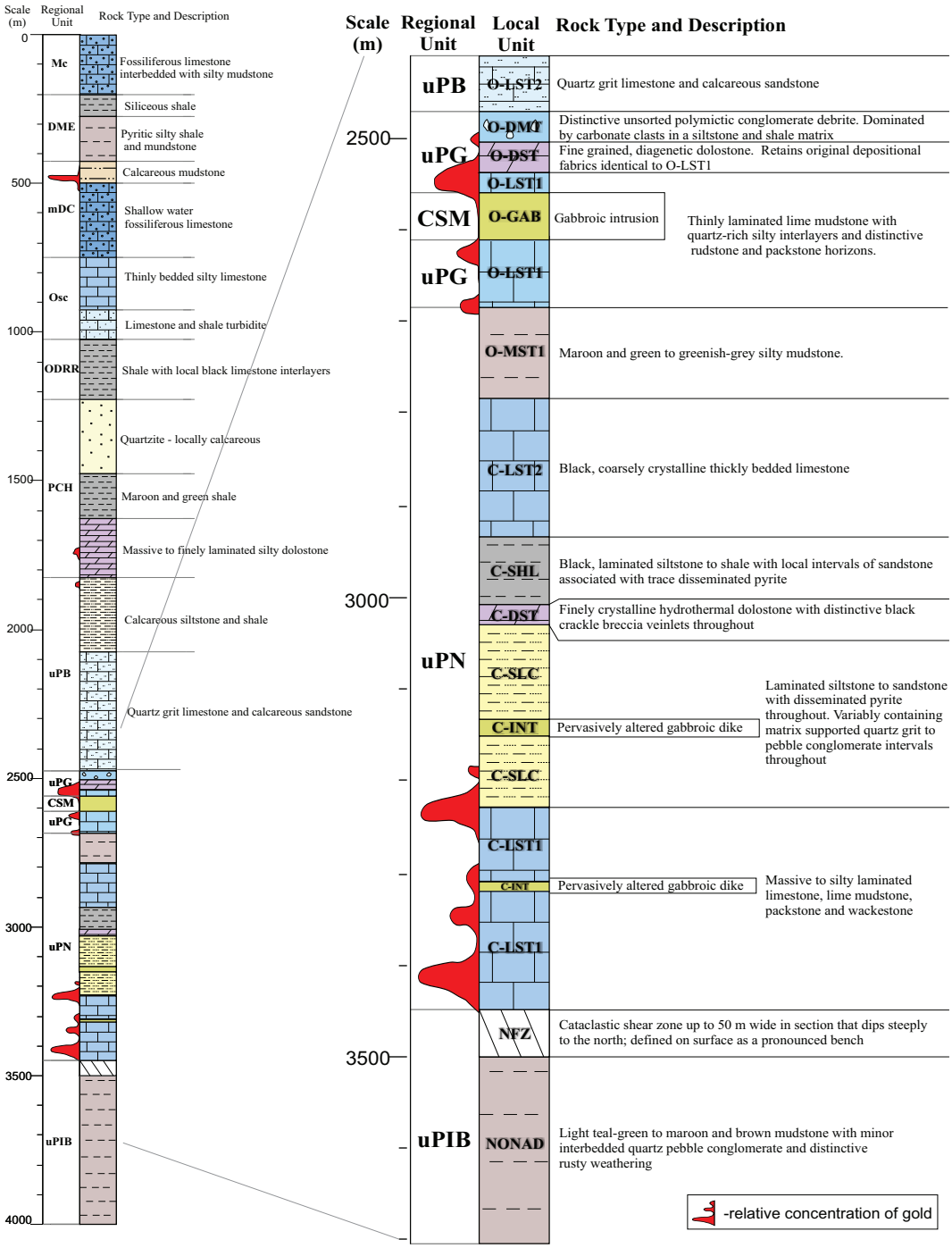

Figure 4. *Stratigraphic section of the local and regional stratigraphy and detailed section of Osiris cluster stratigraphy on the right. Regional unit abbreviations from oldest to youngest: uPIB = Ice Brook Fm, uPN = Nadaleen Fm, uPG = Gametrail Fm, CSM = Cambrian-Silurian Marmot Fm, uPB = Blueflower Fm, PCH = Hyland Group, ODRR = Road River Group, Osc = Ordovician-Silurian carbonate, mDC = Middle Devonian carbonate, DME = Earn Group and Mc = Mississippian carbonate.*

C-SLC: The Conrad siliciclastic unit is part of the Nadaleen Formation and is a grey-green pyritic siltstone and mudstone, poorly sorted matrix-supported quartz pebble conglomerate with lesser grey, well sorted, weakly calcareous sandstone. The conglomerate, informally referred to as 'starry night', consists of rounded quartz pebbles floating in a mix of sand and silt with sporadic larger clasts that appear to be rip up clasts of matrix material (Fig. 5B).

C-DST: The Conrad dolostone is part of the Nadaleen Formation and is a finely crystalline hydrothermal dolostone with distinct black crackle breccia veinlets in the Conrad area. Farther to the west, nearer to the Nadaleen fault, it is a non to partially dolomitized limestone.

C-SHL: The Conrad shale is part of the Nadaleen Formation and is a black, laminated siltstone to shale with local intervals of sandstone associated with trace disseminated pyrite.

C-LST2: The Conrad limestone (2) is part of the Nadaleen Formation and is a dark, crystalline lime mudstone, calcarenite, and lensoidal pebble to boulder conglomerate. It is interpreted as debris flows with lesser interbedded siltstone and grey to black shale. Clast composition of the conglomerate is dominated by limestone and lesser dolostone.

O-MST: The Osiris mudstone is part of the upper Nadaleen Formation and is a finely laminated maroon and green to greenish-grey siltstone. This unit can be subdivided into an overlying maroon and green siltstone and a lower greenish-grey siltstone (Fig. 5C).

O-LST1: The Osiris limestone (1) is part of the lower Gametrail Formation and is a well-bedded, tan and grey limestone with primary sedimentary structures. Monolithic, intraclast rudstone layers, averaging 0.5 to 2 m thick, are common throughout the unit. They consist of randomly oriented to imbricated, tabular to equant clasts in a carbonate mudstone matrix. Clast composition is almost exclusively the same as the enclosing carbonate mudstone (Fig. 5D).

O-DST: The Osiris dolostone is part of the middle Gametrail Formation and is a fine-grained diagenetic dolostone. The dolostone retains many of the original depositional fabrics identical to O-LST1 (*see* above for further description; Fig. 5E).

O-DMT: The Osiris diamictite is part of the upper Gametrail Formation and is a limestone pebble to boulder conglomerate, predominantly matrix supported debrite. Clasts vary from centimetre to metre-scale and comprise limestone that is similar to O-LST1. Matrix composition is variable comprising non to weakly calcareous green siltstone and shale and/or crystalline limestone. The bottom of the unit is consistently marked with a non-calcareous siltstone horizon that is approximately 5 m in true thickness (Fig. 5F).

O-LST2: The Osiris limestone (2) is part of the lower Blueflower Formation and is a very dark grey-black, coarsely crystalline limestone. The base of the unit is often associated with beds of polymictic floatstone containing clasts of orange-weathering dolostone, limestone, rounded quartz pebbles, and minor shale (Fig. 5G).

O-GAB: The 465.6 ± 4.4 Ma (Tucker, 2015) Osiris gabbro has a slight rusty coating on weathered surfaces and dark grey-green on fresh surfaces. The gabbro is composed of medium to coarse-grained amphibole, plagioclase and clinopyroxene.

C-INT: The 74.4 ± 1.0 Ma (Tucker, 2015) Conrad gabbroic dikes dip approximately 60° to the north, 2 subparallel dikes trend roughly east-west and are up to 20 m in true thickness. The dikes are generally competent in drill core, pale beige grey in colour and pervasively altered. The gabbro dikes are composed of coarse plagioclase, clinopyroxene, and abundant secondary carbonate and pyrite (Fig. 5H).

ALTERATION AND MINERALIZATION

Carlin-style gold mineralization in the Nadaleen trend is most commonly hosted in structurally controlled, decarbonatized and silicified silty limestone. Gold mineralization is less commonly found within siliciclastic and mafic intrusive rocks but can occur within structural corridors and immediately adjacent to mineralized limestone. Gold deposition occurs in a variety of settings including fold hinges, stylolites, fault zones, and along lithologic contacts. Decarbonatization occurs contemporaneously with silicification and is the primary alteration associated with gold deposition (Fig. 6A). Gold is found within the rims of sooty arsenian pyrite (Tucker, 2015) and is spatially associated with post-ore realgar and orpiment in hand sample (Fig. 6B-F). Although less common, illite, fluorite (Fig. 6B) and stibnite occur in the vicinity of gold mineralization and can therefore also be good indicators. Intense calcite flooding and chaotic calcite veining can also be a good indicator of mineralization although its temporal relationship to mineralization is complex due to many generations of veining and re-dissolution.

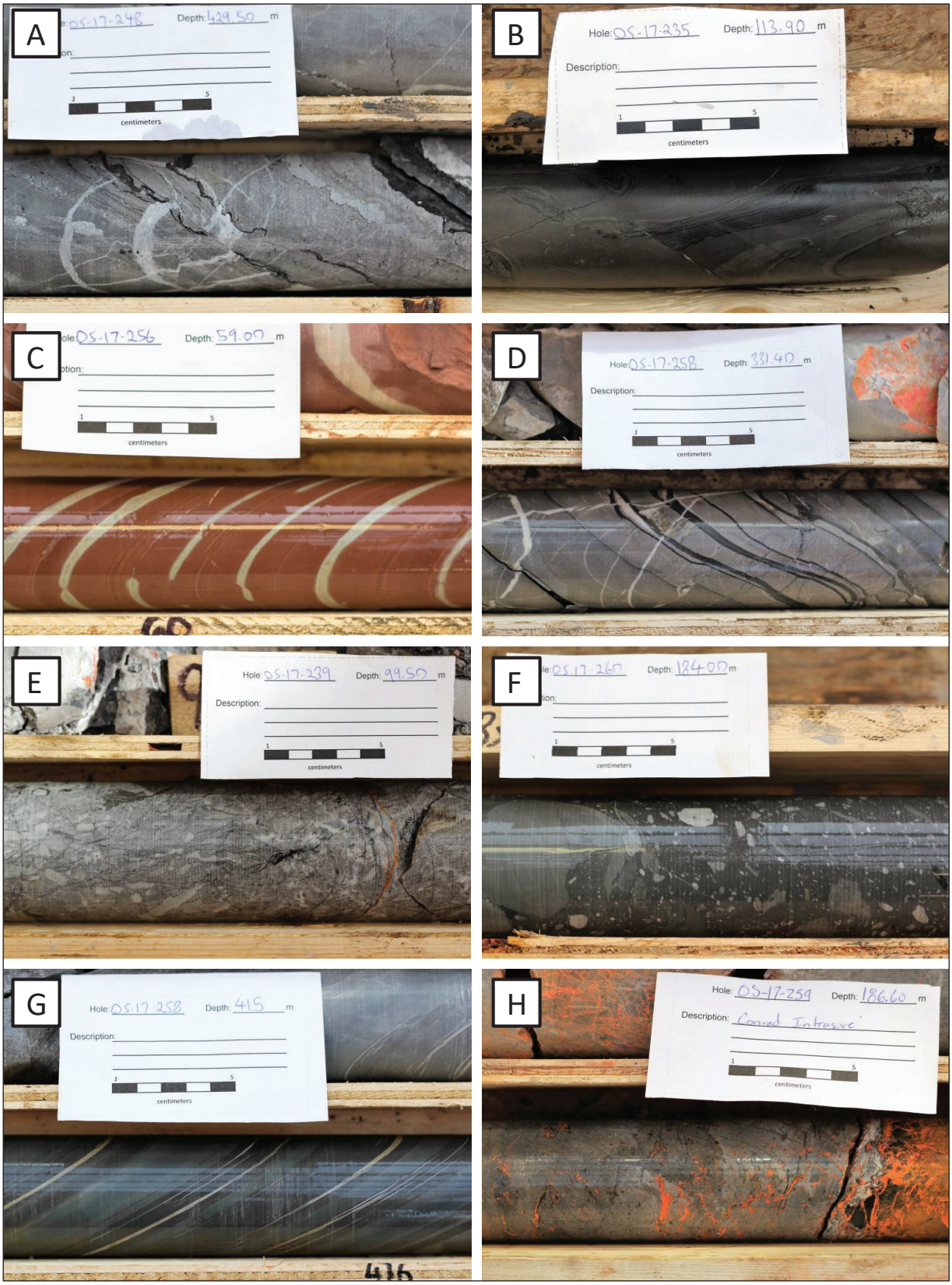

Figure 5. *Representative rock samples from the Osiris cluster from oldest to youngest:* ***(A)*** *C-LST1;* ***(B)*** *C-SLC;* ***(C)*** *O-MST1;* ***(D)*** *O-LST1;* ***(E)*** *O-DST with typical debrite textures;* ***(F)*** *O-DMT;* ***(G)*** *O-LST2; and* ***(H)*** *C-INT.*

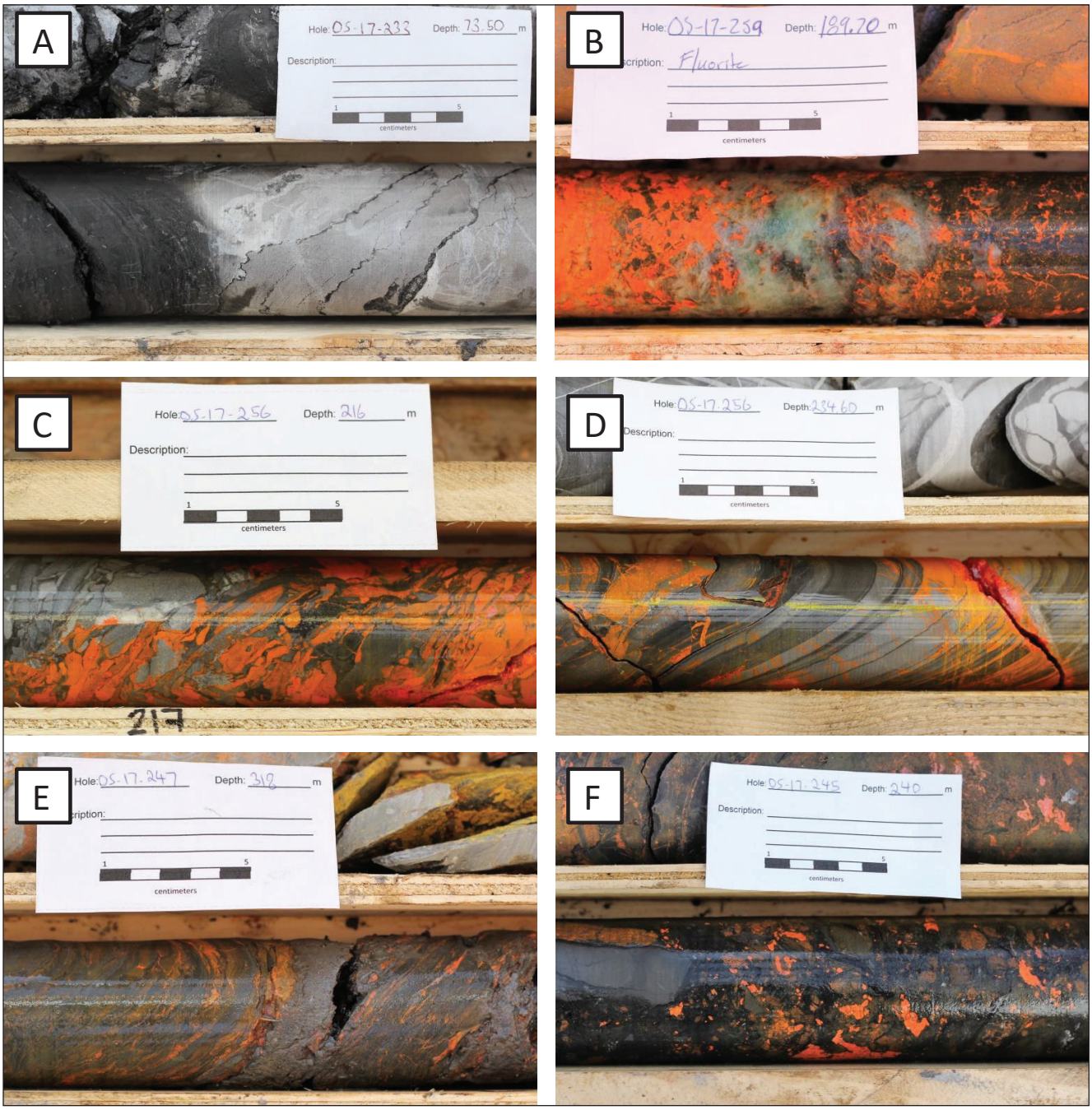

Figure 6. *Representative alteration and mineralization styles from the Osiris cluster.* **(A)** *Black decarbonatization, silicification and stylolitic seams of C-LST1;* **(B)** *Massive realgar, fluorite and decarbonatization and silicification of C-LST1;* **(C)** *realgar preferentially replacing debrite in O-LST1;* **(D)** *realgar intruding along joint and preferentially replacing limestone beds in O-LST1;* **(E)** *sheared, decarbonatized, silicified and patchy realgar replacement of O-LST1 with black sooty seams; and* **(F)** *decarbonatization, silicification, brecciation and preferential realgar replacement of C-LST1.*

DIAMOND DRILL CORE IN YGS CORE COLLECTION

Core from two holes drilled on the Osiris and Conrad have been donated by ATAC Resources Ltd. to the YGS core collection. Drill hole OS-12-130 is from the central-eastern part of Conrad and displays a conformable contact between C-LST1 and C-SLC (Figs. 3 and 7). This hole does not intersect the Nadaleen fault zone or NONAD unit as they are farther to the north (Fig. 7). The hole displays typical contact style mineralization between these units, massive realgar replacement, limestone decarbonatization, gold-bearing stylolitic seams and a complex assembly of calcite veining.

Drill hole OS-11-088 is from the northwestern part of Osiris and displays the entire stratigraphic sequence of Osiris, from oldest to youngest: O-MST1, O-LST1, O-DST, O-DMT and O-LST2 (Figs. 3 and 8). The hole displays typical contact style mineralization at the lithological boundary between the O-MST and O-LST1 units with massive and disseminated realgar replacement and limestone decarbonatization.

Available data for each diamond drill hole includes digital data in the form of pdf files and jpeg images of core photographs. The pdf files include collar survey, lithology, assay and geochemical data.

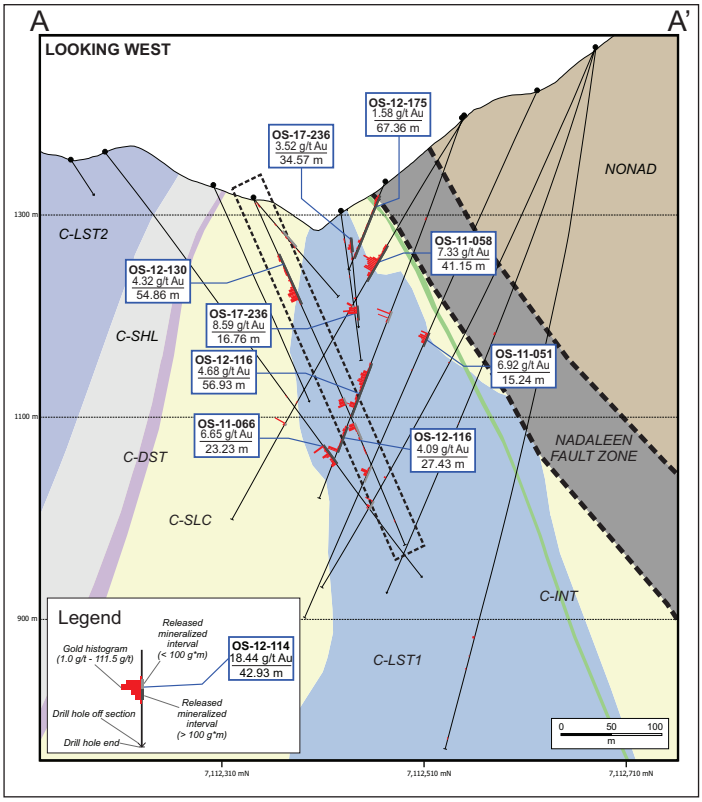

Figure 7. *A-A′ Conrad 50 m-wide cross section looking west highlighting donated drill hole OS-12-130. See Figure 3 for section location.*

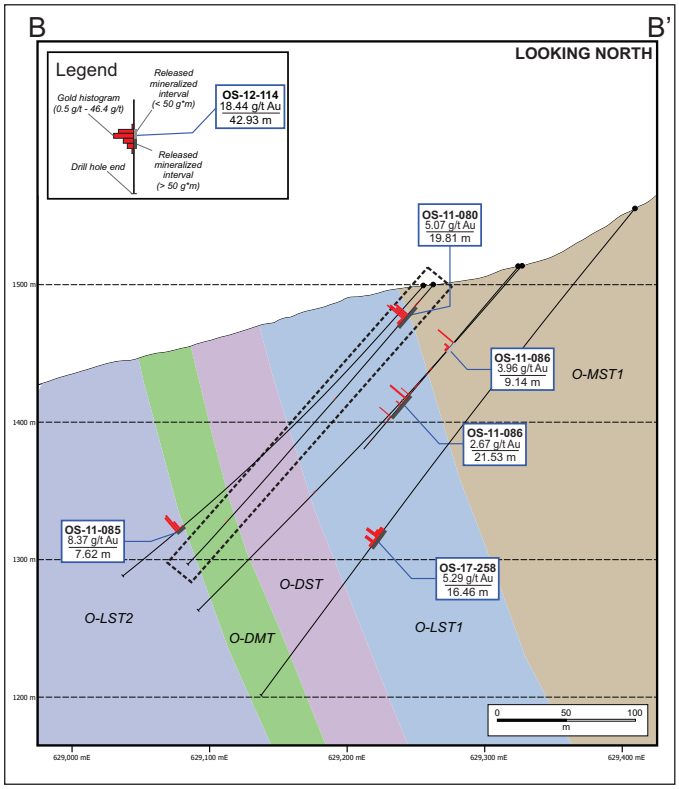

Figure 8. *B-B′ Osiris 50 m-wide cross section looking north highlighting donated drill hole OS-11-080. See Figure 3 for section location.*

Table 1. *Drill core donated to YGS library.*

Hole No.	Easting (m)*	Northing (m)*	Year drilled	Length (m)	Area	Mineralization style
OS-11-080	629265.23	7112549.14	2011	275.84	North Osiris	Contact and disseminated
OS-12-130	630650.51	7112341.04	2012	374.29	Central Conrad	Contact

*UTM NAD83, Zone 8

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

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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.

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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.

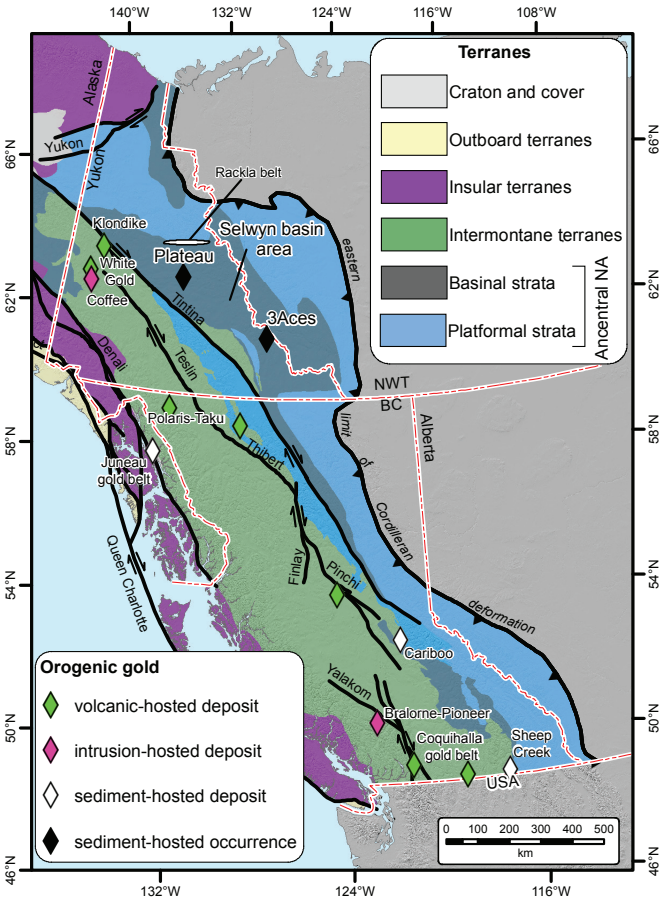

Figure 1. *Terranes, regional faults, significant orogenic gold deposits and camps of British Columbia and Yukon. Deposits from Goldfarb et al. (2005), Dubé and Gosselin (2007) and Yukon MINFILE (2017). Terranes from Colpron and Nelson (2011). NA = North America, Rackla belt includes the Tiger deposit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

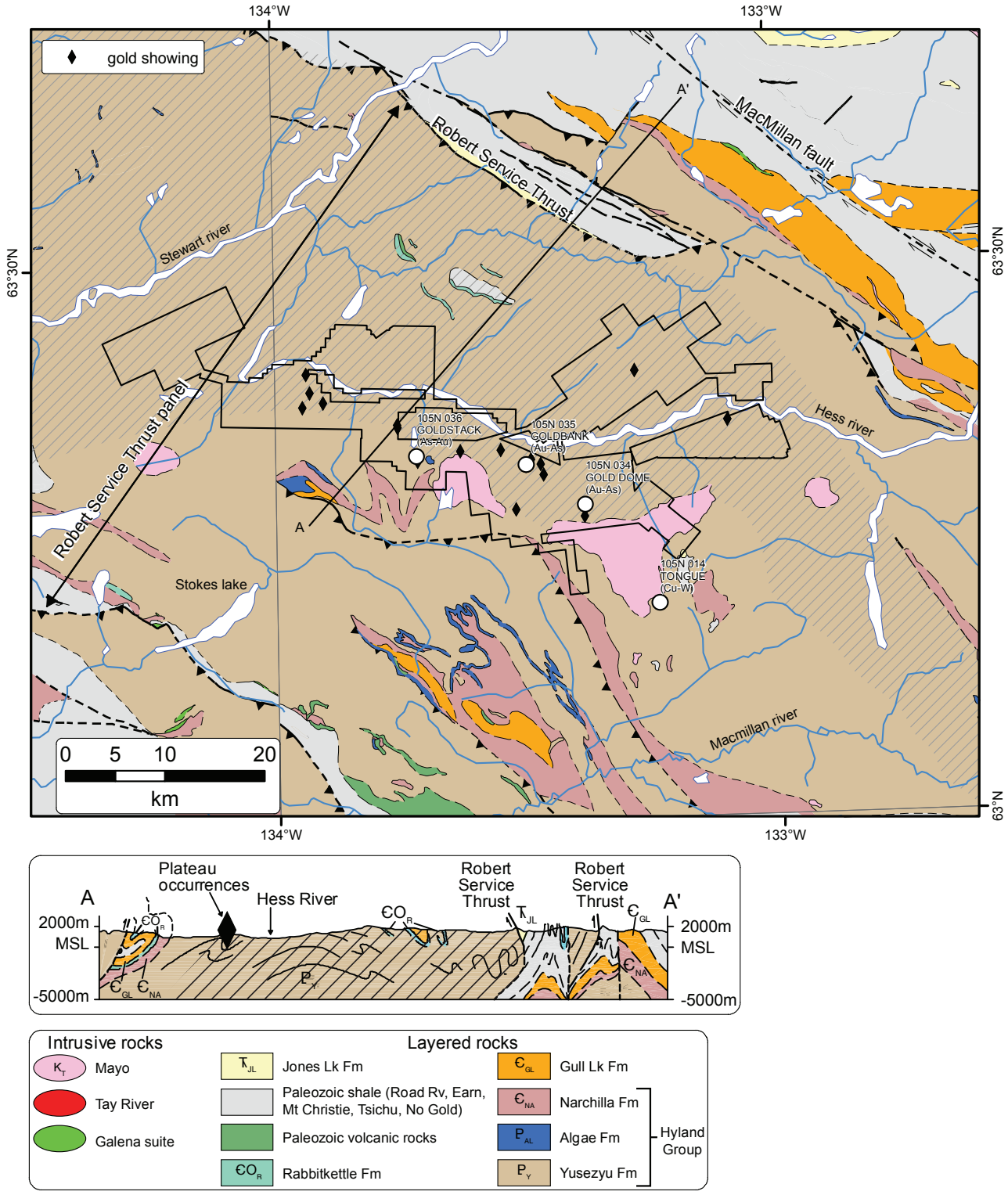

Figure 2. *Simplified regional geology around the Plateau property (YGS, 2017). Claim outline in solid black. Tombstone strain zone shown in diagonal hatching from Roots (1997; 1998). Cross section A-A′ from Roots (2003), diagonal Tombstone strain zone for illustration purposes only.*

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

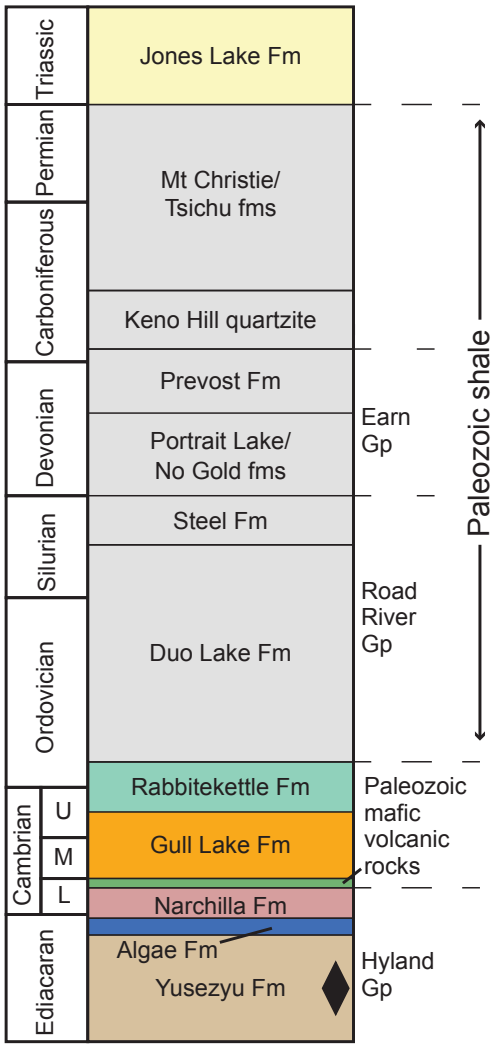

Figure 3. *Simplified stratigraphy for the Plateau area. Modified from (Roots, 1997, 1998, 2003). Unconformities omitted for clarity. Colours same as Fig. 2, black diamond illustrates stratigraphic level of Plateau occurrences.*

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).

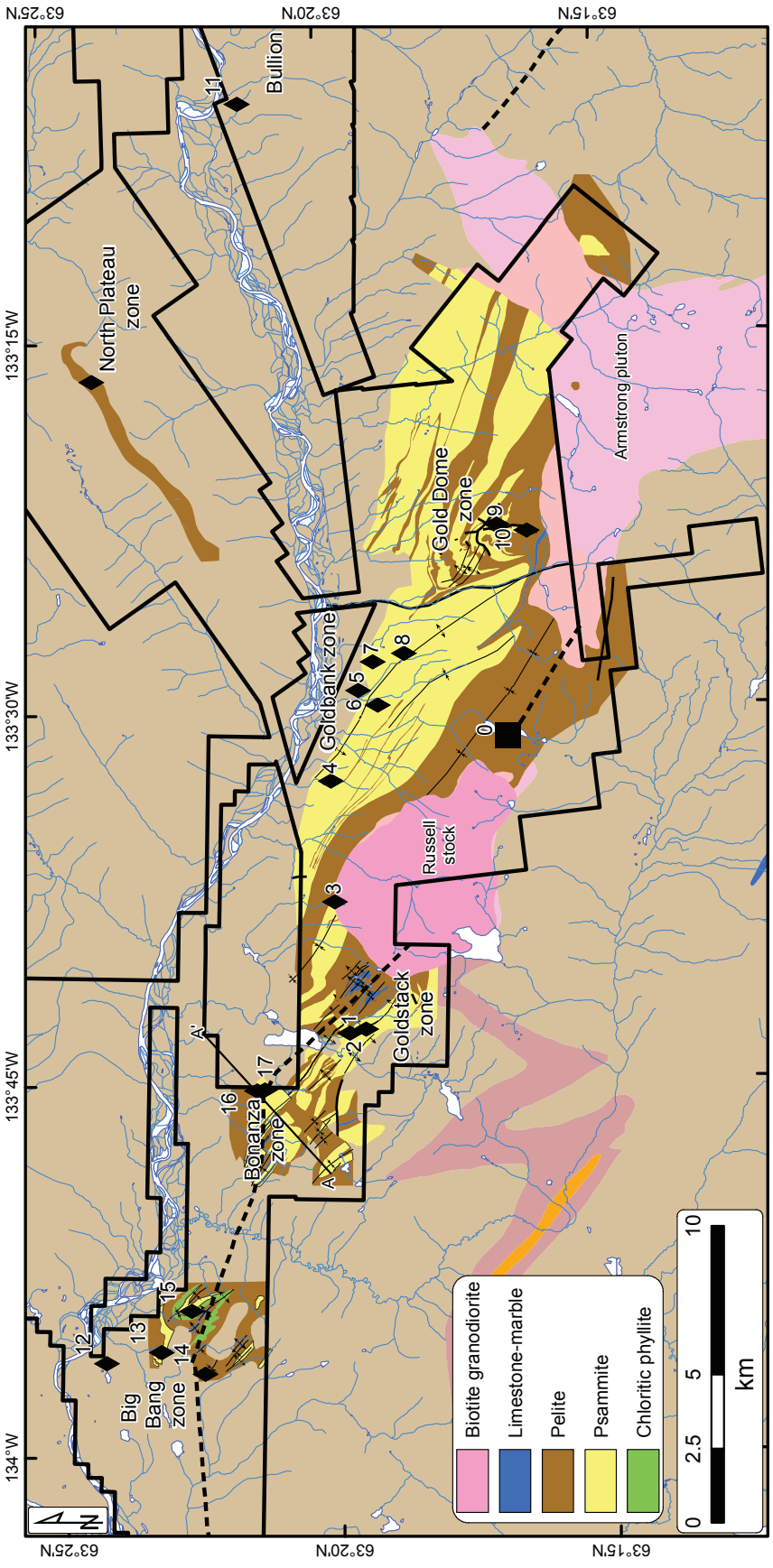

Figure 4. *Simplified Plateau property geology (mapped at 1:20000) from Roach (2013) with detailed mapping (1:2500) in the Goldstack and Bonanza areas from Vanwermeskerken (2017) and Big Bang from Stubley (2017). Location of Fig. 11 A-A' cross section through Bonanza zone shown. Heavy dashed line represents 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.*

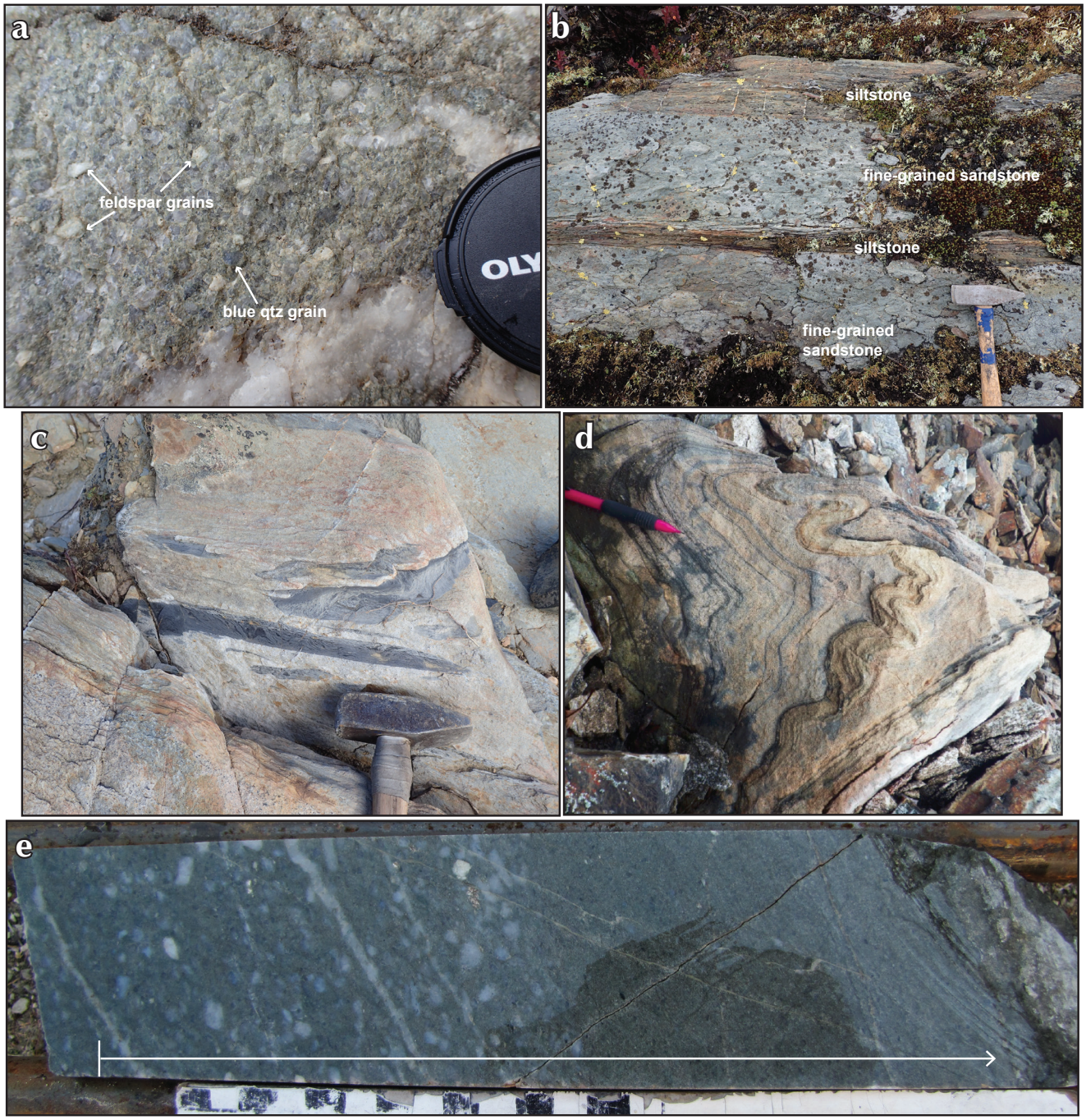

Figure 5. *Layered rocks on the Plateau South property.* ***(a)*** *Coarse-grained sandstone with blue quartz and feldspar grains. Psammite unit, Goldstack showing, lens cap 5 cm across.* ***(b)*** *Interbedded siltstone and fine-grained sandstone, Psammite unit, Goldbar showing, hammer head 13 cm across.* ***(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).

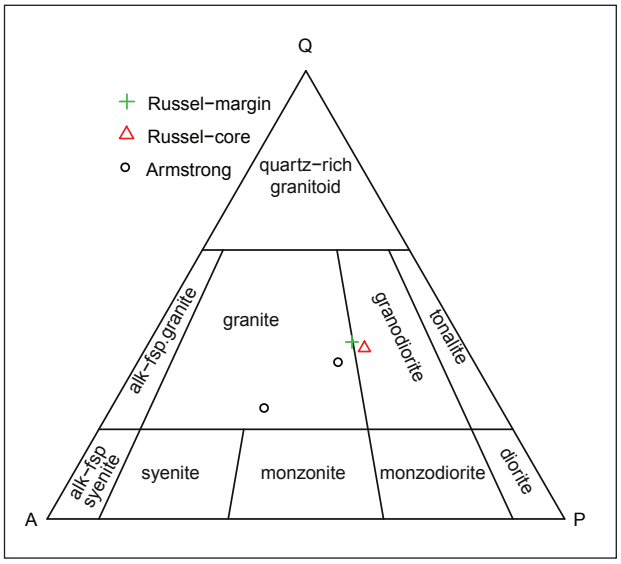

Figure 6. *QAP diagram (Le Bas and Streckeisen, 1991) of Russell stock and Armstrong pluton samples. Q=quartz, A=alkali-feldspar (alk-fsp), P=plagioclase.*

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).

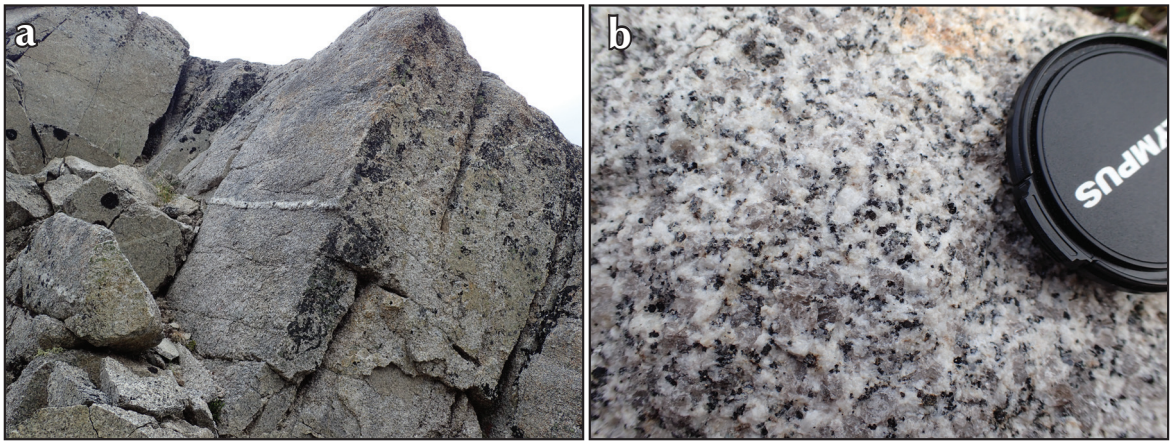

Figure 7. (a) *Granodiorite of the Russell stock, FOV is 2 m wide.* ***(b)*** *Outcrop macro of granite from the Armstrong pluton, 16PS-013-1. Lens cap is 5 cm in diameter.*

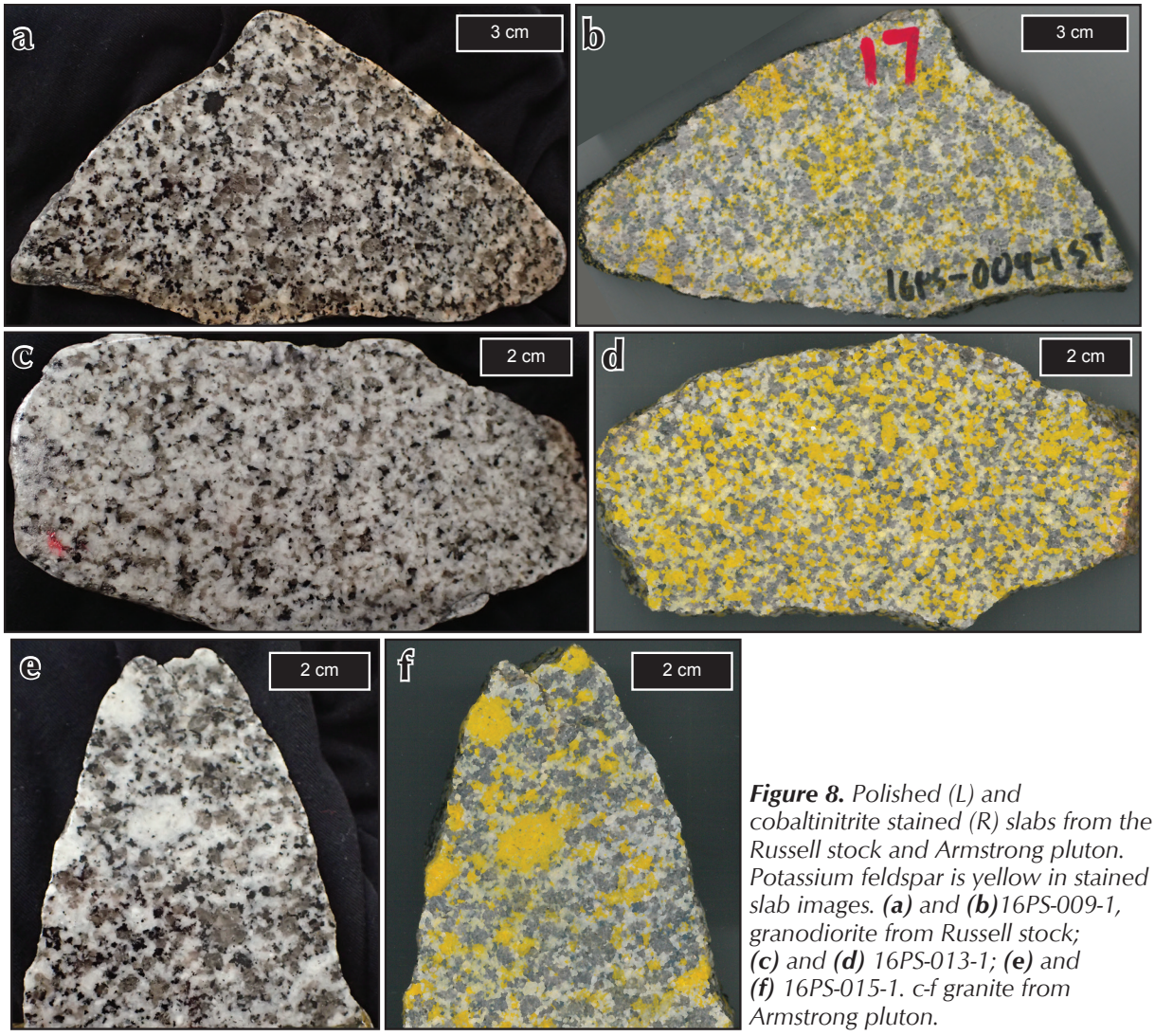

Figure 8. *Polished (L) and cobaltinitrite stained (R) slabs from the Russell stock and Armstrong pluton. Potassium feldspar is yellow in stained slab images.* ***(a)*** *and* ***(b)****16PS-009-1, granodiorite from Russell stock;* ***(c)*** *and* ***(d)*** *16PS-013-1;* ***(e)*** *and* ***(f)*** *16PS-015-1.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

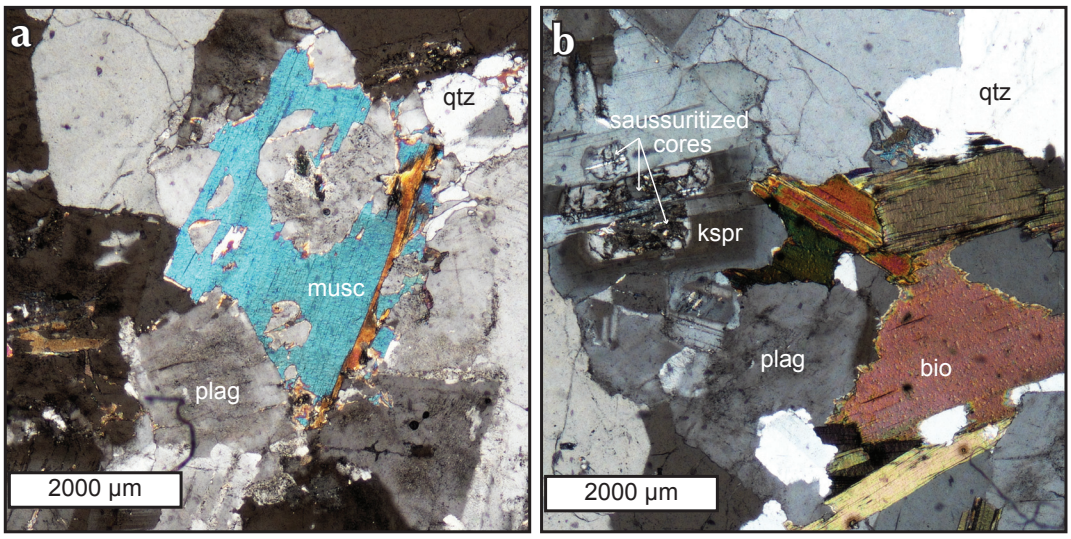

Figure 9. *Cross-polarized light photomicrographs of 16PS-013-1, Armstrong pluton.* ***(a)*** *Coarse-grained magmatic muscovite.* ***(b)*** *Saussuritized feldspar cores and coarse-grained magmatic biotite. qtz = quartz, musc = muscovite, plag = plagioclase, bio = biotite, kspr = potassium feldspar.*

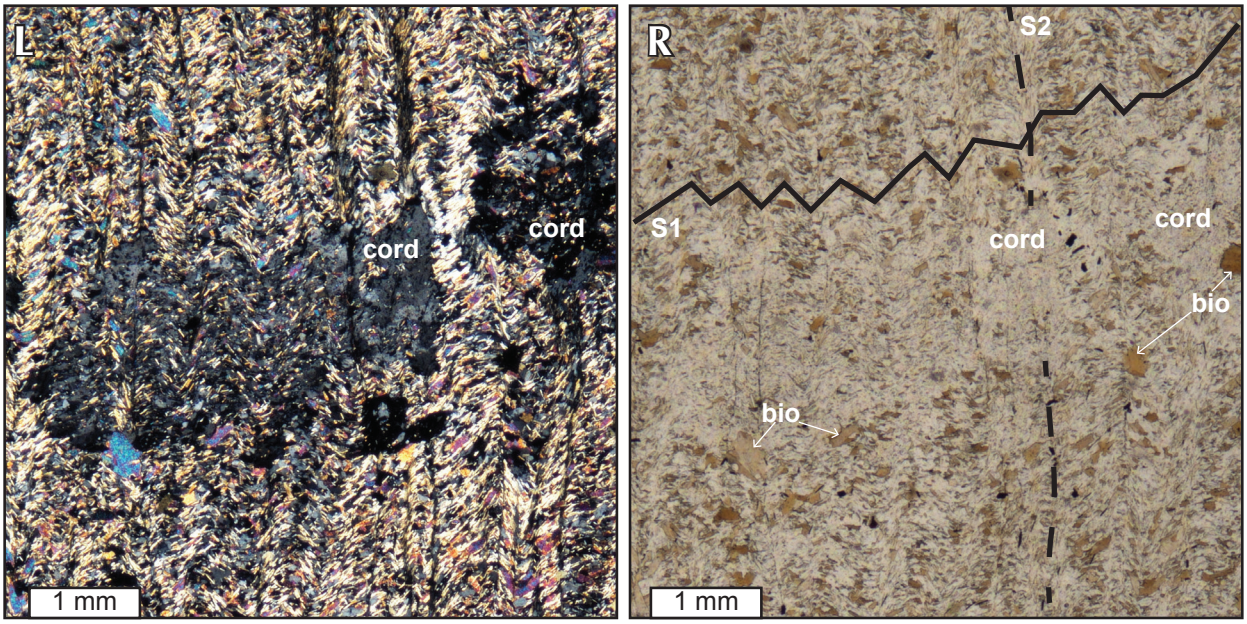

Figure 10. *Cross-polarized **(L)** and plain polarized **(R)** photomicrographs of cordierite overgrowing two generations of foliation in pelite (17PS-09-1). Highly birefringent mineral is muscovite. Cord = cordierite, bio = biotite.*

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.

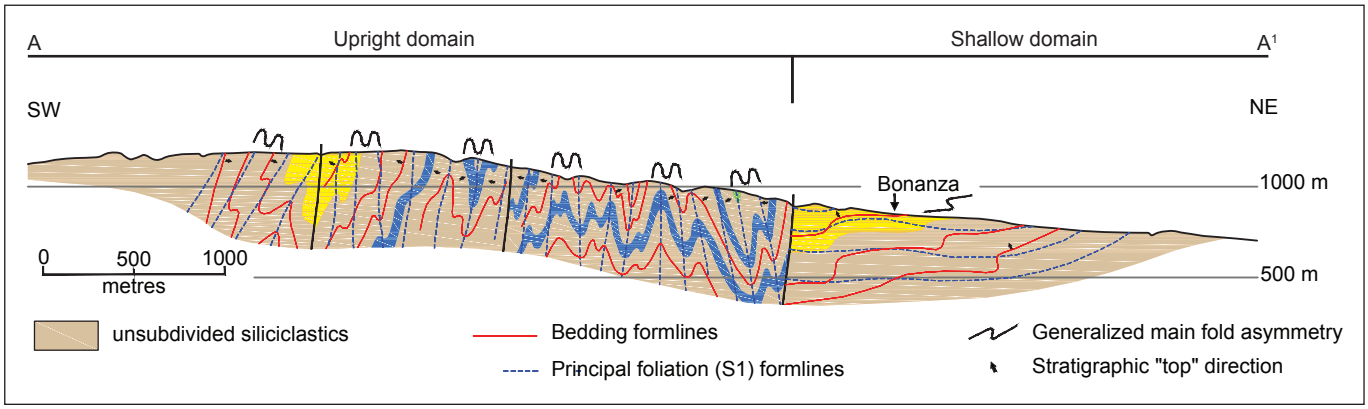

Figure 11. *Preliminary cross section through the Bonanza zone illustrating structural style (Stubley, 2017). Map unit colours same as Fig. 4; location shown on Fig. 4.*

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.

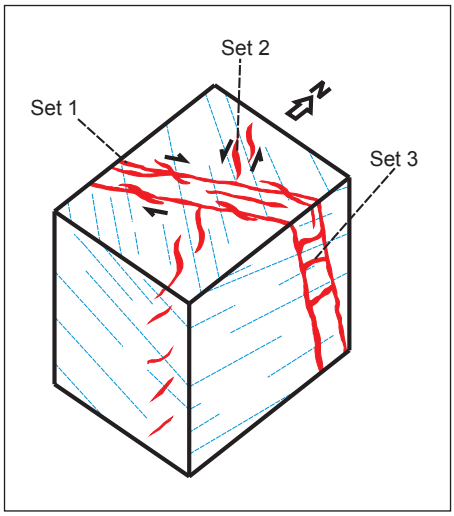

Figure 12. *Block diagram of D_5 veins. Mineralization is primarily associated with Set 1. Blue formlines represent pre-existing foliation.*

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

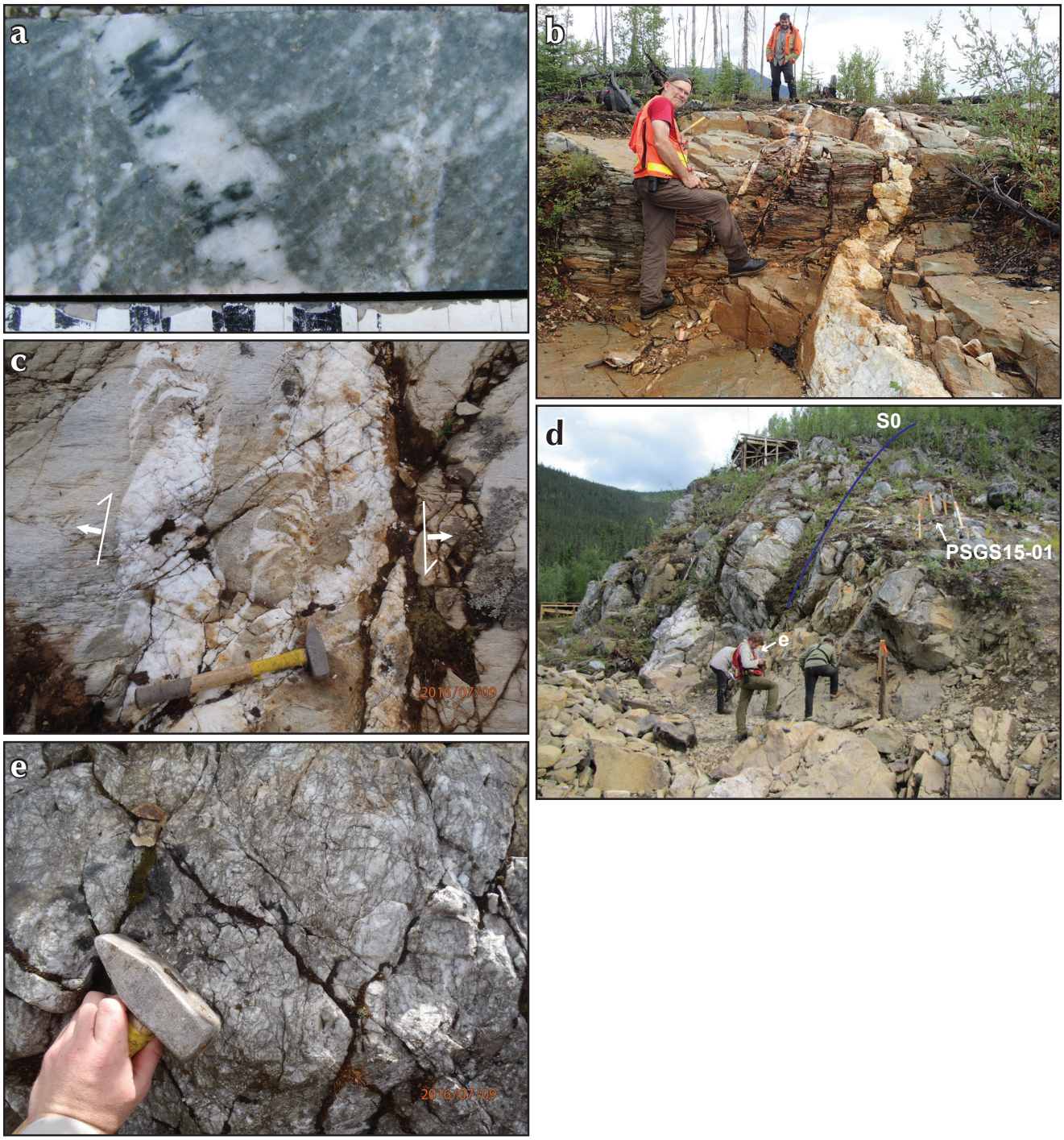

Figure 14. *Approximate paragenetic sequence of veins on the Plateau property.* ***(a)*** *Probable pre-mineralization quartz-chlorite vein from Goldstack showing. PSGS1501-89.90 m, bottom graduations in cm.* ***(b)*** *Steeply dipping mineralized quartz-arsenopyrite veins at the Goldbank showing (Ferrari). 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

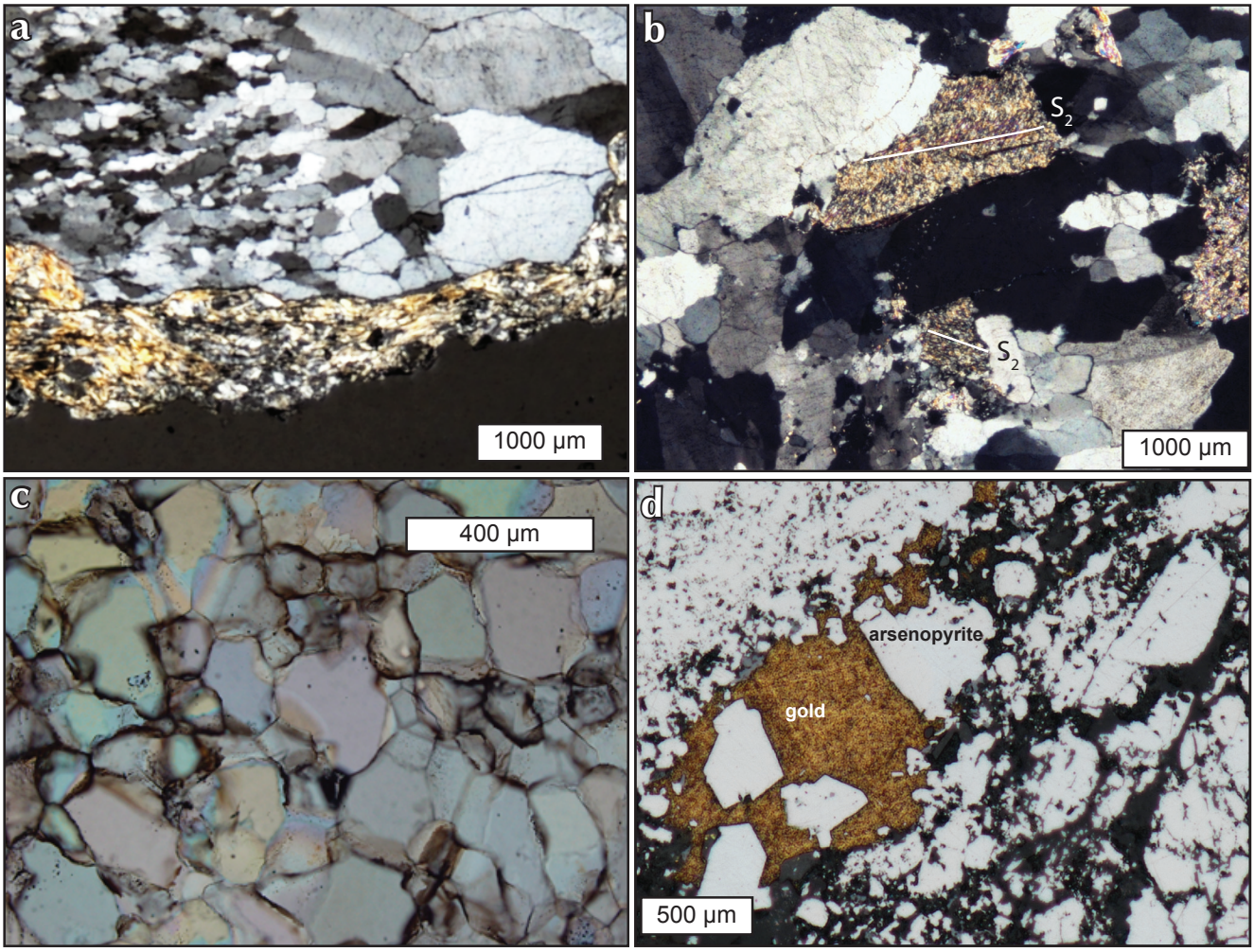

Figure 15. *Mineralized veins on the Plateau South property.* ***(a)*** *Early, recrystallized quartz cut by later thin quartz-sericite-carbonate veinlet, Bonanza main, 16PS07-1.* ***(b)*** *Micaceous wall-rock fragments with rotated foliation (S2) from Big Bang main showing, 17PS-030-1.* ***(c)*** *Recrystallized 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

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Robert E. Leckie Awards

Judy St. Amand and Kathy Sutherland
Mining Lands, Energy, Mines and Resources

St. Amand, J. and Sutherland, K., 2018. Robert E. Leckie Awards. *In:* Yukon Exploration and Geology Overview 2017, K.E. MacFarlane (ed.), Yukon Geological Survey, p. 93-95.

EXCELLENCE IN ENVIRONMENTAL STEWARDSHIP IN PLACER MINING: M2 GOLD MINES LTD.

M2 Gold Mines has been mining along a left limit bar of the lower Indian River (Bear Roast Flat) and become an industry leader in placer mine planning that facilitates reclamation. Their mine development plan on the left limit bar required them to strategically strip and mine the bar in sequences that both facilitated reclamation and reduced material handling. After 4 years of active extraction on the bar they reclaimed the site in 2017. This included levelling and contouring of coarse tailings, decommissioning of the settling facilities and top-coating with a mixture of sand, pea gravel and organics. Landscaping is exemplary and closely resembles pre-mining topography across much of the point bar. As a result of their efforts to re-contour the landscape to near natural conditions and apply a mixture of gravel and organics as a top-coat, revegetation will occur rapidly. This style of reclamation facilitates rapid recovery to a mixed-forest state, as has been previously proven by similar reclamation standards employed by neighboring placer miner, David McBurney.

View to the west of Bear Roast Flat under active mine development in 2015

A view to the SE of Bear Roast Flat under active reclamation. The mine area at the left of the photograph has been contoured and top-coated, together with the drainage channel and settling pond

EXCELLENCE IN ENVIRONMENTAL STEWARDSHIP IN QUARTZ MINING: TRIUMPH GOLD CORPORATION

Work in the Freegold Mountain area has been carried out by several different prospectors and companies over many years. In 2006 the Freegold Mountain project was acquired by Northern Freegold Resources, now Triumph Gold Corporation. While exploration work was being carried out an integral part of the program was to conduct reclamation and clean-up work on current and past disturbances.

Triumph Gold has worked to remove historic camp structures at Tinto Hill, the Revenue zone, operations at Boliden, Bow, Happy and Stoddart creeks. Bridges along the Freegold road have been repaired and maintained. Historical trenches have been resloped and backfilled, and artesian drill holes have been plugged.

Since 2006, the company has planned programs with reclamation in mind. Rather than create new disturbances for drilling or access existing disturbance are used; and heli-supported drilling was often used to prevent further road construction. Weather stations have been established, baseline environmental data collected, and wildlife tracking undertaken. Each field season begins with a session reviewing permit terms and conditions, and the overall approach for environmental management and social responsibility.

In summary, over many years, the people responsible for the oversight of work at Freegold Mountain continuously established standards above what was considered normal industry practice. The goal at Freegold Mountain has been and continues to be respect for the land, local community and the environment, as well as operating in a safe manner. Basically "being a good neighbour".

Training programs for local First Nation members.

Clean-up of historical disturbances.

RESPONSIBLE AND INNOVATIVE EXPLORATION MINING PRACTICES IN QUARTZ MINING: MINTO EXPLORATIONS LTD.

The Minto Mine is committed in using innovative reclamation technologies and for responsible closure of mine facilities. They have completed work in developing a site specific constructed wetland treatment system (CWTS), as well as significant amounts of progressive reclamation.

Minto continues to be a leader in the Yukon in completing progressive reclamation and is paving the way in Yukon specific research of CWTS as a long term, closure water treatment technology.

Demonstation scale CTWS foundation during construction.

Plant establishment in the demonstration scale CTWS in July 2017.

Yukon Exploration and Geology 2017 Abstracts

The following abstracts are from the Yukon Exploration and Geology 2017 volume. Full versions of the individual papers are available from the Yukon Geological Survey website, www.geology.gov.yk.ca.

BEDROCK GEOLOGY OF THE TESLIN MOUNTAIN AND EAST LAKE LABERGE AREAS, SOUTH-CENTRAL YUKON

E. BORDET

Mafic volcanic and clastic strata of the Middle Triassic Joe Mountain Formation, east of Lake Laberge, Yukon, represent a juvenile volcanic arc sequence. Mafic volcanic rocks of the Upper Triassic Lewes River Group were formed in the spatial and temporal continuity of Joe Mountain volcanism. Carbonate sedimentation took place in shallow oceanic basins from the Carnian to Rhaetian in subbasins separated by physiographic boundaries inherent to the arc, resulting in lateral stratigraphic variations. Polymictic conglomerate and turbiditic sequences of the Lower-Middle Jurassic Laberge Group unconformably overlie Triassic rocks. Two north-northwest strike-slip faults, the Laurier Creek and Goddard, control the distribution of units. Joe Mountain Formation rocks are characterized by an east-west structural trend, whereas the Upper Triassic and Jurassic sequences are characterized by north-northwest trending tight folds and thrust faults. At least five post-accretion igneous suites intrude the stratigraphy, including the Late Cretaceous Open Creek volcanic complex.

CLAST FABRIC ANALYSIS OF GLACIAL DIAMICT AT THE ALLAN CREEK SECTION AND ITS IMPLICATION FOR PALEO-ICE FLOW OF LIARD BASIN, SOUTHEASTERN YUKON

S.H. ELLIS, N.J. ROBERTS, K. KENNEDY, A. REYES AND B. JENSEN

The Allan Creek section was identified and briefly described during reconnaissance mapping of Liard basin several decades ago and provides southwestern Yukon's most complete known record of glaciation. The region supported ice sheets during multiple Quaternary glaciations, with landforms in Liard basin recording southeasterly ice-flow during the Last Glacial Maximum (LGM). Inference of earlier ice-flow patterns requires sedimentologic characterization of glacial deposits underlying Liard Plain. We expand macro-scale descriptions of the sequence of four diamict units exposed in the Allan Creek section to provide further insight on paleo-ice flow in southeastern Yukon. Pebble fabric measurements were collected from each diamict unit to compare with known LGM ice-flow directions and previously reported clast orientations. Three of the diamict units record ice-flow along the NW-SE trend of Liard basin. The second highest diamict in the sequence may record ice-flow directions both parallel and transverse to the basin's trend. Only the lowest diamict unambiguously indicates unidirectional ice-flow; it suggests southeastward paleo-flow during early glaciation of southeastern Yukon, similar to that during the LGM.

AN OVERVIEW OF SHALE STUDIES IN YUKON DURING THE 2017 FIELD SEASON

T. FRASER, I. CRAWFORD, M. GADD, K. HENDERSON, M. MELCHIN, J. PETER, P. SACK, E. SPERLING, J. STRAUSS

Summer 2017 fieldwork in Yukon's lower Paleozoic shale basins (Selwyn basin and Richardson trough) involved participants from government geological surveys (Yukon Geological Survey, Geological Survey of Canada) and several universities (Queen's, McGill, St. Frances Xavier, Stanford and Dartmouth College). Research interests include shale chemostratigraphy and biostratigraphy, and pyrite trace element geochemistry to characterize shale units and assess lower Paleozoic paleoenvironmental conditions and depositional controls; and an assessment of hyper-enriched black shales, specifically the colloquial 'Nick' or 'Ni-Mo' mineralized Ni-Zn-Mo-PGE deposit, in order to determine consistent genetic and exploration models for these types of deposits. This paper describes individual research projects underway and summarizes fieldwork in summer 2017.

NEW CONTRIBUTIONS TO THE BEDROCK GEOLOGY OF THE MOUNT FREEGOLD DISTRICT, DAWSON RANGE, YUKON (NTS 115I/2, 6, 7)

M.A. FRIEND, M.M. ALLAN, M. COLPRON AND C.J.R HART

The Mount Freegold district is an ideal natural laboratory to evaluate the structural and magmatic framework for porphyry, skarn, and epithermal mineralization in the Dawson range. The district is located within a major extensional relay zone of the Big Creek fault system, a regionally significant dextral strike-slip structure in which localized extension facilitated the emplacement of mid to Late Cretaceous magmatic rocks. New mapping defines a previously unrecognized granite pluton at Mount Freegold, as well as the *ca*. 77 Ma Stoddart pluton, which represents the magmatic roots of hypabyssal intrusive rocks at the Revenue Cu-Mo-Au-Ag deposit and Nucleus Au-Ag-Cu deposit. The relay zone in the Big Creek fault system is partly plugged by the *ca*. 70 Ma Seymour Creek stock, which is cut by a southern strand of the fault system. Episodic fault movement took place over a minimum 35 m.y. interval during which at least three distinct epochs of magmatic-hydrothermal mineralization occurred.

AN APPRAISAL OF DEVONIAN-MISISSIPPIAN SHALE STRATA IN YUKON'S LIARD BASIN

M.P. HUTCHISON

This study presents the first shale gas appraisal of Devonian-Mississippian shale strata in Yukon's Liard basin. Assessed volumes of 68 Tcf gas-in-place and 7.6 Tcf marketable gas are contained within two shale plays identified from an integrated wireline log and geochemical evaluation: the Devonian (Givetian-Frasnian) Horn River shale and the Devonian-Mississippian (Famennian-Tournaisian) Exshaw-Patry shale. Average burial depths of 3018 mTVD and net pay thicknesses of 73 m for the Horn River, and 2688 mTVD and 89 m for the Exshaw-Patry plays are interpreted. Both plays are dominated by black, organic-rich, siliceous mudstones, and exhibit: elevated TOC contents (0.6-6.9 wt%); maturities within or past the dry gas window (2.1-4.6%R_o); very high biogenic silica proportions (averaging 80.2-90.3%); high mineralogical stiffness (0.80-0.87); and average porosities of 1.2% for the Horn River and 4.2% for the Exshaw-Patry play. Resource distribution models indicate 50% of Yukon's marketable gas will be found in 30% of its assessed area, with the best potential for significant volumes located in the very southeastern part of the territory, where play depth and thickness increases.

EVIDENCE FOR LIMITED GLACIATION IN NORTHERN KLUANE RANGE, SW YUKON, WITH IMPLICATIONS FOR SURFICIAL GEOCHEMICAL EXPLORATION

K.E. KENNEDY

Preliminary investigation of surficial geology in northern Kluane Range has resulted in new interpretations of Pleistocene ice cover including extensive unglaciated terrain and restricted glaciation during the Last Glacial Maximum. Two glacial limits are identified: one at ~1500-1600 m a.s.l., recording the most extensive glaciation of the area; and a series of ice contact features from ~1100-1300 m a.s.l. that record younger, less extensive glacial limits. This paper describes Pleistocene limits of the Donjek glacier and the distribution of surficial materials in the upper Quill, Maple, and Wade drainages. The source and transport mechanism of surface materials has particular significance for surficial geochemistry sampling programs and implications for mineral exploration are addressed.

MOD PROPERTY, VMS MINERALIZATION IN THE WESTERN PART OF THE YUKON-TANANA TERRANE? (YUKON MINFILE 105B 029, 031)

T. LIVERTON AND S. CASSELMAN

Base metal-silver prospects in the upper Swift river region were discovered in 1946. These prospects, occurring in Yukon-Tanana terrane, have been previously described as isolated skarn occurrences and have hitherto received limited prospecting attention. Exploration work at the Mod property in 2016 has indicated that the sulphide mineralization is deformed (hence it predates the adjacent Cretaceous Seagull batholith) and that it demonstrates textures that are not consistent with a skarn origin. If, indeed, this mineralization is of exhalative origin then a large region of Yukon-Tanana terrane becomes prospective for mineralization similar to that of the Finlayson district.

RE-EVALUATING THE CHRONOSTRATIGRAPHIC FRAMEWORK FOR FELSIC VOLCANIC AND INTRUSIVE ROCKS OF THE FINLAYSON LAKE REGION, YUKON-TANANA TERRANE, YUKON

M.J. MANOR AND S.J. PIERCEY

The Finlayson Lake district contains >30 Mt of volcanogenic massive sulphide (VMS) mineralization, but has not been the focus of field-based research since the mid-2000s. We present herein preliminary fieldwork on Yukon-Tanana terrane (YTT) host rocks that are the groundwork for future petrologic, isotopic, and geochronologic studies of the stratigraphy and crustal evolution of the VMS deposits and YTT rocks in the Finlayson Lake region and other peri-Laurentian terranes of the northern Cordillera. During the summer of 2017, we logged seven drill holes that intersected the stratigraphic hanging walls and footwalls of the mafic-hosted Fyre Lake and felsic-hosted Kudz Ze Kayah and GP4F VMS deposits. The stratigraphic results generally reveal finely laminated to bedded mafic or felsic volcaniclastic rocks that are interbedded with clastic rocks or cut by intrusive rocks and reflect changes in depositional environments and tectonomagmatic regimes in the Late Devonian to Early Mississippian.

STRATIGRAPHIC AFFINITY OF LATE NEOPROTEROZOIC LIMESTONE IN THE VICINITY OF TILLEI AND MCPHERSON LAKES (NTS 105H/13, 14) SOUTHEASTERN YUKON

D. MOYNIHAN

The area around Tillei and McPherson lakes includes extensive exposure of a relatively thick, late Neoproterozoic limestone. The limestone is lithologically similar to the Espee Formation of the Ingenika Group, but is in geological continuity with the Hyland Group. The Hyland and Ingenika groups are age-equivalent sequences that were in close proximity before they were separated by Cenozoic dextral displacement on the Tintina fault. The area may therefore contain evidence for stratigraphic linkages between the two groups. The limestone is interpreted to have been deposited in a high-standing region outboard of the Hyland Group type area. Further work is required to determine the extent to which late Neoproterozoic paleobathymetry aligns with Paleozoic platform/basin margins.

THE STRUCTURAL FRAMEWORK FOR CARLIN-TYPE GOLD MINERALIZATION IN THE NADALEEN TREND, YUKON

A. STEINER, K. HICKEY AND A.B. COULTER

Structure imparts a significant control on the distribution of recently discovered Carlin-type gold mineralization in the Nadaleen trend, Yukon. An improved understanding of the structural framework for gold mineralization is essential for continued exploration success and interpreting ore fluid controls. Structural observations from the Osiris cluster of the Nadaleen trend indicate that NW-verging F_1 folds were refolded in response to later SSW-NNE directed contraction. F_2 folds have a subvertical ESE-striking axial plane with subvertically plunging axes on steep F_1 limbs and subhorizontal fold axes in shallow F_1 limbs. F_2 folds have a pervasive axial planar cleavage recognized regionally. The steeply dipping Osiris and Nadaleen faults appear to cut all folds. Mineralization is spatially associated with later NW-striking faults in the Conrad zone. Much of the folding within the mineralized Conrad Limestone is synsedimentary and its geometry reflects its emplacement as an olistostrome.

NEW INVESTIGATIONS OF BASAL LABERGE GROUP STRATIGRAPHY, WHITEHORSE TROUGH, CENTRAL YUKON

L. H. VAN DRECHT AND L.P. BERANEK

The tectonic evolution of the Whitehorse trough in central Yukon is largely preserved by the Early to Middle Jurassic Laberge Group, an ~3000-m thick succession of synorogenic clastic strata that unconformably overlies arc and arc marginal rocks of the Lewes River Group. A two-year project was initiated to test a Sinemurian to Toarcian transgression of basal Laberge Group strata westward across the Whitehorse trough and examine the regional relationships between the timing of Jurassic exhumation, sedimentation, and terrane accretion in the northern Canadian Cordillera. Field studies in 2017 targeted basal Laberge Group strata at seven locations in central Yukon. At each field locality, Basal Laberge Group strata are known or inferred to unconformably overlie the Povoas formation and multiple units of the Aksala. Pre-Early Jurassic unconformities may indicate variable basin topography due to the complex internal stratigraphy of the Lewes River Group, or that regional exhumation and erosion affected the Whitehorse trough prior to Laberge Group sedimentation.

YGS LIST OF PUBLICATIONS AND MAPS FOR 2017

YGS released 66 publications in 2017: 2 Annual Reports, 62 Open Files, 1 Miscellaneous Reports and 1 Educational Series pamphlet

OPEN FILES

Colpron, M., 2017. Revised geological map of Livingstone Creek area (NTS 105E/8). Yukon Geological Survey, **Open File 2017-1**, scale 1:50 000.

Hutchison, M.P., 2017. Whitehorse trough: Past, present and future petroleum research – with a focus on reservoir characterization of the northern Laberge Group. Yukon Geological Survey, **Open File 2017-2**, 48 p. plus appendices and plates.

Witter, J. and Miller, C., 2017. Curie point depth mapping in Yukon. Yukon Geological Survey, **Open File 2017-3**, 37 p.

Mackie, R.A., Arne, D.C. and Pennimpede, C., 2017. Assessment of Yukon regional stream sediment catchment basin and geochemical data quality. Yukon Geological Survey, **Open File 2017-4**, 29 p. and digital files.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 095B. Yukon Geological Survey, **Open File 2017-5**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 095C. Yukon Geological Survey, **Open File 2017-6**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 095D. Yukon Geological Survey, **Open File 2017-7**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 095E. Yukon Geological Survey, **Open File 2017-8**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105A. Yukon Geological Survey, **Open File 2017-9**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105B. Yukon Geological Survey, **Open File 2017-10**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105C. Yukon Geological Survey, **Open File 2017-11**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105D. Yukon Geological Survey, **Open File 2017-12**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105E. Yukon Geological Survey, **Open File 2017-13**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105F. Yukon Geological Survey, **Open File 2017-14**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105G. Yukon Geological Survey, **Open File 2017-15**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105H. Yukon Geological Survey, **Open File 2017-16**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105I. Yukon Geological Survey, **Open File 2017-17**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105J. Yukon Geological Survey, **Open File 2017-18**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105K. Yukon Geological Survey, **Open File 2017-19**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105L. Yukon Geological Survey, **Open File 2017-20**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105M. Yukon Geological Survey, **Open File 2017-21**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105N. Yukon Geological Survey, **Open File 2017-22**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105O. Yukon Geological Survey, **Open File 2017-23**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 105P. Yukon Geological Survey, **Open File 2017-24**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106B. Yukon Geological Survey, **Open File 2017-25**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106C. Yukon Geological Survey, **Open File 2017-26**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106D. Yukon Geological Survey, **Open File 2017-27**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106E. Yukon Geological Survey, **Open File 2017-28**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106F. Yukon Geological Survey, **Open File 2017-29**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106K. Yukon Geological Survey, **Open File 2017-30**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 106L. Yukon Geological Survey, **Open File 2017-31**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115A. Yukon Geological Survey, **Open File 2017-32**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115B. Yukon Geological Survey, **Open File 2017-33**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115C. Yukon Geological Survey, **Open File 2017-34**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115F. Yukon Geological Survey, **Open File 2017-35**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115G. Yukon Geological Survey, **Open File 2017-36**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115H. Yukon Geological Survey, **Open File 2017-37**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115I. Yukon Geological Survey, **Open File 2017-38**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115J. Yukon Geological Survey, **Open File 2017-39**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115K. Yukon Geological Survey, **Open File 2017-40**, 1 map and data.

Aurora Geosciences Ltd. and Bruce, J.O., 2017. Reprocessing of Yukon magnetic data for NTS 115N. Yukon Geological Survey, **Open File 2017-41**, 1 map and data.

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