

YUKON
EXPLORATION
& GEOLOGY
OVERVIEW
2013

Edited by
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Front cover photograph: Looking south across the Dezadeash Ranges. Photo by Steve Israel.

PREFACE

Yukon Exploration and Geology (YEG) 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 available in digital format only and can be downloaded from our website. The YEG Overview is available in a digital format (colour), as well as in a limited print run (black and white).

YEG 2013 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 efforts are appreciated.

Monica Nordling has returned again this year to work with me through Christmas, and into the New Year, in order to complete YEG. She enjoyed basking in the glory as our YEG 2012 volume received the first (in what we hope will be many) EMRIE Award for “Best EMR Publication” of 2013. The prized trophy is seen on the back cover of this issue. I would like to thank my Yukon Geological Survey colleagues for their comments and critiques of manuscripts; Patrick Sack and Charlie Roots helped with several papers, and thanks also to Don Murphy, Steve Israel, Maurice Colpron, David Moynihan, and Matt Hutchison.

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 staff: (front row, left to right) Monica Nordling, Carolyn Relf, Tiffani Fraser, and Lara Lewis; (back row, left to right) Sarah Laxton, Sam Darling, Panya Lipovsky, Lee Pigage, Bailey Staffen, Aubrey Sicotte, Matt Hutchison, Karen MacFarlane, David Moynihan, Robert Deklerk, Patrick Sack, Maurice Colpron, Steve Israel, Don Murphy, Charlie Roots, Midori Kirby, Derek Torgersen. Missing from photo: Sue Roy, Olwyn Bruce, Rosie Cobbett, Sydney van Loon, Kristen Kennedy, Jeff Bond, and Johann Slam.



TABLE OF CONTENTS

Summary of Yukon Geological Survey's 2013-2014 Activities	
C. Relf	1
Yukon Hardrock Mining, Development, and Exploration Overview 2013	
L. Pigage, P.J. Sack, L.L. Lewis, D. Torgerson, and R. Deklerk	21
Yukon Placer Mining Overview 2013	
S. van Loon and P. Lipovsky	49
Yukon Mining Incentives Program: 2013-14 update	
D. Torgerson.....	53
Yukon Oil and Gas Overview 2013	
B. Adilman	59
Robert E. Leckie Awards	
J. St. Amand.....	67
Yukon Exploration and Geology 2013 Abstracts	
.....	69
2013 List of Publications and Maps	
.....	77

Summary of Yukon Geological Survey 2013-14 Activities

Carolyn Relf¹

Director, Yukon Geological Survey

Relf, C., 2014. Summary of Yukon Geological Survey 2013-14 Activities. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 1-19.

INTRODUCTION

In 2013-14, the Yukon Geological Survey (YGS) staff carried out three bedrock mapping projects, three regional-scale thematic projects, and a number of targeted field studies using ground-penetrating radar. Additionally, surficial mapping of three communities was completed as part of a community hazards mapping program being delivered in collaboration with Yukon College.

The survey also invested in a number of projects with external partners, including the processing and interpretation of existing datasets to enhance their value, a study to assess the application of a new tool for exploration, and several graduate student thesis studies. A new partnership was established with the Department of Environment's Water Resources Branch to evaluate gaps in surface and subsurface water data for Eagle Plain and initiate a new monitoring network in advance of increased oil and gas exploration in this region.

In addition to delivering geoscience projects, YGS tracked results of hardrock and placer exploration projects, monitored permafrost via its community-based network, delivered a variety of outreach and educational activities, and responded to numerous requests for information.

This year is the fourth and final year of the Canadian Northern Economic Development Agency's funding under their Strategic Investments in Northern Economic Development (SINED) Program. Between 2010 and 2014, the agency invested over \$3.5M in geophysical surveys, geochemical studies, targeted placer research, community-based mapping, and the upgrading of digital information services. YGS is exploring the potential for further funding under a renewed SINED program.

This report presents an overview of YGS activities in 2013-14; more detailed papers on some of the projects noted here are included in this year's Yukon Exploration and Geology volume; results of other projects will be released separately.

YUKON GEOLOGICAL SURVEY PROGRAM FUNDING AND OVERSIGHT

The YGS undertakes a variety of field-based and desktop geoscience studies that address a number of interests, and provides information to the public in the form of maps, technical reports, raw data, and educational material. Collectively YGS' activities support the stewardship of Yukon's energy and mineral resources, and contribute to the sustainability of Yukon's communities. The YGS is a branch of Yukon government's Department of Energy, Mines and Resources (EMR).

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Annual activities of the YGS are planned each winter following consultation with two Technical Advisory Committees (one for minerals; one for oil and gas), consideration of Yukon Government priorities, and discussion with potential research partners regarding opportunities for collaboration. Annual planning is also informed by a Yukon geoscience needs report, updated every five years following a planning workshop that examines existing gaps and emerging needs in the territory's knowledge base. In February 2014, YGS will be holding its fifth planning workshop. A report will follow, in which outstanding questions on Yukon's geology will be identified and research projects to address those questions will be outlined.

YGS OPERATING BUDGET

The Yukon Geological Survey's geoscience budget this year totaled \$2 420 000, of which \$1 250 000 was the survey's operating budgeted and \$1 170 000 was allocated for the Yukon Mining Incentives Program (YMIP). In addition to these funds, YGS received a Strategic Investments in Northern Economic Development (SINED) grant from the Canadian Northern Economic Development Agency (see below).

In recognition of the challenges that prospectors and exploration companies currently face raising investment capital, the Minister of Energy, Mines and Resources increased the amount of funding for Yukon Mining Incentive Program (YMIP) this year by \$400 000. A total of \$1 170 000 was made available to support projects in three modules (Grassroots, Focused Regional, and Target Evaluation). Program criteria remained the same as in previous years, with proposals being evaluated against defined benchmarks and grants being awarded based on merit.

In 2013-14, 81 YMIP applications were received and 54 were approved for funding. This represents a higher-than-average success rate of applications relative to previous years, which reflects the intent of the funding increase. Funding was distributed fairly evenly between individuals (36%), private companies (33%), and publicly-traded junior companies (31%). The locations and types of projects funded (*i.e.*, hardrock versus placer) and their distribution between modules are presented by Torgerson (2014). Of all mineral exploration projects undertaken this year in Yukon, nearly half were supported with YMIP funding.

SINED FUNDING

This fiscal year is the fourth and final year of a four-year federal SINED grant to enable geoscience projects in Yukon. This year's grant was for \$913 000. Projects funded under the program are designed to support economic development by stimulating exploration investment, reducing exploration risk, or mitigating geologic hazards that threaten communities and infrastructure.

Over the four year program, SINED funds were invested in six types of projects: geophysics, geochemistry, surficial mapping, targeted studies (primarily placer-related), data mining, and information services. This year, projects fell into all but the latter category. A summary of 2013-14 SINED-funded activities is presented in Table 1, and brief project descriptions are included in the sections that follow.

As in previous years of the program YGS is seeking feedback on the value and impact of SINED-funded projects. Readers are encouraged to contact the author or visit www.surveymonkey.com/s/YGS_Survey_2013 to provide comments on selected SINED-funded projects.

GEO-MAPPING FOR ENERGY AND MINERALS

In March 2013, the Geological Survey of Canada wrapped up a five-year Geo-mapping for Energy and Minerals (GEM) program. Under GEM, they delivered a number of mapping projects, aeromagnetic surveys, and thematic studies in southwestern Yukon, Eagle Plain, and Coates Lake area in southeast Yukon.

In August, the Prime Minister announced a renewal of GEM funding. Under GEM-2, GSC will invest \$100M over seven years (2013-2020) across the three territories and the northern parts of provinces. YGS is working with the Geological Survey of Canada to identify potential projects in Yukon that would address Yukon's priorities and meet the GEM program criteria.

YUKON GEOLOGICAL SURVEY ORGANIZATIONAL OVERVIEW

STAFF CHANGES

Yukon Geological Survey consists of four operational units (Fig. 1): Bedrock Geology (managed by Don Murphy), Mineral Services (managed by Lee Pigage), Surficial Geology (managed by Jeff Bond), and Technical

Table 1. Summary of 2013-14 projects being supported by funding from the federal Strategic Investments in Northern Economic Development (SINED) program.

2013-14 SINED Activity	Status
Geophysics	
Resistivity/IP surveys of shallow precious metal deposits: proof-of-concept study	Field work completed; data being processed. Anticipate a spring 2014 release
Combined IP & GPR survey of aggregate pits in Whitehorse	Work completed; anticipate report in spring 2014
Geophysical data inversion and modeling project	Work completed; anticipate report in spring 2014
Regional in-fill gravity survey, Klondike area	Contract awarded; field work to start in March 2014, data release in summer
Geochemistry	
Regional stream sediment geochem data weighted sums modeling	Maps and report released in November 2013; Heberlein, 2013
Surficial Geology	
Community-scale mapping of geologic hazards (Dawson City, Faro, Ross River)	Maps to be released by December 2014
Targeted Studies	
Selwyn Basin pyrite chemistry study	Results presented by Sack <i>et al.</i> (2014)
Fluvial modeling of White Channel gravels (University of Leeds)	PhD nearing completion,
Trace element chemistry of placer gold as a porphyry pathfinder	Results presented by Chapman <i>et al.</i> (2014)
Indian River placer minerals	Field work completed; sample analysis underway
Glacial limits in Ogilvie Mountains (Simon Fraser University)	MSc thesis; first year of study
Assessment of jade in St. Cyr area (Iowa State University)	Results presented by Isard and Gilotti (2014)
Baseline water monitoring for Eagle Plain (partnered with Water Resources Branch, Dept. Envir.)	Water sampling completed; 4 new hydrometers installed; work continuing over winter
Development for drill core program	~45% of collection is catalogued and moved
Data Mining	
Scanning and indexing of industry files	Contract underway; work is ongoing

Services (managed by Karen MacFarlane). These units are coordinated and supported by an Operations & Finance manager (Suzanne Roy) and the YGS Director (Carolyn Relf).

The Surficial Geology unit had a number of temporary staff absences this fiscal year, resulting in some flux with respect to program delivery. Jeff Bond took a year's deferred leave between January 2013 and January 2014, and Kristen Kennedy and Panya Lipovsky were each on maternity leave for part of the year (Kennedy started her leave in June; Lipovsky finished hers in September). In spite of these absences, the unit managed to meet its project obligations. Sydney van Loon was hired for the year to visit placer operations and collect data on placer production for the upcoming Placer Industry Report (targeted for release in 2014-15), and two consultants (Derek Turner and Karen McKenna) were retained to undertake surficial mapping as part of the community mapping program.

The Bedrock Geology unit also underwent changes this year. In November, Matthew Hutchison joined the survey in the capacity of oil and gas geologist and in January (2014), Rosie Cobbett started maternity leave.

The author would like to take this opportunity to welcome Matthew to the YGS, congratulate Kristen and Rosie on the arrival of their new family members, and welcome Jeff Bond and Panya Lipovsky back.

ORGANIZATIONAL PLANNING

In February 2014, YGS will be undertaking a two-day workshop to identify gaps in Yukon's geoscience knowledge base, flag emerging issues that may influence YGS priorities over the next few years, and discuss potential opportunities to collaborate on research with partners and/or clients. Such planning workshops are held every five years; the upcoming one will be held on February 11th and 12th, 2014. The first day will be open to external clients and stakeholders in order to stimulate discussion and generate input.

The document generated from the workshop will include geoscience project ideas for the next five to ten years. Defining priorities and setting annual work plans will depend on external factors such as client needs, industry trends, and funding opportunities, and internal factors such as staff capacity and policy direction.

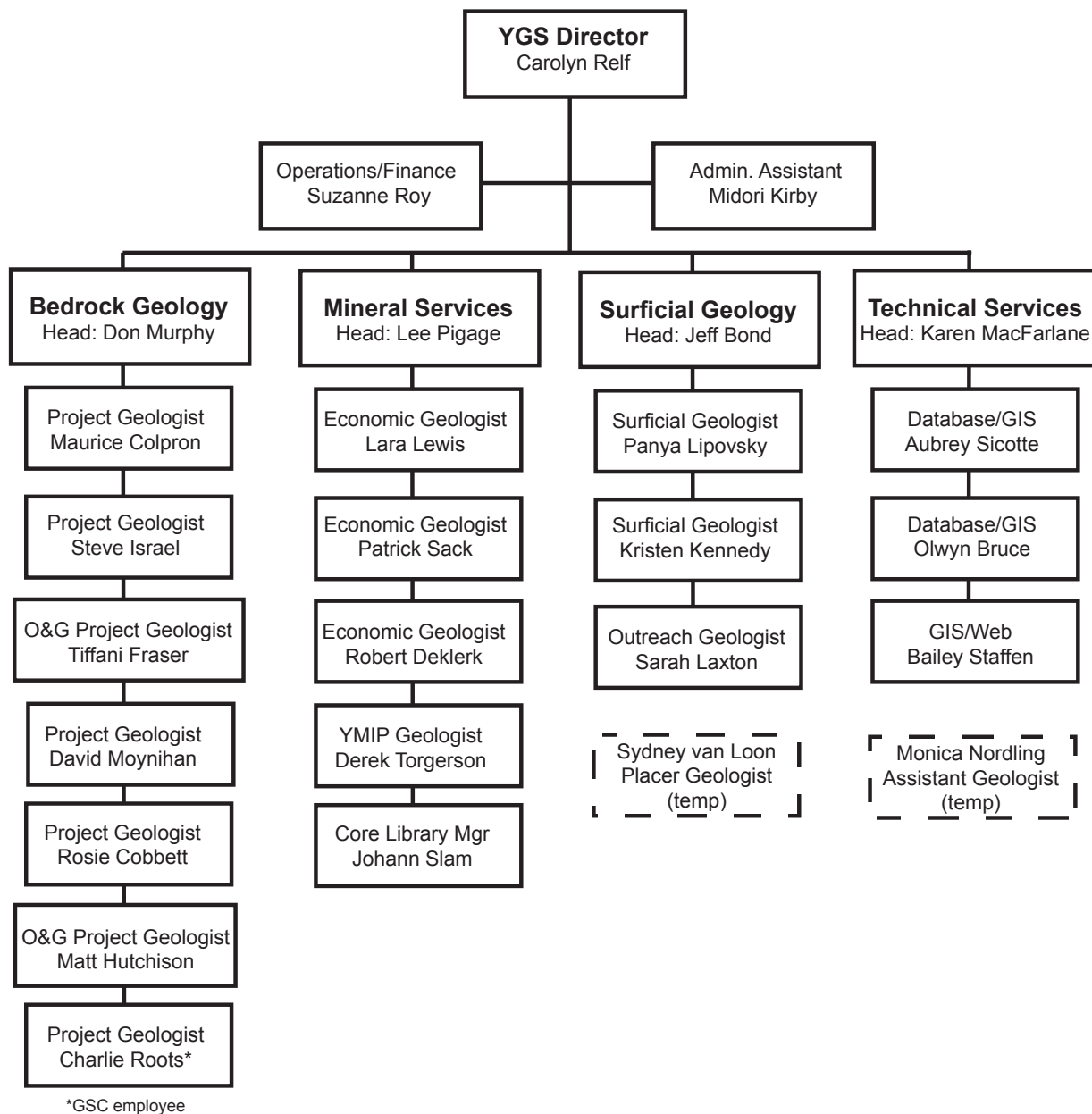


Figure 1. Yukon Geological Survey organizational chart.

HIGHLIGHTS OF FIELD PROJECTS

SOUTH COAST BELT PROJECT

Steve Israel extended coverage of southwestern Yukon’s Coast Belt geology to the Dezadeash Range (115A/10, 11, 14, 15) this summer (Fig. 2). Mapping targeted the relationship between metamorphosed Yukon-Tanana terrane rocks and rocks of the Kluane schist. The area preserves tectonic fabrics that record their

juxtaposition as well as evidence for subsequent structural and magmatic overprinting.

One of the significant points of interest for this map area is the fact that the geologic setting has potential for both intrusion-related and orogenic gold. Israel and Kim (2014) describe the geology in detail and highlight similarities between this area and the Juneau gold belt in the southeast Alaska.

2013 YGS Field projects

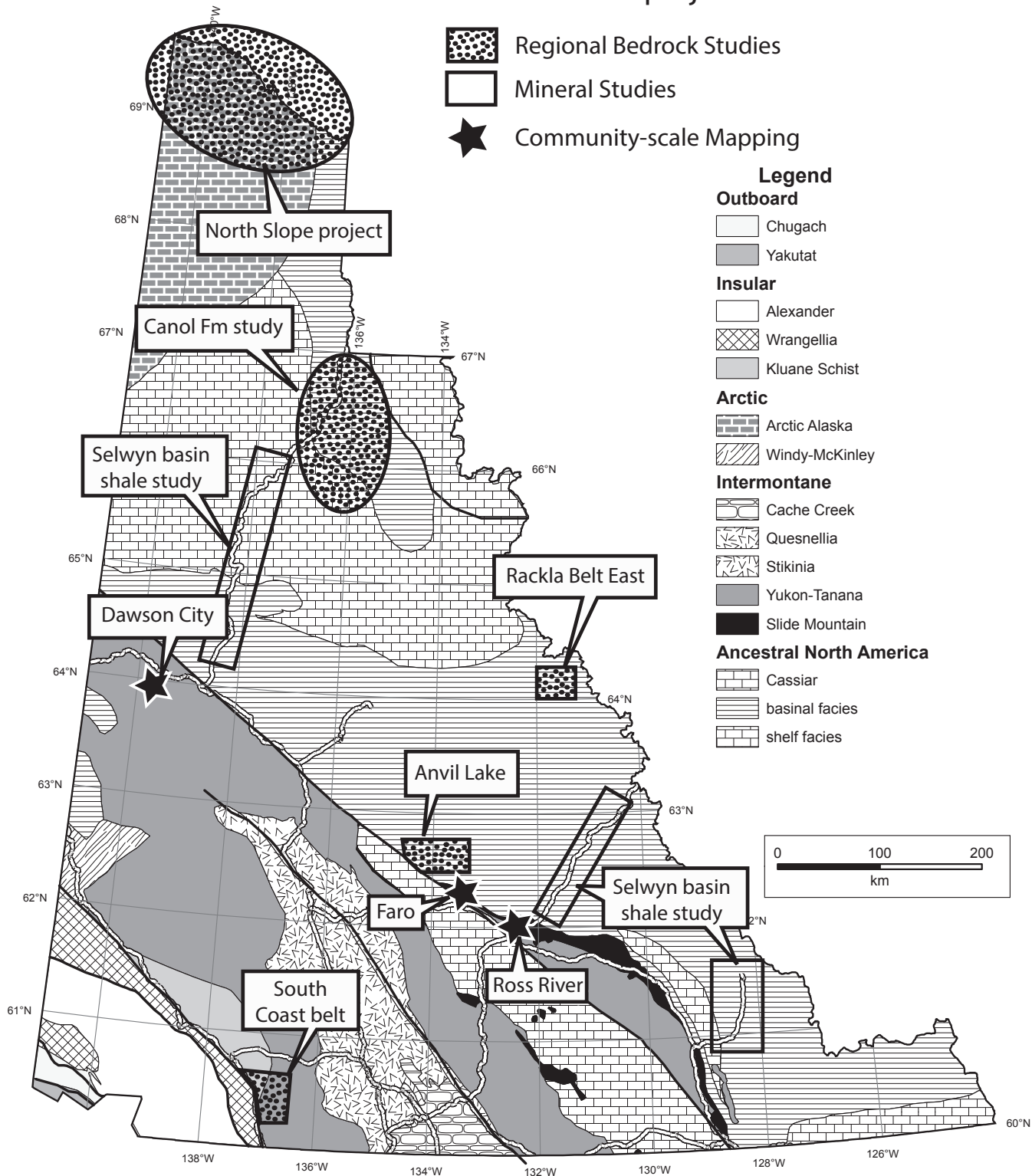


Figure 2. General locations of 2013 YGS field projects.

RACKLA BELT EAST PROJECT

In 2010, YGS initiated a regional-scale (1:50 000) mapping project in the Rackla belt in order to upgrade mapping along the northern margin of Selwyn basin in central Yukon (Fig. 2). New bedrock geology maps covering five NTS map sheets (106C/1 to 4 and 106D/1) were released earlier this year (Colpron *et al.*, 2013). This summer, David Moynihan extended map coverage eastward into map sheet 106B/4.

One of the key questions addressed by this year's mapping was whether the Dawson thrust fault, which separates strata of the Selwyn basin from shelf/slope rocks of the Ogilvie platform, could be traced eastward beyond 106C/1. Moynihan's mapping documented a major change in the orientation of the structural grain in this area: west of this year's map area, fabrics are west-to west-northwest-trending, parallel to the Dawson thrust. In the area mapped this summer, fabrics strike northwest (Fig. 3). This change in orientation occurs in the region where displacement on the Dawson thrust dies out.

A second focus of the project addressed the relationship between Proterozoic sedimentary rocks in 106C/1 and 2 (correlated to the Windermere Supergroup) and Proterozoic rocks further east where they have been mapped as Hyland Group. New field observations suggest that the upper Yusezyu Formation of Hyland Group is the stratigraphic equivalent of the upper part of the Blueflower Formation (Windermere Supergroup), and the two formations converge in 106B/4. This interpretation

is being tested by colleagues at Harvard University with carbon isotopes and paleontologic data (Justin Strauss), and at Boise State University with detrital zircon geochronology (Jim Crowley).

Descriptions of the geologic and structural observations are presented in more detail by Moynihan (2014).

CANOL FORMATION PROJECT

A new study was initiated this year by Tiffani Fraser on the Devonian Canol Formation (Fig. 2). This formation, which is made up of organic-rich siliceous black shale and chert, extends across northern Yukon into the central Mackenzie Valley in the Northwest Territories, and likely has stratigraphic correlatives in Alaska, northern British Columbia, and the western Arctic Islands.

The Canol Formation is the source rock for the Norman Wells oil field, and is currently the target of a shale oil play in the Mackenzie Valley. The purpose of this study is to document the extent of Canol Formation in Yukon, characterize its geologic features, and assess its potential as both a hydrocarbon source rock and reservoir in Yukon, and in particular, the Eagle Plain basin. A description of a near-complete section of the Canol Formation in the Richardson Mountains and the geochemical analyses that are underway is presented by Fraser (2014).

ANVIL LAKE PROJECT

Rosie Cobbett initiated a new mapping project in the Anvil Lake area (105K/11, 12) this summer (Fig. 2). The project

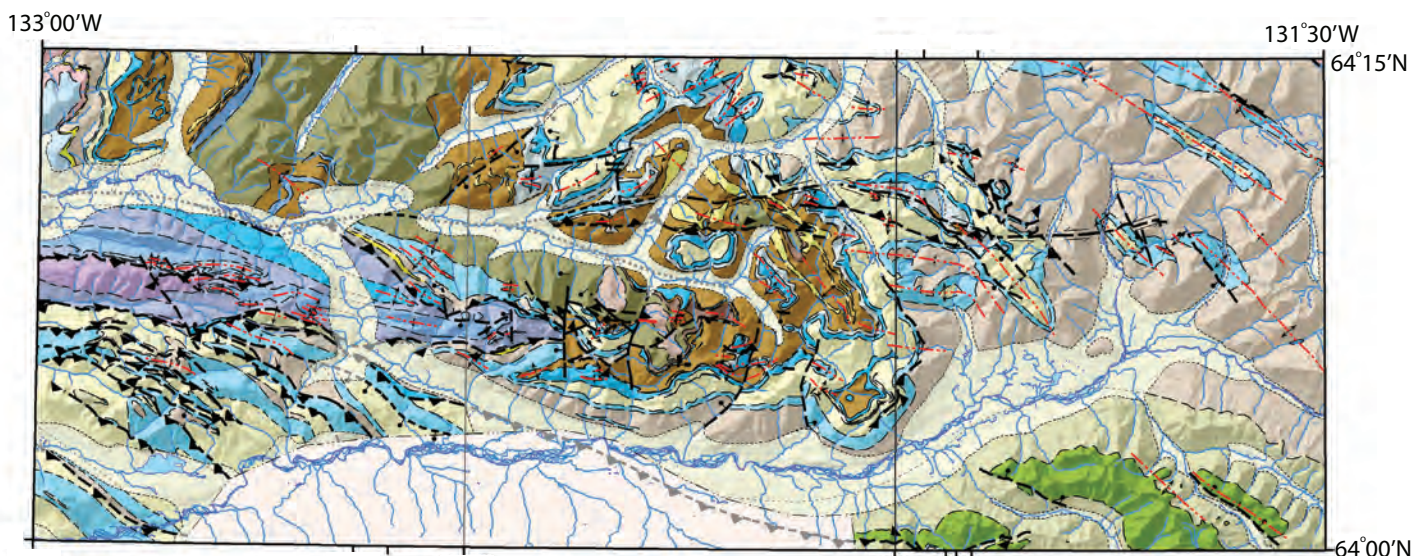


Figure 3. Simplified geology map of eastern part of Rackla belt. The eastern-most map sheet was mapped by Moynihan in 2013 (see Moynihan, 2014).

is designed to upgrade regional stratigraphic correlations in the southern Selwyn basin and document the stratigraphic and structural settings of silver-rich mineral occurrences in the area (including the Keg Ag-Zn-Pb-Cu deposit).

The area mapped to date preserves variably-metamorphosed Cambrian to Triassic sedimentary and volcanic rocks, intruded by mid-Cretaceous granitoid rocks. The supracrustal package defines northeast-vergent folds and thrusts that are truncated by steep normal faults. Field observations suggest potential for at least three different styles of mineralization: SEDEX, VMS, and epigenetic silver-rich veins. Details of each of these styles and their stratigraphic and structural controls are presented in Cobbett (2014).

NORTH SLOPE PROJECT

Maurice Colpron negotiated a partnership between YGS, the “Bundesanstalt für Geowissenschaften und Rohstoffe” (BGR) from Germany, and Université Pierre et Marie Curie (UPMC) from France to fund one month of fieldwork on the Yukon North Slope this summer. The project was a contribution to BGR’s “Circum-Arctic Structural Events”

(CASE) program and the 15th expedition under this program. CASE 15 provided the logistical support for 20 geoscientists from Germany, France, USA, and Canada, including 4 graduate and 2 undergraduate students (Fig. 4). Field work was carried out from a basecamp at the Blow River airstrip on the Arctic coastal plain, fly camps deployed from this base, and from Old Crow. Figure 5 illustrates the main areas where field work was focused.

A number of thematic studies were undertaken in the area, including an examination of Neoproterozoic to lower



Figure 4. Photo of Maurice Colpron in the North Slope.

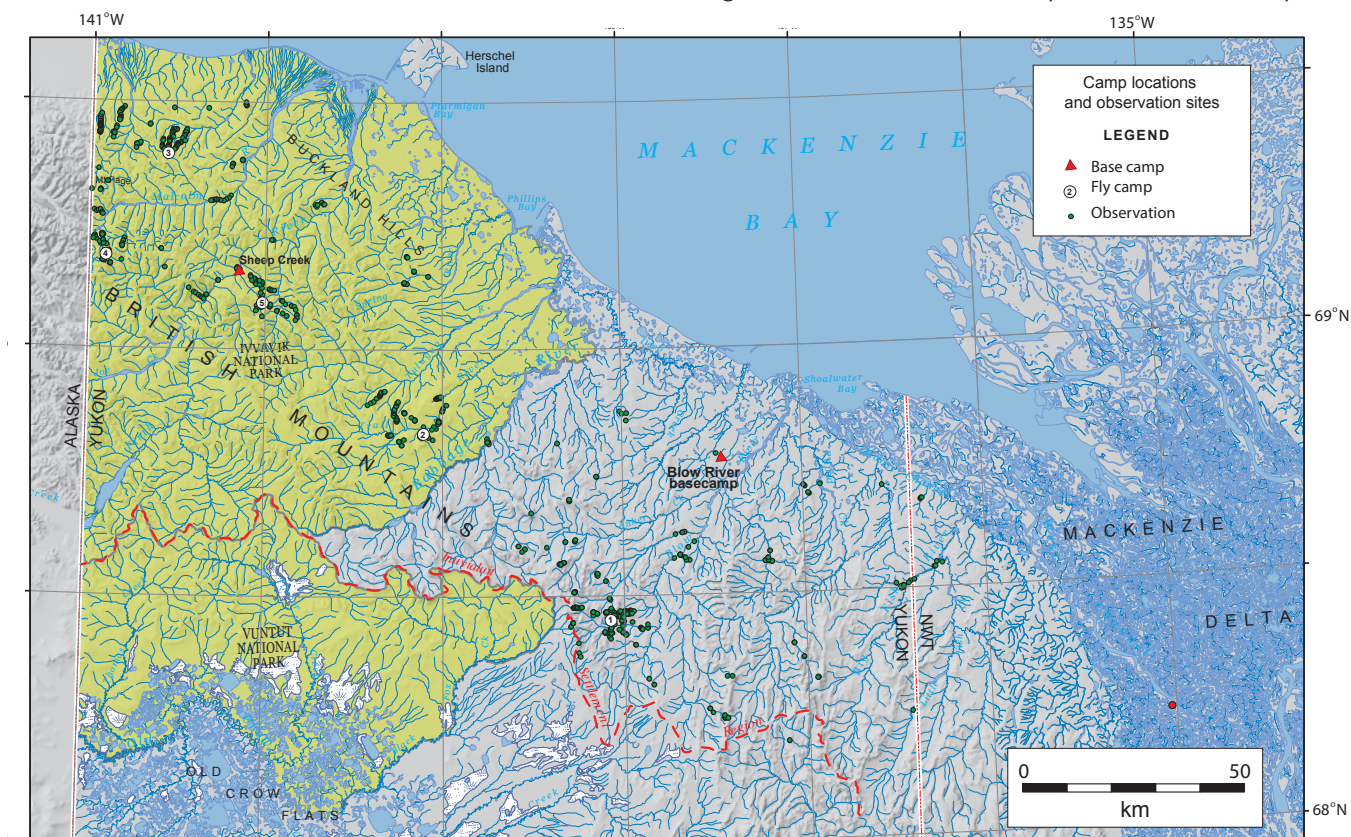


Figure 5. North Slope project 2013 field observation locations.

Paleozoic stratigraphy in the Barn and British mountains, analysis of Paleozoic deformation and its relationship to Devonian plutons, a study of Upper Cretaceous and Tertiary strata (stratigraphy, sedimentology, and paleontology), and detailed structural analysis of Tertiary faults. Samples were collected for U-Pb geochronology of igneous and detrital zircons, and for low temperature thermochronology (apatite fission-track and U-Th-He analyses).

A key scientific objective of the CASE 15 project is to evaluate the paleogeographic affinity of lower Paleozoic and older strata on the Yukon North Slope; specifically to assess whether they were translated along the paleo-Arctic margin in the Devonian. A second objective is to understand the link between the Cordillera and the Arctic by comparing faults on the Yukon North Slope to their possible counterparts on northern Ellesmere Island and Svalbard. A third objective, supported by the thermochronology, is to establish the thermal history and landscape evolution of the region.

Preliminary results support the idea that Tertiary structures on the Yukon North Slope have a similar history as those in the eastern Arctic and that a major transform fault may link the eastern and western Arctic regions.

SELWYN BASIN SHALE PROJECT

Gold exploration in Selwyn basin over the past several years has resulted in a number of significant new discoveries. Most notable are the Carlin-style occurrences along the Rackla belt in central Yukon and orogenic occurrences in southeastern Yukon. A new gold-source model by Large *et al.* (2011) for sediment-hosted gold deposits suggests diagenetic pyrite in carbonaceous shales is a likely source of gold, arsenic, and other trace elements for these deposits. Patrick Sack initiated a study last year of the trace element content of pyrites in shales near the Conrad Carlin-type and 3Ace orogenic gold occurrences in collaboration with researchers at the Centre of Excellence in Ore Deposits at the University of Tasmania. Preliminary interpretation

of the data reveal that early diagenetic pyrites are more enriched in trace elements than subsequent generations of pyrite (Fig. 6). Furthermore, the trace element compositions of diagenetic pyrites from the Conrad occurrence are similar to pyrites that are distal from the northern Carlin Trend in Nevada; the 3Ace diagenetic pyrite are very similar to those from the 30M oz Sukhoi Log orogenic-style gold deposit in eastern Russia.

This year, shale samples from the Hyland, Road River, and Earn groups were sampled to characterize pyrites from different stratigraphic levels in the Selwyn basin area, particularly with respect to gold fertility (Fig. 2). Differences in pyrite composition, if observed, could also serve as useful chemostratigraphic indicators.

Results of the Selwyn basin shale study, funded from YGS' SINED grant, are presented in more detail by Sack *et al.* (2014).

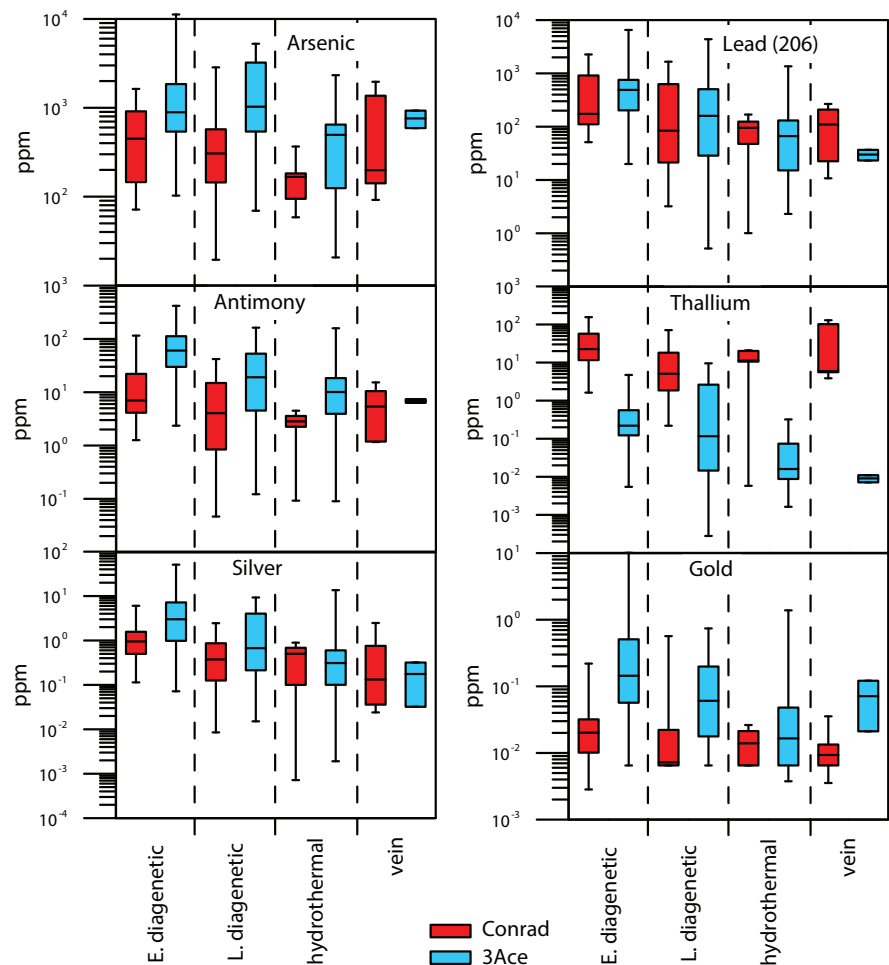


Figure 6. Selected trace element plots from four generations of pyrites adjacent to the 3Ace and Conrad showings, Selwyn basin. Note the decrease in trace element concentrations over time. Figure reproduced from Sack *et al.*, 2014.

COMMUNITY MAPPING

In collaboration with the Northern Climate Exchange (NCE) at Yukon College, YGS has been generating landscape hazards maps for communities in Yukon. These maps integrate surficial geology with information on permafrost and hydrology to identify areas prone to landslides, debris flows, flooding, and permafrost degradation.

This summer, three communities were mapped: Faro, Ross River, and Dawson City (Fig. 2). Surficial geology field work was undertaken by contractors (Karen McKenna for Dawson City; Derek Turner for Faro and Ross River), with Kristen Kennedy, Sarah Laxton, and Panya Lipovsky contributing to project planning (Kennedy), ground penetrating radar surveys (Laxton), and map production (Lipovsky).

Hazards maps for all three communities will be released by December 2014.

STEVENSON RIDGE SURFICIAL GEOLOGY

Surficial mapping in the Stevenson Ridge area was initiated in 2007 by YGS under the leadership of Jeff Bond and Panya Lipovsky. Three summers of field mapping (2007, 2008, 2010) was completed on seventeen 1:50 000 map sheets (Fig. 7); to date, new maps have been released for fifteen of these map sheets (Bond and Lipovsky, 2009a to d; Bond and Lipovsky, 2012a and b; Lipovsky and Bond, 2012a to c; and Lipovsky and Bond, 2013a to f). The remaining maps will be released in early 2014.

Highlights of mapping include significant revisions to the pre-Reid, Reid, Gladstone, and McConnell glacial limits, with associated implications for the application of soil sampling; local evidence for dammed paleodrainages which may have produced conditions favourable for placer deposition; and improved documentation of loess distribution which will assist in identifying areas where soil samples will be affected by dilution.

TAY RIVER SUITE STUDY

In 2009, Lee Pigage and co-workers undertook a regional bedrock mapping project in the Coal River map area of southeastern Yukon (Fig. 7). Mapping was funded by the Geological Survey of Canada through their GEM-1 program, and the map was released in 2011 (Pigage *et al.*, 2011). A number of poorly exposed, previously undocumented plutons were mapped and sampled, and follow-up geochemical and geochronological studies (the latter in collaboration with Jim Crowley at Boise State University) were undertaken. Based on their ages and chemical character, the plutons are interpreted to be part of the mid-Cretaceous Tay River Plutonic Suite (Pigage *et al.*, 2014a).

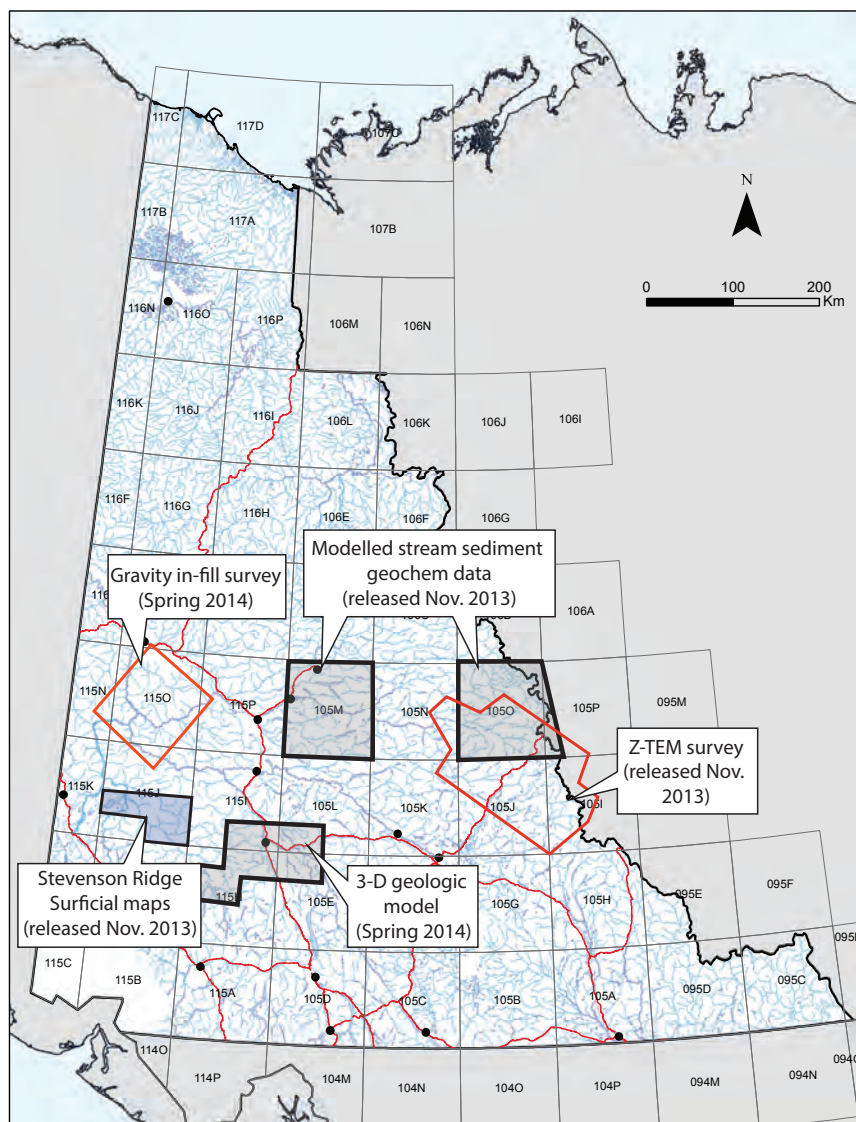


Figure 7. Simplified map showing locations of recently-released geophysical, geochemical, and surficial maps, and planned footprint of Dawson area gravity survey. References for released maps are cited in text.

GEOPHYSICS PROJECTS

YGS is overseeing five SINED-funded geophysics projects this year; one project has been completed, three are near completion, and the fifth will start shortly and is scheduled to be complete by the end of March (2014).

The first project, completed in November, involved the processing and inversion of magnetic and Z-TEM data collected in the Selwyn Basin by Geotech Ltd. on contract to Exploration Syndicate Inc. (ESI). The airborne survey covered nearly 25 000 km² in the North Canol Road region (see Figs. 7 and 8) and straddles the Yukon-NWT border. Last fiscal year, YGS purchased the data from ESI,

and over the summer Condor Consulting processed the data and generated a series of maps and profiles. These were released, along with the raw data, in November (Condor Geophysics, 2013).

A second geophysics project, not yet completed, is testing shallow (~90 m) DC resistivity/induced polarization (IP) as an exploration tool for near-surface precious metal deposits that are buried under thick soil cover. The instrument, the Supersting RI/IP, is a high resolution system designed for geotechnical and groundwater applications and is easier and cheaper to operate than traditional IP systems. In this study, it is being applied to shallow, drill-delineated, mineralized zones to assess

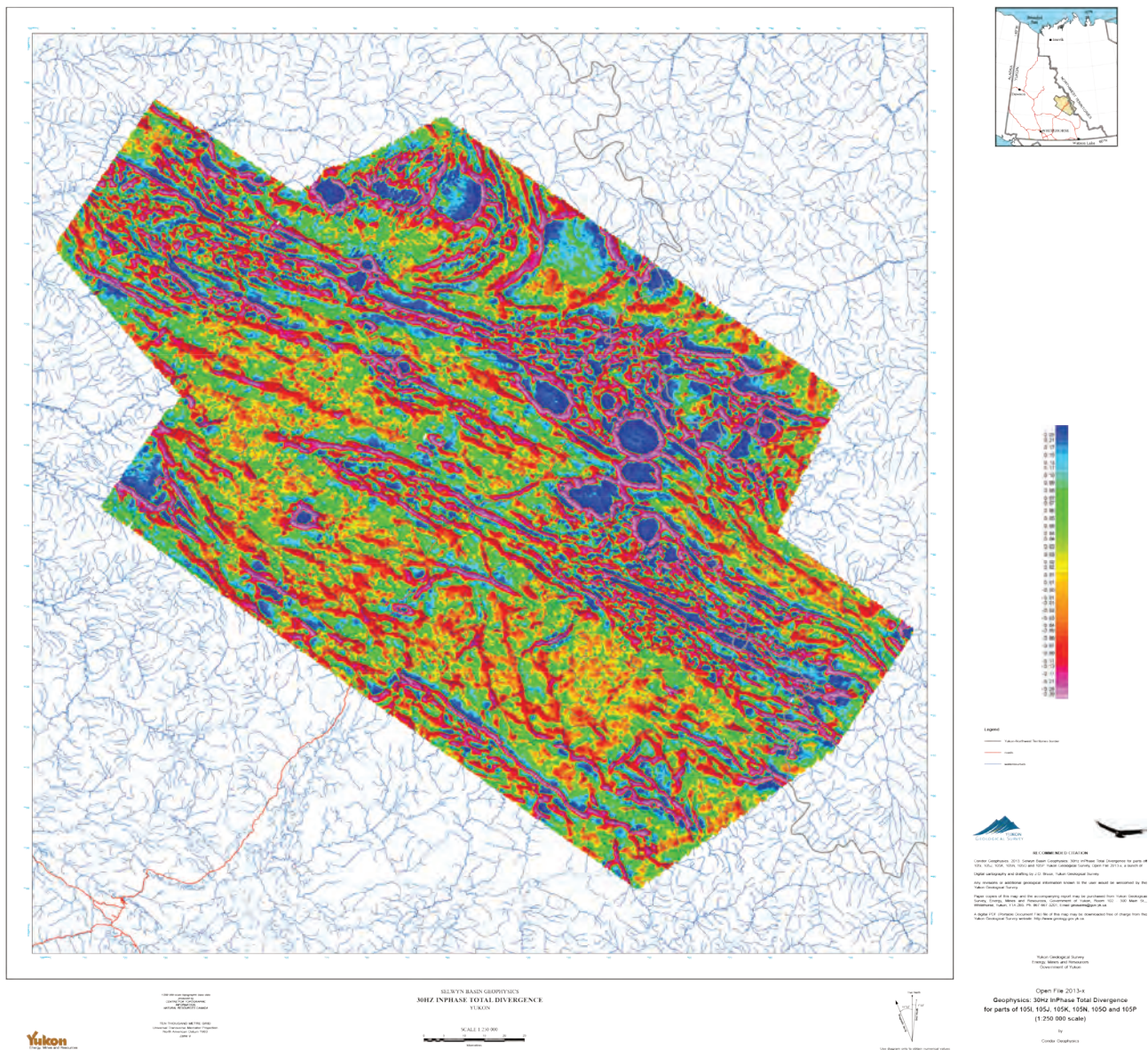


Figure 8. Image of one of the series of ZTEM maps released in 2013. Map shows 30 Hz inphase total divergence.

how effectively it can image the size and orientation of the zone. GroundTruth Exploration has surveyed nine mineral occurrences, representing six different styles of mineralization, and is finding good correspondence between the modeled anomaly and the drill data. Figure 9 illustrates an example of a resistivity profile from Rockhaven Resources Ltd.'s Klaza zone. A report that presents the data, outlines the data processing techniques and evaluates the instrument's effectiveness for this particular application will be released this spring.

A third geophysics study applied IP and Ground Penetrating Radar (GPR) surveys to four Whitehorse gravel pits (three existing and one planned) to support the city's requirement for aggregate for municipal development and road maintenance. The geophysical surveys were ground truthed using a sonic drill and by mapping exposed sections. Kyrotec Arctic Innovation undertook the IP

surveying and drilling, and Sarah Laxton (YGS) collected the GPR data. A co-authored report on the results will be released this spring.

Another geophysical project underway involves data inversion and modeling. The project, being led by Mira Geosciences, entails integrating and inverting a number of datasets in the Aishihik Lake – Carmacks region of southern Yukon (Fig. 7) to create a three-dimensional model of the geology. The datasets include the two SINED-funded gravity surveys completed in 2011 and 2012 over northern Aishihik Lake (Yukon Geological Survey, 2011) and the northern Whitehorse trough area (Aurora Geosciences Ltd., 2012), new regional airborne magnetic data collected by the Geological Survey of Canada under their Geomapping for Energy and Minerals Program, recently-compiled bedrock geology data for the Whitehorse trough (Colpron, 2011) and north Aishihik

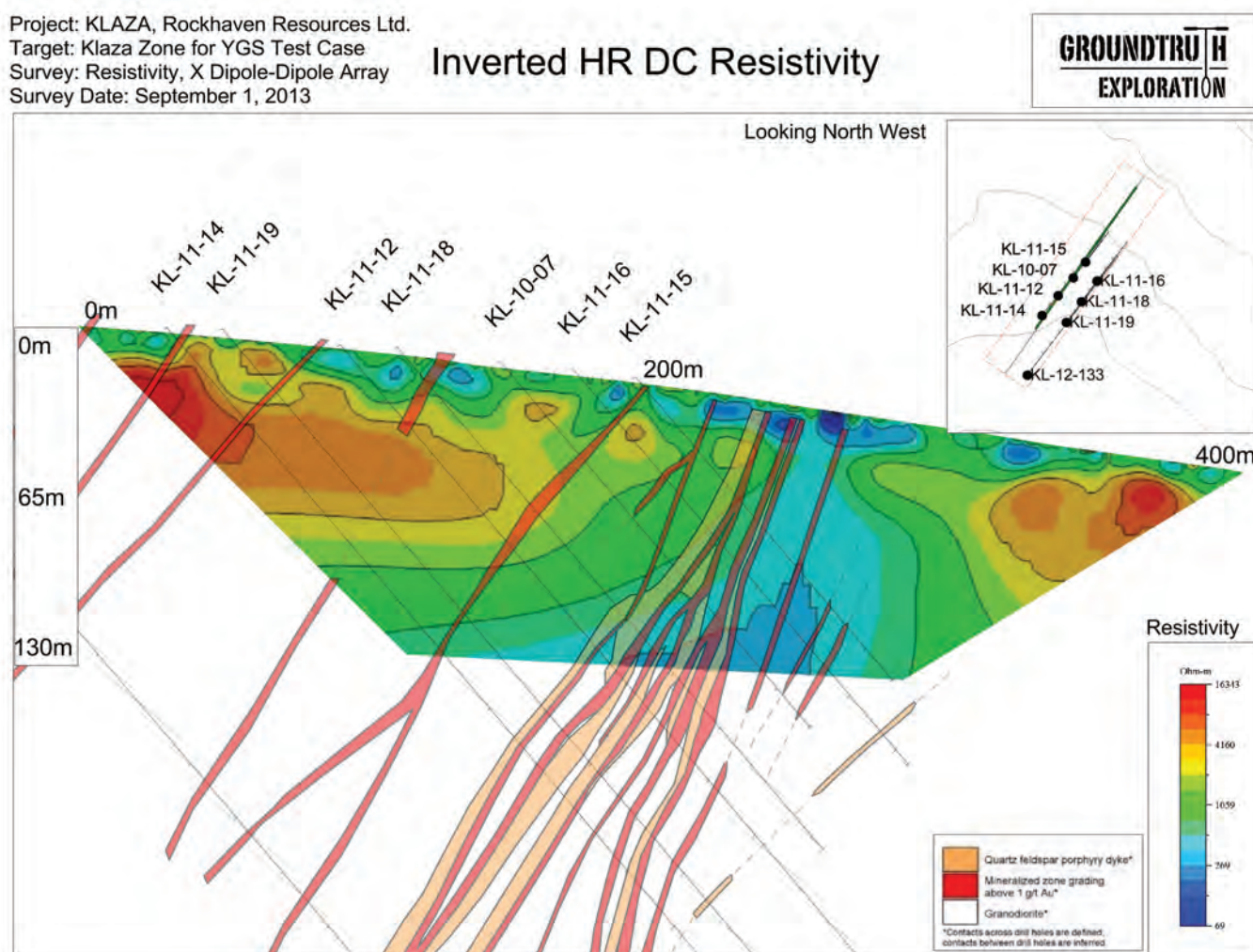


Figure 9. Example of the DC Resistivity/IP survey results over Rockhaven Resources' Klaza zone. Drill-delineated mineralized zones are superposed on the resistivity profile.

Lake area (Israel and Westberg, 2011), and two seismic surveys covering parts of the Whitehorse trough (White *et al.*, 2012). Results of the study will be presented at the 2014 Exploration Roundup in Vancouver and in a report to be released this spring.

The final project, scheduled to begin in early March 2014, is an in-fill gravity survey at a station spacing of 2 km in the Klondike region. The study area lies about 20 km south of Dawson City (Fig. 7), and is underlain by a large gravity low (defined by existing regional gravity data at ~20 km spacing). This anomaly is of interest as it may indicate an alteration system or structural feature that is related to gold mineralization in the source area of Eldorado and Bonanza creeks.

In addition to the above SINED-funded geophysical surveys, Sarah Laxton collected ground penetrating radar (GPR) data in support of a number of studies. One of the surveys targeted the Whitehorse cemetery, and was designed to determine whether any unmarked graves were located outside the boundary of the property (Fig. 10). Laxton also continued her collaboration with the RCMP, using GPR to image buried pigs as proxies to human remains. A third study involved the application of GPR to the Llewellyn Glacier south of Atlin Lake; this project, coordinated by the Northern Climate Exchange (Yukon College), is examining hydrological processes in the headwater region of Yukon River in order to predict what impact climate change may have on the river. This study has implications for the hydro dam at Whitehorse.

REGIONAL STREAM SEDIMENT GEOCHEMISTRY MAPS

As reported in previous years, YGS contracted Wayne Jackaman to undertake a SINED-funded project to re-analyse all available Selwyn basin stream sediment sample pulps, which are archived in Ottawa by the Geological Survey of Canada. This work was completed between 2010 and 2012, and the new data, comprising a 53 element suite, have been released (Jackaman, 2011a to c; Jackaman, 2012a to e).

As a next step to improving the single element dataset, SINED funds were used to contract Heberlein Geoconsulting to further process the data covering two map sheet areas: 105M and 105O/P (Fig. 7). These areas were selected because they are known to host a variety of mineral deposit types, allowing an assessment of whether the value-added analysis would be effective in predicting the presence of known mineral occurrences and, by



Figure 10. Sarah Laxton collecting GPR data over a grave site.

inference, un-discovered occurrences. As part of the project, catchment areas were delineated for each sample point and weighted mean sums modeling was applied to combinations of elements to allow geochemical signatures to be linked to particular mineralization types.

The catchment polygons illustrate two points that are not immediately obvious from the sample locations alone. First, shading of the catchments reveals a number of drainages in both map areas that were not sampled by the original surveys, highlighting areas where further sampling should be done. Second, catchment sizes, and therefore the influence of dilution, vary significantly, which has important implications for interpreting metal anomalies.

To carry out the weighted sums modeling, Heberlein assigned values to elements for each of the mineral deposit types being modelled (e.g., polymetallic veins, SEDEX, Carlin-style gold, etc.). The value assigned is proportional to the concentration of that element in the deposit type of interest; large positive values indicate elevated concentrations and negative values indicate element depletion. In the example illustrated in Figure 11, results of modeling for polymetallic vein mineralization in map sheet area 105M are shown along with documented polymetallic vein occurrences from the MINFILE database. The modelled values show a strong correlation with MINFILE occurrences. Of note is the presence of a number of catchment areas in the southern part of the map with high model values but no associated MINFILE occurrences, suggesting the presence of undiscovered mineralization. Maps and an accompanying report on this project were released in November (Heberlein, 2013).

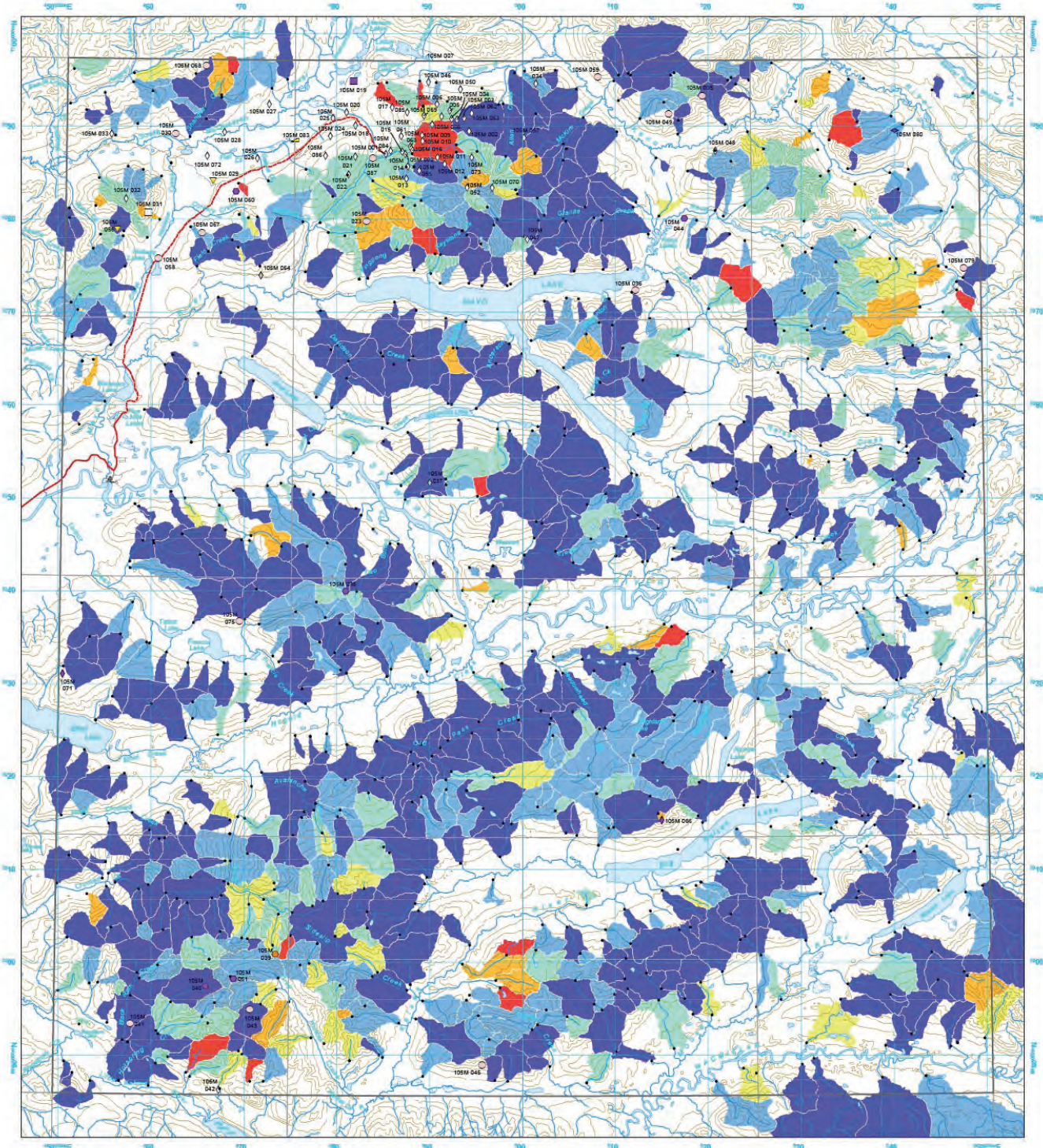


Figure 11. Map showing results of weighted sums modelling for polymetallic vein type mineralization in map sheet area 105M. Catchment areas shaded with warmer colours have a higher probability of hosting this type of deposit.

GEOSCIENCE OUTREACH

Sarah Laxton delivers YGS' outreach and education program. Activities that target schools include an annual geoscience workshop for Yukon teachers, field trips, tours during Yukon Mining Week and Geoscience Forum, and collection of permafrost data from monitoring stations in communities. Other activities such as geology walks in Miles Canyon and Tombstone Park and public presentations are aimed at the general public (Fig. 12).

In collaboration with Charlie Roots, Sarah is developing a geology map of Tombstone Park for the park's interpretive centre. They are also completing a geology highway map of Yukon.



Figure 12. Photo of Sarah Laxton with a group of students near Hasselberg Lake, Yukon.

UNIVERSITY COLLABORATIONS

YGS provided logistical and/or financial support for a number of university projects this year. Interim results from a number of these projects were presented at the Yukon Geoscience Forum in November and overviews of some of the projects are included in this volume.

WHITE CHANNEL GRAVELS

Robert Lowther (Leeds University) is continuing work on a PhD study of the stratigraphy and depositional setting of the White Channel gravels in the Klondike. The project includes field work, which has now been completed, and a lab component involving modeling of sediments in a flume. This project is funded in part with SINED resources; results of the study are presented by Lowther *et al.* (2014).

NEOPROTEROZOIC STRATIGRAPHY

Galen Halverson (McGill University) and his students continued their research in the Ogilvie Mountains this year. The team is re-interpreting regional stratigraphic correlations of early Neoproterozoic sequences based on bedrock mapping, new geochronologic data, and geochemical data (major and trace elements and stable isotopes). YGS provided some logistical support to the field crew.

PLACER GOLD AS A PATHFINDER FOR CU-AU PORPHYRIES

In this study, Rob Chapman (Leeds University) is comparing the trace element compositions of placer gold grains downstream from the Casino deposit to gold grains in Casino drill core. The placer gold has a distinct chemical signature that matches that of gold from the Casino deposit, suggesting that placer grains can be used as indicators of deposit type in the source area of creeks. Details of this study, which was funded in part by SINED, are presented by Chapman *et al.* (2014).

INDIAN RIVER PLACER MINERALS

A second study by Rob Chapman is following up reports of elevated counts of tin, titanium, and tungsten in heavy mineral concentrates from Indian River to determine whether these metals are present in economic concentrations. Sampling showed that tin and tungsten occur on benches about mid-way down the river from its headwaters and titanium is common in all samples (locally, as very coarse ilmenite). The source of these metals was not determined, although tungsten is interpreted to be derived from scheelite in orogenic veins in the region.

Another component of the Indian River study examined the range of gold grain fineness in gravels to determine the best method(s) for sample processing to maximize recovery (e.g., conventional sluicing vs. enhanced gravity concentration). The study revealed that different size fractions are concentrated in different parts of the section (Fig. 13). These results were presented at the November 2013 Yukon Placer Forum in Whitehorse.

GLACIAL LIMITS IN THE OGILVIE MOUNTAINS

Another SINED-funded study involves mapping and sampling of glacial sediments in the Ogilvie Mountains in central Yukon. This project is being undertaken by Logan Brown under the supervision of Brent Ward (Simon Fraser University). Its purpose is to determine the timing of

the penultimate glaciation in the region using Terrestrial Cosmogenic Nuclide exposure dating. These ages will be coupled with U-Pb geochronology if tephra layers can be found. Determining the timing and extent of the pre-Reid ice limit has implications for drift prospecting, and mapping of surficial materials will provide information on aggregate.

ORIGIN OF THE TOWER PEAK ASSEMBLAGE, ST. CYR AREA

Jane Gilotti (University of Iowa) is supervising a thesis by Sierra Isard in the St. Cyr area in south-central Yukon. The area is underlain by a package of high pressure rocks characterized by eclogitic lenses. The package includes a unit of mafic to ultramafic rocks of oceanic affinity (Cassiar terrane) and a volcanic unit of uncertain age and origin (the Tower Peak assemblage). The thesis involves mapping, structural analysis, and geochronology to determine the affinity of the volcanic rocks. An incidental part of the study is comparing the St. Cyr area to Frances Lake, where jade deposits occur in a setting very similar to that in the present study. The jade assessment is being supported with SINED funds. Results of field work are presented in Isard and Gilotti (2014).

PROVENANCE STUDY OF SEDIMENTARY ROCKS IN THE WERNECKE BRECCIA

Jacob Verbaas (Simon Fraser University) is undertaking a study of the Werknecke Breccia in central Yukon that focuses on clasts preserved in the breccia that are interpreted to be exotic with respect to the Wernecke Supergroup. Some are igneous clasts derived from a proposed arc ("Bennetia") that over-rode Laurentia during the Raklan orogeny. Other clasts are sedimentary in origin, comprising purple and green clastic rocks and interstitial sediment between breccia clasts. Verbaas' preliminary data support an interpretation of the sediments as the remains of an overlap assemblage that was deposited on Bonnetia. YGS provided some logistical support for this study.

ONGOING YGS ACTIVITIES

MONITORING

YGS Mineral Services staff visited 27 mineral exploration properties to monitor exploration results and expenditures. The Surficial Geology unit visited placer mining operations and collected data to include in the upcoming Placer

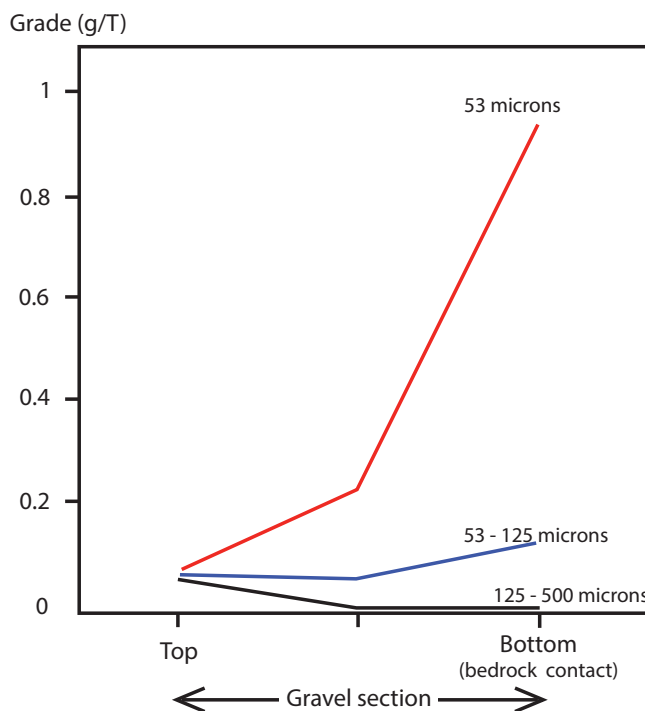


Figure 13. Plot showing variations in placer gold grade with depth in section for different size fractions of gold. Data reproduced with permission from Chapman (personal communication).

Industry Report. Highlights of both hardrock and placer exploration and development activities were presented at the Yukon Geoscience Forum in November and are summarized in this volume (Pigage *et al.*, 2014b; van Loon and Lipovsky, 2014).

YGS continued its program of permafrost monitoring across the territory in 2013. Sarah Laxton collected data on active layer thickness from fourteen locations in Yukon and ground temperature data from stations in six communities (Whitehorse, Destruction Bay, Carmacks, Faro, Beaver Creek, and Dawson City). The information collected contributes to a permafrost data network that can be accessed on-line at <http://permafrost.gov.yk.ca>.

In response to public concerns about the potential impact of oil and gas development on surface and groundwater, YGS, EMR's Oil and Gas Branch, and the Department of Environment's Water Resources Branch held a workshop in June with water regulators from adjacent jurisdictions to share information on water management practices. Following the workshop, enhancements were made to Water Resources' water monitoring program in Eagle

Plain. Four new hydrometric stations were installed on drainages downstream from Northern Cross Yukon's exploration site, and water samples were collected from several creeks and tributaries for analysis. This monitoring work was funded in part by SINED.

PUBLICATIONS

In 2013, YGS released 17 Open Files, 2 Miscellaneous Reports, and 1 Geoscience Map. The 2013 Yukon Exploration & Geology volume, released early in 2014, contains 14 technical papers. In addition to the above publications, industry reports can also be downloaded from the YGS website. This year, a number of Yukon Consolidated Gold files (172 maps and 13) were scanned at the National Archives in Ottawa and uploaded to the website. In addition to these files, 1261 maps and 4621 reports (totaling 33 GB of data) from the survey's collection of industry documents were scanned and indexed as of the end of December.

DATASETS

In addition to publications, YGS manages a number of dynamic datasets. Some of the data (e.g., MINFILE) are accessible on-line, and others (e.g., litho-geochemistry) are being cleaned and should be ready to be web-enabled in the new year.

A new web portal, accessible from www.geology.gov.yk.ca, was created in December to host downloadable GIS data for an updated version of the Yukon bedrock geology map. The updated map incorporates new maps in southwestern Yukon that have been generated since the first digital map was published (Gordey and Makepeace, 2001). Unlike the original map, this map will be dynamic and as new shape files and data are created they will be added incrementally to the compilation.

The MINFILE database has seen a number of upgrades in the last year. In response to advice provided by industry clients in 2012, Rob Deklerk has focused data updates on those areas which have seen significant exploration over the past few years to ensure that information on currently active projects is as up-to-date as possible. Efforts were also made to remove entries with no documented mineral occurrences. Some 200 "unknown" showings were inherited from the original database when occurrence numbers were assigned to all staked claims, regardless of whether an occurrence was found on the claim.

While MINFILE showings have been accessible on-line for a number of years via the Yukon government's Map Viewer application, the data posted were static extracts that were manually loaded into the viewer. This year, Geomatics Yukon developed an automated script that updates the MINFILE layer weekly, capturing any new data that have been entered in the last week.

In 2011, YGS' collection of mineral occurrence hand samples was catalogued and MINFILE occurrence numbers were assigned to samples. This year, the samples were entered into the database; users can now query MINFILE and determine whether samples are available for viewing. Similar information on the availability of drill core will be added to MINFILE over the next year.

A public comment form is scheduled to be added to the MINFILE web interface shortly. The form will allow users to provide input and comments on existing mineral occurrence data or to make suggestions for new mineral occurrences. The forms will be reviewed by Rob Deklerk and the information in them may be adopted or rejected based on his review.

H.S. BOSTOCK CORE LIBRARY

Since opening the new building in November, 2011, YGS has seen a steady increase in client use of the facilities. Last winter YGS completed an inventory of drill core to ensure the collection was documented before being moved. At the same time, a policy was developed for accessing drill core to view and sample, and criteria for donating core were established.

Over the summer, ground was prepared and 10 core racks were installed in the compound at the new H.S. Bostock Core Library. Following this work, over 12 000 boxes of drill core (roughly 45% of the collection) were photographed, catalogued, and moved to the new racks. SINED funds were used to cover costs associated with the core move. Next summer, another ~7000 boxes are scheduled to be moved; the rest of the core collection will remain at the old facility at 426 Range Road. Retaining a portion of the core at the old facility will allow room for growth of the collection.

Drill core metadata (including drill hole number, core rack location, etc.) will be imported into the Enterprise database over the winter and linked with MINFILE occurrences. Once this information has been reviewed for accuracy, the web application will be modified to allow users to search for drill core via the search tool.

Queries about what drill core exists and how to access it can be made to Lee Pigage, Head of YGS Mineral Services (lee.pigage@gov.yk.ca).

SUMMARY

2013 was an extremely busy year for the Yukon Geological Survey. Staff delivered a total of six regional bedrock projects and contributed to numerous smaller thematic field and desktop studies. As the current SINED funding cycle winds down, a larger-than-usual volume of data and maps have been released, and progress on the drill core program has resulted in an increasing number of users accessing the collection over the summer and fall.

With the Geological Survey of Canada's announcement of GEM program renewal (GEM 2) in August, and the possibility of another cycle of SINED funding, YGS' planning workshop is timely as it will help to identify key questions that will influence research directions over the next several years.

As always, YGS is happy to have input from clients and stakeholders, and welcomes opportunities to discuss new project ideas.

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Yukon Hardrock Mining, Development, and Exploration Overview 2013

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Pigage, L.C., Sack, P.J., Lewis, L.L., Torgerson, D., and Deklerk, R., 2014. Yukon Hardrock Mining, Development, and Exploration Overview 2013. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 21-47.

INTRODUCTION

In 2013, the global mineral industry was buffeted by financial challenges. Multi-national corporations have had major asset write downs because of falling metal prices. Major equipment costs have increased dramatically. Junior exploration companies have not been able to raise venture capital for funding projects as investors have been adverse to perceived high risk ventures.

Yukon was not exempt from these challenges. Many exploration programs were downscaled with emphasis placed on lower cost activities. In spite of the global milieu, over 100 exploration projects were ongoing in Yukon during the 2013 field season (Fig. 1, on inside front cover); 16 of these projects had expenditures of over \$500 000, and 10 out of those 16 had expenditures greater than \$1 million. The exploration overview presented in this report is a progress report rather than a comprehensive summary of Yukon exploration and mining. Many results are still pending at the publication deadline of this volume and thus are preliminary in nature. Summary statistics and analytical results are based on news releases by companies and personal communication with company representatives.

Exploration spending in 2013 is estimated to have been approximately \$45 million (Fig. 2), similar to the estimated exploration expenditures of 2006-2007 and 1995-1996, but well below 2011 estimated exploration expenditures of \$300 million. Gold exploration accounted for 76% of expenditures (Fig. 3). Zinc-lead exploration totalled 3% of expenditures; silver exploration and copper exploration accounted for 12% and 6% of total exploration expenditures, respectively. Exploration for nickel and PGEs constituted 3% of exploration spending for 2013.

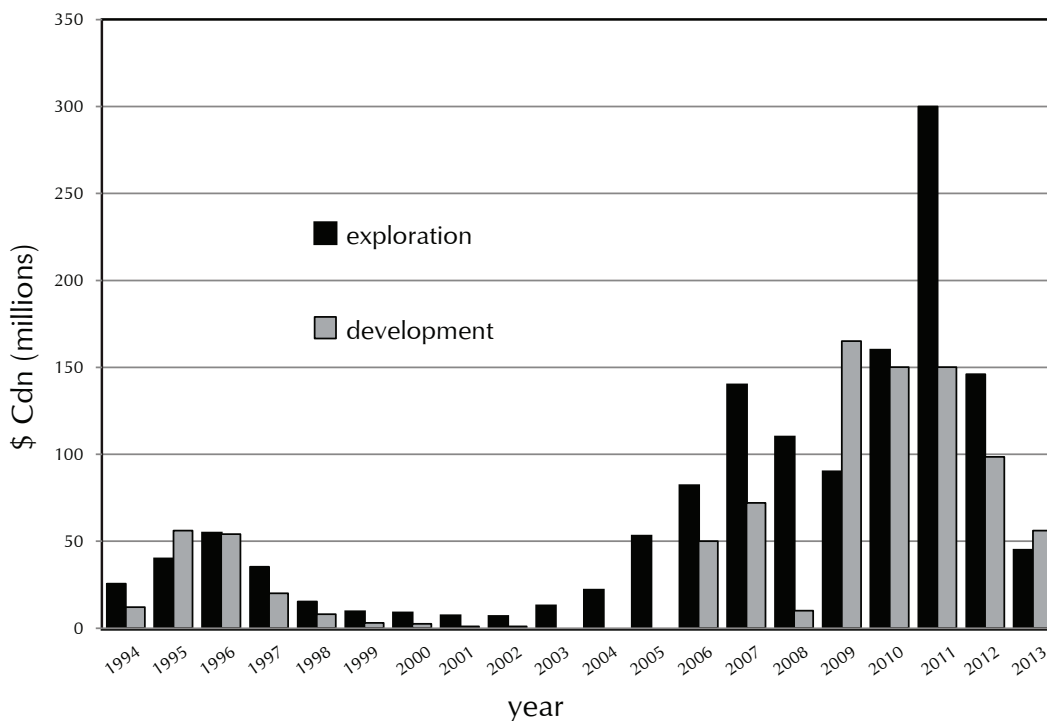


Figure 2. Estimated exploration and development expenditures on Yukon projects, 1994-2013.

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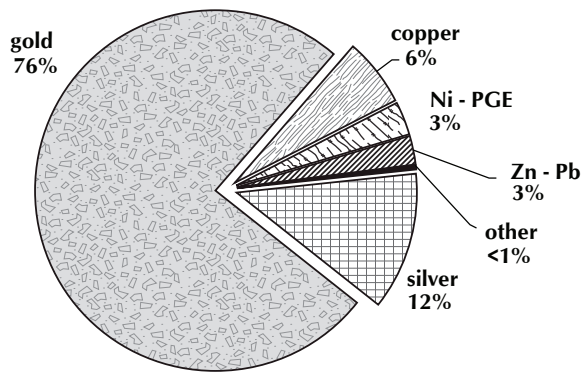


Figure 3. Estimated % exploration expenditures on Yukon projects, 2013 sorted by primary metal(s) of interest. Total exploration expenditures for 2013 were approximately \$45 million.

Claim staking in 2013 continued to drop from its high in 2011; only 2441 quartz claims were staked by the end of October (Fig. 4). The number of claims in good standing has been drifting downward with exploration companies evaluating and consolidating their holdings. At the end of October 2013 the number of quartz claims in good standing had decreased to a total of 235 882, some 15 000 less than the total in 2012. The number of quartz claims in good standing represents slightly less than 11% of the total Yukon land base. Most of the staking activity (Fig. 5) occurred in the Dawson (38%) and Whitehorse (37%) mining districts. The greatest number of claims staked was in the month of February.

Exploration activity continued to range from grassroots prospecting, and regional soil and silt sampling, to evaluating drill targets. The dramatic decreases in exploration dollars spent, quartz claim staking, and number of claims in good standing all indicate that the second Yukon gold rush of 2010-2012 is now over.

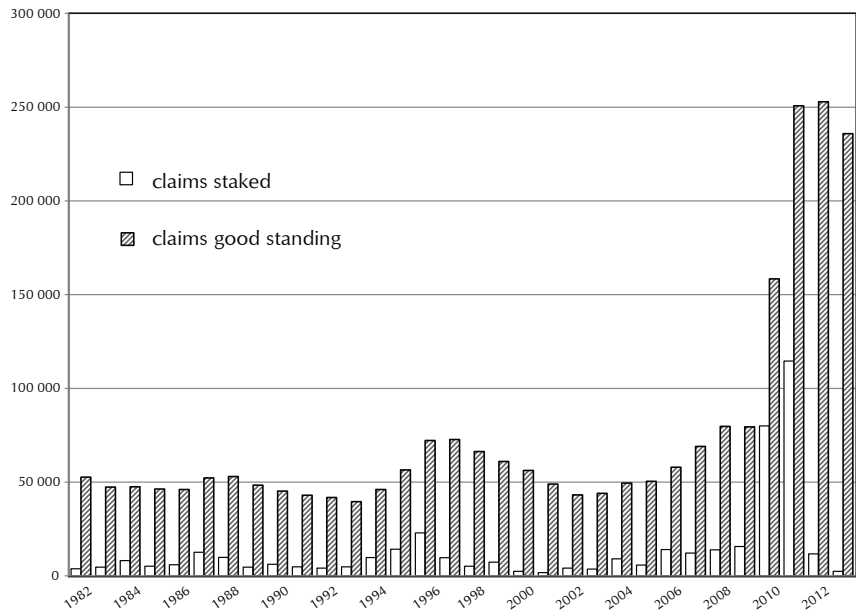


Figure 4. Number of claims staked and number of claims in good standing in Yukon between 1982 and October 31, 2013.

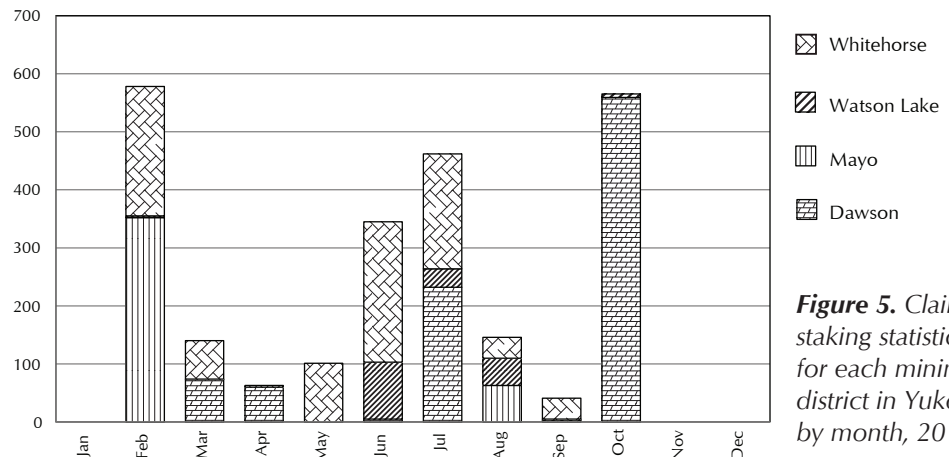


Figure 5. Claim staking statistics for each mining district in Yukon by month, 2013.

MINING AND MINE DEVELOPMENT

Yukon, in 2013, had three operating hardrock mines: Minto, Bellekeno, and Wolverine (Fig. 1). Development expenditures in 2013 are estimated at \$56 million (Fig. 2, Fig. 6) and include permitting expenditures by Western Copper and Gold Corporation for the Casino project, as well as infrastructure expenditures at Minto, Bellekeno, and Wolverine.

The **Minto** (Yukon MINFILE 115I 021) high-grade Cu-Au-Ag open-pit mine, operated by Capstone Mining Corp. (www.capstonemining.com), extracted 826 621 tonnes of ore during the first nine months of 2013 and processed 1 043 241 tonnes of mined and stockpiled ore, producing 10.4 million kg of copper, 2981 kg of silver, and 287 kg of gold from copper concentrates trucked to Skagway, Alaska (modified from Capstone's October 10, 2013 News Release). Mill throughput during the first nine months averaged 3821 tonnes per day. Copper recoveries during this period averaged 91%. Recoveries of silver and gold averaged 75% and 76%, respectively. Production in Q4 is expected to have similar throughputs. Open pit mining was from the Area 2 open pit south of the older Main open pit; the Main pit is now being used as a tailings pond facility. In September 2013 Capstone accessed the underground ore and began feeding it into the mill stream.

Capstone did not spend any money on exploration in 2013, but spent over \$42 million on developing access to the underground ore, purchasing underground equipment and drills for open pit mining, upgrading the camp, and permitting. A submission was made to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) in July 2013, for permitting new reserves outlined in the phase 5 and 6 pre-feasibility studies.

Alexco Resource Corp. mined 65 206 tonnes of ore during the first nine months of 2013 and milled 68 033 tonnes of ore at the **Bellekeno** (Yukon MINFILE 105M 082) Ag-Pb-Zn mine in the historic Keno Hill district. The mill produced 7796 tonnes of lead concentrate averaging 5458 g/t Ag and 60% Pb, and 3450 tonnes of zinc concentrate having an average grade of 360 g/t Ag and 45% Zn (September 23, 2013 News Release). Concentrate was trucked to Skagway, Alaska.

In May 2013, Alexco received the completed and signed Water Use License amendment allowing ore from the **Lucky Queen** (Yukon MINFILE 105M 085) and **Onek** (Yukon MINFILE 105M 084) deposits (Fig. 7) to be mined and entered into the mill stream. On May 31st, Alexco announced several cost cutting measures in response to decreased silver and zinc prices, including reductions in staff and deferral of mining of the Onek and Lucky Queen deposits. All mining and milling operations were suspended in early September for the winter 2013-14. In December 2014, Alexco announced a new Preliminary Economic Assessment study for its Keno Hill district operations (December 5, 2013 News Release). The PEA study recommended deferring mining until 2015. At that time production will be primarily from the Flame & Moth deposit supplemented by ore from the Bellekeno deposit.

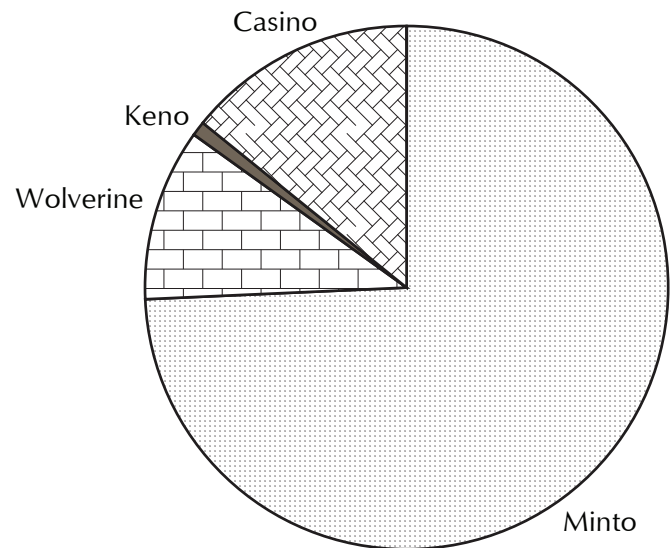


Figure 6. Estimated percentage of development expenditures in 2013. Total development expenditures were approximately \$56 million.

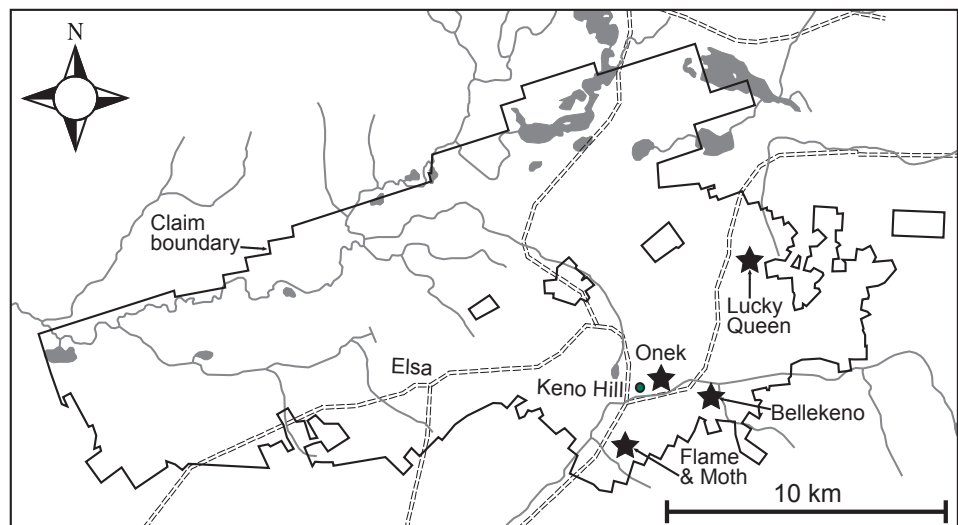


Figure 7. Map of the Keno Hill district outlining locations of exploration and development projects.

Bellekeno ore will eventually be replaced in the milling process by ore from the Lucky Queen deposit. Permitting for development and production from the Flame & Moth deposit is currently underway.

Wolverine Mine is owned by Yukon Zinc Corp. (www.yukonzinc.com), a private company, and produces zinc, copper, and lead concentrates that are trucked to the port of Stewart, British Columbia. In Quarter 1, 2013 the Wolverine (Yukon MINFILE 105G 072) high-grade Zn-Ag-Cu-Pb-Au underground mine production reached design capacity of 1700 tonnes/day. At the designed milling rates, the mine has an expected life of ten years (Regan, 2007).

Yukon Zinc Corp. announced on June 27 (June 27, 2013 News Release) that it was reducing production by 40% and its workforce by 30% to reduce costs. These reductions were in response to declining metal prices and an uncertain economic environment. Production was increased in October to 75% of design capacity (Yukon Zinc September 25, 2013 News Release). Yukon Zinc extracted approximately 476 000 tonnes of ore and milled 466 000 tonnes during the first 10 months of 2013.

Yukon Zinc Corp. was the first company to receive the Robert E. Leckie award for Responsible and Innovative Mining Practices (2012).

EXPLORATION

This overview of hardrock exploration in the territory has been subdivided into two geographic areas for purposes of presentation: north of the Tintina fault and south of the Tintina fault (Fig. 8). Within each geographic area, the overviews have been further organized by commodity and inferred style of mineralization.

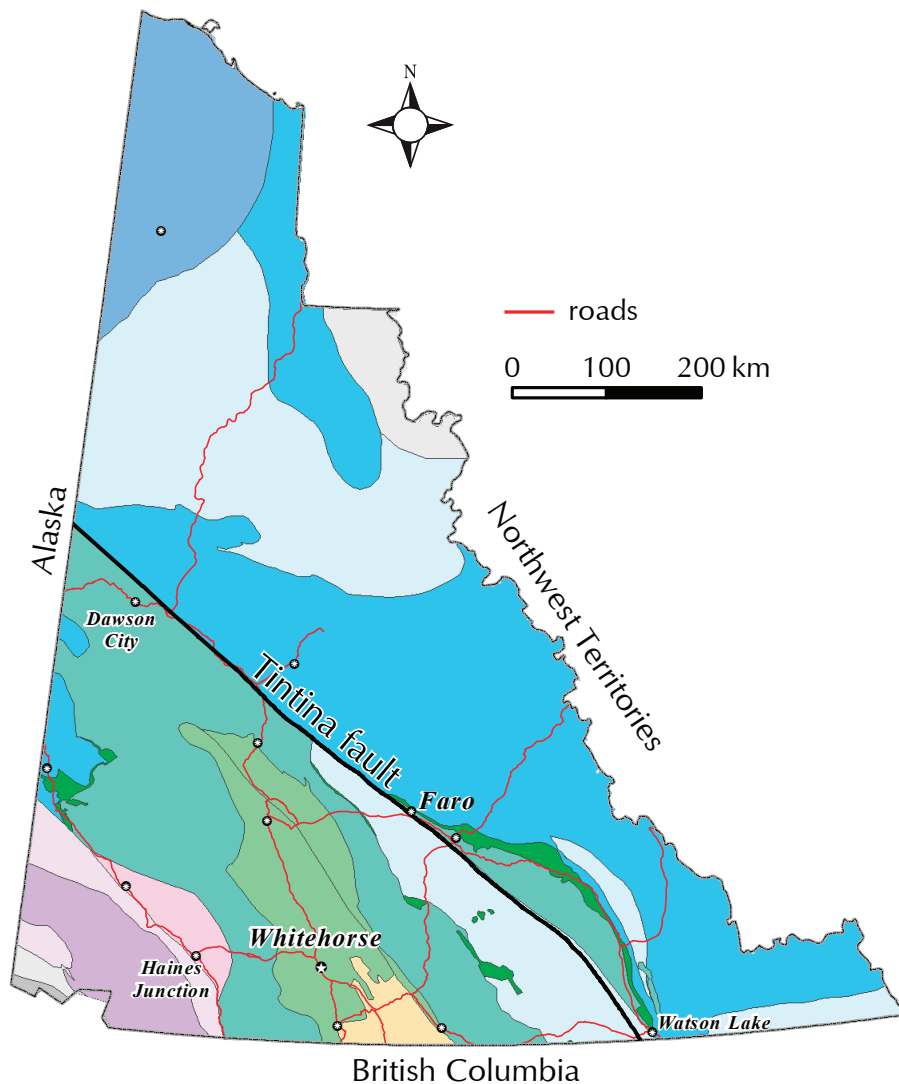


Figure 8. Geographic areas of 2013 exploration projects in Yukon. The heavy black line indicating the Tintina fault divides the territory into two geographic areas: north of Tintina fault and south of Tintina fault. See Figure 1 (inside cover) for Terrane legend.

NORTH OF TINTINA FAULT

Precious metals – gold

Exploration north of the Tintina fault (Fig. 8) during 2013 was focused largely on gold targets; Carlin-style deposits garnered over half of the exploration expenditures, while intrusion-related and orogenic gold were also of interest. Significant silver (plus lead and zinc) targets were also evaluated. Overall in the area, there were 36 active projects for a total estimated exploration expenditure of approximately \$20 million; five projects spent over \$1 million. There was a major decrease in the amount of diamond drilling with only 20 000 m of drilling on eight projects; most companies explored using traditional grassroots methods such as soil and stream sampling, trenching, prospecting, and geological mapping.

Carlin-style gold

ATAC Resources (www.atacresources.com) was active on its **Rackla Gold Project**, spending approximately \$7 million exploring the Nadaleen and Rau trends. The Nadaleen Trend has been the focus for the past couple of years and consists of the Osiris area (Conrad, Osiris, Isis, Isis East, and Sunrise zones) and the Anubis zone (Yukon MINFILE numbers pending). The Rau Trend includes the Tiger deposit (Yukon MINFILE 106D 098), Ocelot occurrence (Yukon MINFILE 106D 007), and the Bengal occurrence, which was discovered in 2012 (Yukon MINFILE 106D 098). The majority of work in 2013 was again focused on the Nadaleen Trend with 7300 m of diamond drilling in 26 holes mainly on the Isis East and Sunrise zones (Table 1; Fig. 9). Results from 2013 drilling at the Sunrise linked the zone to the original Carlin-style discovery in the area, the Osiris zone (Fig. 10).

Table 1. Selected drill intercepts from ATAC Resources’ Osiris area (compiled from ATAC Resource’s August 14, September 19, and October 9, 2013 News Releases). *True thicknesses are between 70% and 100% of drilled intersection thicknesses.

Drillhole	Zone/Area	Depth of intersection (m)	Intersection*
OS13-219	Conrad	76.20	4.23 g/t Au over 68.58 m
OS13-217	Sunrise	218.85	6.76 g/t Au over 16.76 m
OS13-214	Sunrise	173.13	5.54 g/t Au over 19.81 m
OS13-206	Sunrise	120.70	9.83 g/t Au over 15.24 m

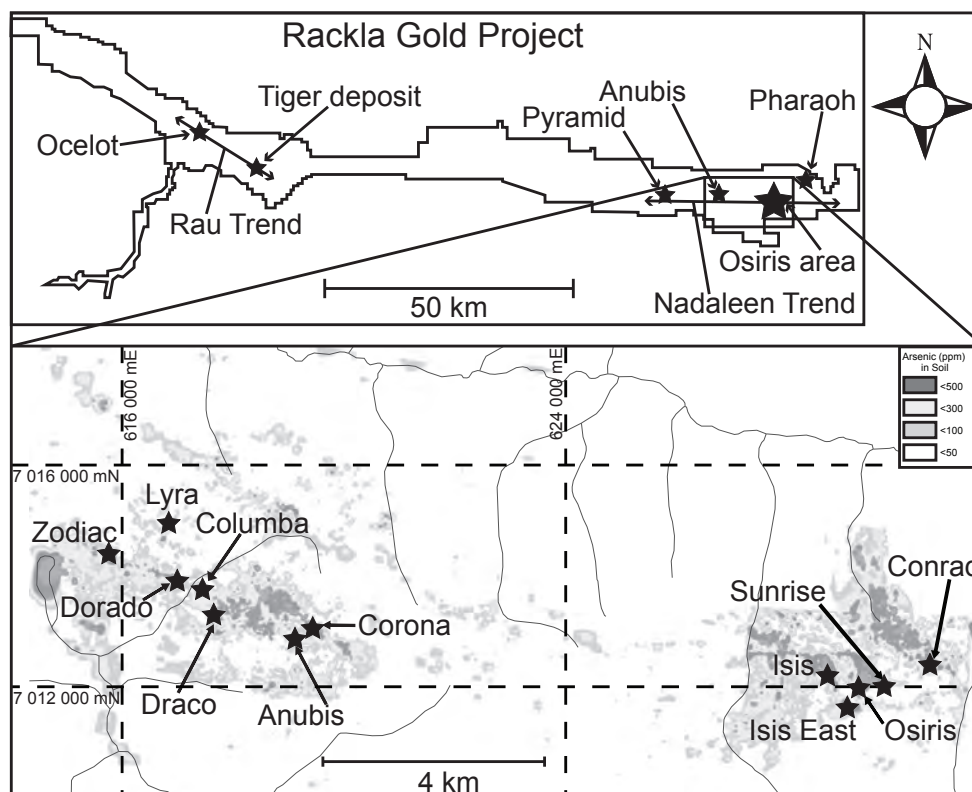


Figure 9. Rackla Gold Project property map with an arsenic-in-soils map for the Osiris to Anubis area (modified from November 12, 2013, Anubis to Osiris arsenic in soil geochemistry ATAC Resources map).

Grassroots exploration on the property was focused on the Anubis zone (Yukon MINFILE number pending) which was discovered late in 2012, 10 km west of the main Osiris area (Yukon MINFILE number pending). Soil sampling (8469 samples) and excavator pitting (3539 samples) were used to expand the zone to 12 km² and define six new drill targets: the Corona, Columba, Dorado, Draco, Zodiac, and Lyra zones (Yukon MINFILE numbers pending). The best grab samples from test pits at the Zodiac, Corona, and Draco zones assayed >1 g/t Au; samples from the Zodiac and Corona assayed 900 g/t Ag and 2910 g/t Ag, respectively (November 12, 2013 News Release).

Anthill Resources (www.anthillresources.com) spent approximately \$5 million exploring its **Einarson** claims (Yukon MINFILE numbers pending) located to the east and south of ATAC Resources' Rackla project. Drilling in 2013 focused on the 2012 Venus discovery of Carlin-style mineralization and the F2 target located approximately 20 km to the south of Venus. The company also undertook soil sampling at the Misty and B zones, approximately 40 km to the east of the Venus zone (Fig. 11).



Figure 10. Mineral Development Officer Judy Shannon at the Sunrise zone. ATAC Resources successfully linked the Sunrise zone at depth with the original Carlin-type Osiris discovery on the property.

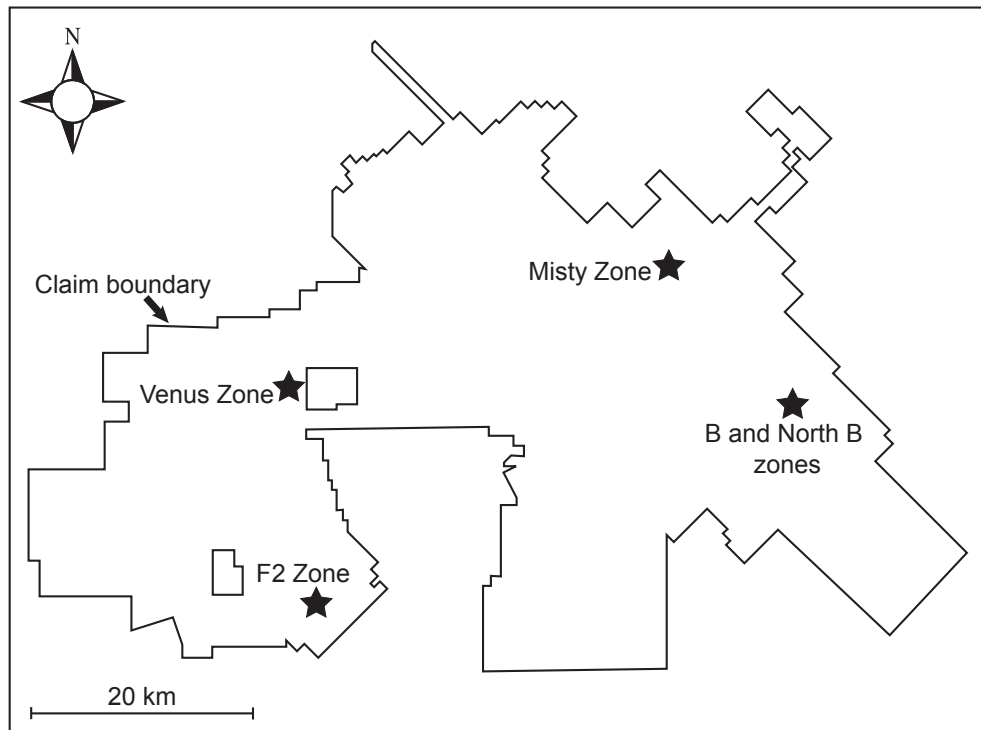


Figure 11. Anthill Resources' Einarson property, showing the zones where work was done in 2013.

In May of 2013, Colorado Resources (www.coloradoresources.com) optioned its **Oro** property, which contains the Brick-Neve occurrence (Yukon MINFILE 105O 042), to a wholly owned subsidiary of major mining company Gold Fields Ltd. Gold Fields completed a 13 hole (2614 m), approximately \$2 million, diamond drill program on the property in 2013. This was the first drilling on the property since the late 1980's

when analysis from drill samples from the J.O. Saddle zone returned 0.5 g/t Au over 66 m. Gold Fields' diamond drill program focused on seven targets within a 5x25 km prospective area; the company also conducted a proprietary analysis of the more than 20 000 soil samples Colorado Resources has collected on the property to date. In November, Gold Fields dropped the option to focus on near-term development opportunities. However, Gold Fields noted that although high grade results were not recognized on the Oro property, there are sufficient widespread anomalous gold areas to warrant further work. Work by Colorado and Gold Fields on the property has identified 17 areas considered to be prospective for Carlin-style mineralization.

Strategic Metals (www.strategicmetalsltd.com) was active across the Territory, working on a total of 28 properties and spending an estimated \$1.8 million. One of its larger programs was the **Midas Touch** project (Nad and Crag properties) immediately north of ATAC Resources' Rackla Gold Project. Work at the Midas Touch project (Yukon MINFILE numbers pending) consisted of infill soil and stream sampling, prospecting, and geological mapping.

Cantex Mine Development (www.cantex.ca) focused its regional geochemical work on the **North Rackla** and **Mt. Good** properties (Yukon MINFILE numbers pending) while conducting limited prospecting and follow-up work on its Bonnet Plume, Mt. Williams, North Stewart, Rogue River, and Hess River claim blocks (Yukon MINFILE numbers pending). Approximately 11 000 soil talus samples were collected from the North Rackla property: analysis of 9 of 11 samples taken along a 300 m line returned anomalous gold, arsenic, and antimony.

Rackla Metals Inc. (www.racklametals.com) focused its efforts on the **Face** (Yukon MINFILE number pending) claim block located at the western end of the Dawson fault, northwest of Dawson City. The company spent approximately \$250 000 on soil sampling, prospecting, and geological mapping. The Face property was staked along the western extension of the Dawson fault, which is associated with the Carlin-type occurrences of ATAC Resources to the east. Work in 2013 involved follow-up on 2011 and 2012 soil and stream sediment anomalies. Soil (1109 samples) and rock sampling (115 samples) in 2013 identified an approximately 1 km² anomaly of coincident silver and zinc within black shales of the Road River Group.

Ansell Capital Corp. (www.ansellcapital.com) worked on the **Dal** property (Yukon MINFILE number pending) located in the Rackla Belt, south of ATAC Resources' Nadaleen Trend. Follow-up on 2012 soil anomalies led to the collection of 787 soil and 6 rock samples. Eleven soil samples assayed >0.3% Ni and one sample returned 0.43 ppm Au and 0.25% Ni (November 12, 2013 News Release).

Intrusion-related and orogenic gold

Victoria Gold Corp. (www.vitgoldcorp.com) saw the successful completion of the YESAB Executive Committee screening of its proposed **Eagle** gold mine (Yukon MINFILE 106D 025) and received its Quartz Mining License in September, 2013. Victoria Gold also ran a small grassroots program on its VBW claims, following up on a 2012 ridge and spur soil anomaly called the Falcon zone. Grid soil sampling analysis on the Falcon zone in 2013 resulted in identifying a 4 km-long east trending soil anomaly that was reconnaissance drilled late in the season. This 4 hole diamond drill program intersected 59.2 m of 0.58 g/t Au mineralization in the first hole (November 2013 Corporate Presentation).

In 2013, Golden Predator Corp. underwent significant corporate changes including a name change to Americas Bullion Royalty Corp. (www.aubullion.com). Over the past several years, Golden Predator accumulated an extensive Yukon claim package. The focus in 2013 was on the past-producing **Brewery Creek** gold mine (Yukon MINFILE 116B 160). The 2013 resource estimate for the property (based on 2012 drilling) doubled the contained ounces of gold occurring in the oxide ore, and added approximately 30% to the sulphide ore (Table 2). The mine plan has been revised to include crushing of ore, which has increased gold recoveries by 30% (May 5, 2013 News Release). The original Brewery Creek mine operators did not crush leach pad material due to the high cost of an onsite generator; however, since the mine closed in 2001, the Mayo-Dawson transmission line has been completed, and grid power is now within 15 km of the mine site. Work also continues on a Preliminary Feasibility Study, amending the Quartz Mining and Water licenses, and preparing for submission to the YESAB Executive Committee.

Table 2. NI 43-101 resource estimate for the Brewery Creek deposits, 2013. The estimate includes 14 deposits plus the existing heap leach pad. A cut-off grade of 0.5 g/t Au for oxide and 0.7 g/t Au for sulphide ore were used (modified from Americas Bullion Royalty Corp.'s October 24, 2013 News Release).

Deposit	Classification	Tonnes (Mt)	Au (g/t)	Contained Au (oz)	Contained Au (kg)
Oxide	indicated	14.2	1.27	577,000	16 358
	inferred	9.3	0.93	279,000	7910
Sulphide	indicated	3.5	1.28	142,000	4026
	inferred	12.4	1.37	546,000	15 479
Total	indicated	17.6	1.27	719,000	20 383
	inferred	21.7	1.18	825,000	23 388

Goldstrike Resources (www.goldstrikeresources.com) worked the **Plateau South** and **Summit** (Yukon MINFILE numbers pending) properties in Selwyn basin. The primary focus for 2013 was on the Plateau South property where Goldstrike drilled both the Goldstack Zone and the Gold Dome-VG Zone (Table 3). The Goldstack and Gold Dome-VG zones are reportedly hosted within felsic metavolcanic rocks and hydrothermal breccia surrounded by a broad gold-arsenic alteration halo. A small grassroots exploration program consisting of trenching, mapping, prospecting, and geophysics was carried out at the Summit property. Highlights include 2.74 g/t Au over 5 m in trench SUM-TR-03 and definition of two multi-element soil geochemical anomalies with up to 0.5 g/t Au (October 15, 2013 News Release).

Table 3. Selected drill results from the Plateau South property (modified from Goldstrike Resources' September 9, 2013 News Release). *True thicknesses are between 27% and 65% of drilled intersections.

Drillhole	Zone/Area	Depth of intersection (m)	Intersection*
PSGS13-04	Goldstack	8.00	2.28 g/t Au over 53.0 m
including		17.00	10.91 g/t Au over 10.0 m
PSVG13-03	Gold Dome-VG	4.57	7.60 g/t Au over 9.03 m

Northern Tiger Resources (www.northern-tiger.com) continued work on its **3Ace** property (Yukon MINFILE 105H 066) and the adjoining **Sprogge** property (Sugar Bowl; Yukon MINFILE 105H 103), located in southern Selwyn basin. The company did grassroots exploration including excavator and hand trenching, soil and rock sampling, and prospecting. Northern Tiger also collected three 1000 kg bulk samples from the Sleeping Giant zone. Towards the end of 2013, Northern Tiger Resources and Redtail Metals Corp. entered into a proposed merger agreement (October 28, 2013 News Release), which would form a single exploration company with a significant Yukon property package including the 3Ace, Sonora Gulch (Yukon MINFILE 115J 008), and R15 (Yukon MINFILE 105G 071) properties, as well as the Clear Lake (Yukon MINFILE 105L 045) and Marg (Yukon MINFILE 106D 009) deposits.

Banyan Gold Corp. (www.banyangold.com) completed its acquisition of the **Hyland Gold** Project (Yukon MINFILE 095D 011, 033) in early 2013. The company conducted a small soil and rock sampling program on the property that resulted in the discovery of the new Montrose Ridge zone located approximately 6.5 km south of the Hyland gold deposit. The Montrose Ridge zone is a coincident gold-arsenic soil anomaly; results from sampling include maximum values of 0.191 g/t Au, 597 ppm As, and 2.9 g/t Ag (November 18, 2013 News Release).

In 2013, Ryan Gold Corp. (www.ryangold.com) conducted limited follow-up sampling and mapping on the Mahtin and May-Qu projects. Ryan Gold compiled 2011 and 2012 drillhole data from Ida Oro and relogged existing drill core in order to reclassify the intrusive phases and develop a working model for further exploration, targeting, and assessment. As well, the field camp at the Flume project was decommissioned and the project prepared for return to Bearing Resources Ltd.

Precious metals – silver

Vein/breccia

Alexco Resources' (www.alexcoresource.com) 2013 exploration program consisted of 2829 m of diamond drilling in 13 holes. Drilling occurred mainly on the **Flame & Moth** deposit (Yukon MINFILE 105M 087; Fig. 7) with a further 5 holes being completed on the Bulldozer discovery located 600 m west of the Flame & Moth vein (Table 4). Drilling on the Flame & Moth vein confirmed that the mineralized

Table 4. Selected drill results from the Flame and Moth deposit and Bulldozer occurrence (modified from Alexco Resource's September 18, 2013 News Release). *Intersections are true thicknesses.

Drillhole	Zone/ Area	Depth of intersection (m)	Intersection*
K13-0504	Flame	327.64	986.7 g/t Ag, 0.38 g/t Au, 1.38% Pb, and 6.26% Zn over 5.56 m
including		330.67	2414.0 g/t Ag, 0.55 g/t Au, 3.55% Pb, and 8.81% Zn over 0.62 m
K13-0505	Flame	340.37	149.6 g/t Ag, 0.20 g/t Au, 0.13% Pb, and 1.14% Zn over 6.42 m
including		344.15	752.3 g/t Ag, 0.46 g/t Au, 0.33% Pb, and 7.05% Zn over 0.85 m
K13-0506	Flame	418.85	436.0 g/t Ag, 0.08 g/t Au, 0.18% Pb, and 3.53% Zn over 4.33 m
including		418.85	1980.0 g/t Ag, 0.30 g/t Au, 0.75% Pb, and 11.60% Zn over 0.66 m
K13-0494	Bulldozer	186.88	985.4 g/t Ag, 0.36 g/t Au, 12.62% Pb, and 12.82% Zn over 1.31 m
including		187.07	2640.0 g/t Ag, 0.33 g/t Au, 36.04% Pb, and 12.80% Zn over 0.25 m

zone extends at least 220 m further southwest along strike, and is open laterally and at depth. A variety of geophysical surveys including ground penetrating radar (GPR), seismic, and resistivity were completed across the Flame vein to determine the best method for finding new veins under overburden. A revised mineral resource estimate for the Flame & Moth deposit was released by Alexco Resource in January 2013 (Table 5).

Table 5. Revised NI 43-101 resource for Alexco Resource's Flame & Moth deposit (Farrow and McOnie, 2013) reported at a contained metal value NSR cut-off of \$185/tonne using consensus long term metal prices and recoveries developed for the nearby Bellekeno deposit. Silver grades capped at 3000 g/t; lead grades capped at 15%; zinc grades capped at 20%.

Area	Classification	Tonnes	Ag (g/t)	Au (g/t)	Pb (%)	Zn (%)	Contained Ag (kg)	Contained Au (kg)
Flame & Moth	Indicated	1 378 000	516	0.42	1.72	5.7	711 048	579
	Inferred	107 000	313	0.27	0.86	4.21	33 491	29

Since releasing its maiden resource on the Keg deposit (Yukon MINFILE 105K 078) in 2012, Silver Range Resources (www.silverrangeresources.com) has continued

exploring its 1100 km² **Silver Range** project near Faro. In 2013, Silver Range diamond drilled 1156 m in 7 exploration holes and 1 geotechnical hole. The drilling was done on the Hammer, Owl Southwest, and Vent zones (Fig. 12; Table 6). The company also continued a property-wide evaluation of the 26 silver-bearing zones identified since 2010; highlights include grab samples from the Newton zone that ran 982 g/t Ag, 4.18% Pb, and 9.73% Zn, and from the Gauss zone that assayed 504 g/t Ag, 1.06% Cu, and 14.35% Pb (October 30, 2013 News Release).



Figure 12. High-grade mineralization from the Hammer zone. Inset map shows the location of zones discussed in text.

Table 6. Selected drill intercepts from Silver Range Resources' Keg property (modified from Silver Range's October 30, 2013 News Release). *Intersections are drilled thicknesses.

Drillhole	Zone/Area	Depth of intersection (m)	Intersection*
OSW13-005	Owl Southwest	31.52	125.4 g/t Ag, 0.79% Pb and 0.14% Zn over 2.61 m
OSW13-006	Owl Southwest	71.13	42.6 g/t Ag, 0.13% Pb and 0.24% Zn over 11.18 m
		79.50	147.0 g/t Ag, 0.49% Pb and 1.42% Zn over 1.05 m
Ham13-22	Hammer	110.00	337.0 g/t Ag, 0.49% Pb and 4.59% Zn over 0.49 m

Habanero Resources Inc. (www.habaneroresources.com) completed a short diamond drill program on its **Haldane** project (Yukon MINFILE 105M 032) intersecting mineralization in two holes (Table 7). Mineralization is characteristic of the Keno Hill mining district and primarily consists of massive manganese-iron oxides. Entourage Metals Ltd. (www.entouragemetals.com) acquired the **La Liga** property (Yukon MINFILE 105K 108) from Inform Resources (www.informresources.com) in May of 2013. Entourage Metals' 2013 trenching program focused on assessing the Red Devil to Galactose trend identified by Inform Resources. High-grade silver-lead mineralization was encountered in both the newly discovered Gunner zone (Tr13-10, 20 m of 36.8 g/t Ag and 0.68% Pb) and the existing Red Devil zone (TrLL13-01, 5 m of 173 g/t Ag and 3.87% Pb) (September 3, 2013 News Release).

Table 7. Selected drill intercepts from Habanero Resources' Haldane property (modified from Habanero Resources' October 23, 2013 News Release). *Intersections are drilled thicknesses.

Drillhole	Zone	Depth of intersection (m)	Intersection*
HLD13-12	Main	unknown	83.8 g/t Ag, 0.14% Pb, 1.39% Zn, and 0.12 g/t Au over 3.08 m
HLD13-13	West Fault	unknown	136.0 g/t Ag, 0.06% Pb, 0.04% Zn, and 0.01 g/t Au over 0.58 m

Base metals – lead + zinc

Sedimentary exhalative

The Selwyn-Chihong joint venture between Selwyn Resources Ltd. (www.selwynresources.com) and Canada Chihong Mining (www.chihongcanada.com) concluded in 2013, and in June Chihong Canada Mining purchased the remaining interest in the **Selwyn** project (Yukon MINFILE 105I 012, 032, 037, 053, 066, 067, 068) to become the sole owner. Chihong Canada has identified three priorities to advance the Selwyn project: 1) an internal feasibility study optimizing the mine plan, 2) upgrading resources, and 3) upgrading road access along the existing winter road, which leaves the Nahanni Range Road just north of the Cantung Mine.

SOUTH OF TINTINA FAULT

Although exploration south of Tintina fault was focused predominantly on gold targets, other commodities such as nickel/PGEs, silver, lead/zinc, and copper contributed to overall exploration expenditures. Nevertheless, gold exploration accounted for the majority of exploration dollars in the region. In total, five projects spent over \$1 million and 76 projects were active for a total estimated exploration expenditure of approximately \$25 million. Only 10 projects were diamond-drilled.

Precious metals – gold

Vein/breccia

Kaminak Gold Corp. (www.kaminak.com) continued to expand its **Coffee** property, 130 km south of Dawson City (Yukon MINFILE 115J 110, 111) with an \$11 million exploration program in 2013. This was, by far, the largest exploration program in Yukon in 2013. Diamond drilling began in March and over 55 000 m of drilling

was completed by November, 2013. Gold mineralization at the Coffee property is hosted in multiple late structures that crosscut various rock units. Infill drilling was carried out at the central zone of the Supremo T3 deposit and at the Latte deposit in order to upgrade those resources. Exploratory drilling verified the continuity of zones and resulted in new discoveries. Drilling between the Supremo T5 and T7 zones successfully linked the two zones with a new structure called the T5 Splay. The 2013 exploration program also identified three new drill discoveries: T1, Arabica, and Sumatra (Table 8). Kaminak plans to begin a preliminary economic assessment of the Coffee property in Q1, 2014. (November 2013 corporate presentation).

Table 8. Selected drill intercepts from Kaminak Gold Corp.'s Coffee property (compiled from Kaminak Gold Corp.'s August 8, October 10, November 7, and November 12, 2013 News Releases). *True width of intersection is estimated at approximately 2/3 down hole length.

Drillhole	Zone	Depth of intersection (m)	Intersection*
CFD0338	Supremo T3 infill	27.00	19.00 g/t Au over 3 m
CFD0307	Supremo T4	11.0	1.84 g/t Au over 3 m
and		29.00	7.48 g/t Au over 6 m
and		42.00	9.95 g/t Au over 1 m
CFR0514	Sumatra	4.57	1.54 g/t Au over 16.77 m
CFR0565	Latte	67.06	2.44 g/t Au over 54.86 m
and		132.59	1.41 g/t Au over 7.62 m
CFD0303	Supremo/latte connector	95.00	5.67 g/t Au over 16 m

Pacific Ridge Exploration Ltd.'s (www.pacificridgeexploration.com) program at **Mariposa** (Yukon MINFILE 115O 075) identified new drill targets through a compilation of previous drill results, high-resolution IP/resistivity surveys, and Geoprobe sampling. Highlights of the Geoprobe sampling include a 3.08 g/t Au rock chip sample on the Skookum Main Zone, where no previous gold-in-soil anomaly existed (November 14 News Release), and rock chip samples of 7.20 g/t Au and 3.49 g/t Au on samples from Skookum West. Pacific Ridge also worked its road-accessible **King Solomon Dome and Sophie** (Yukon MINFILE 115O 083) properties in the Dawson City area. The company extended the soil grid over King Solomon Dome to the south, to cover the Sophie claims. This was followed by 14 lines of IP/resistivity over the King and Prince zones. The results from this survey outlined several north-northeast trending structures coincident with gold-in-soil anomalies, which were tested by a Geoprobe sampling (Fig. 13) program (September 11, 2013 News Release).



Figure 13. Groundtruth Exploration's Geoprobe on the King Solomon Dome property. The Geoprobe is a direct-push, track-mounted drilling machine. It can obtain soil samples and samples from the overburden/bedrock interface.

Rackla Metals Inc. (www.racklametals.com) explored its **King Solomon Dome** property (Yukon MINFILE 115O 068) optioned from Kestrel Gold Inc. with three diamond drillholes (1191 m). The drill program was designed to test surface quartz veins, geochemical anomalies, and IP/resistivity geophysical anomalies. Drilling intersected 4.89 g/t Au over 13 cm in hole DDH13-02 and other intervals of low-grade gold mineralization. Rackla has since dropped its option on the property. A short program on the **Iola** project (Yukon MINFILE 105F 054) in south Yukon was undertaken to follow up on anomalous gold and silver results from soil sampling in 2012. The 2013 program, which included further sampling and geological mapping, failed to uncover results of interest, and the claims were allowed to lapse.

Goldbank Mining Corp. (www.goldbankmining.com) completed a modest program on its **Leota** (Leotta; Yukon MINFILE 115O 074) hardrock claims in the historic Klondike Goldfields. The 2013 work program included trenching, and soil and rock sampling. Grid soil sampling was undertaken near historical placer workings and a total of 80 pits were excavated and sampled. Results are pending. West of Leota, Klondike Gold Corp. (www.klondikegoldcorp.com) continued unravelling the complex geological history underlying its **Lonestar** property (Lone Star; Yukon MINFILE 115O 072). The focus for 2013 was a structural study of the Lone Star Ridge, the site of the 1911 Lone Star mine.

Taku Gold Corp. (www.takugold.com) completed a small work program at its **Sulphur** property (Yukon MINFILE number pending), 45 km southeast of Dawson City. Six Geoprobe lines were completed over a 700 m strike length on the Blues zone to test the bedrock underlying anomalous gold-in-soil values. Bedrock samples from the Geoprobe work assayed up to 588 ppb gold and the results appear to delineate three parallel gold-bearing structures. Taku also explored its **Wounded Moose** (Yukon MINFILE number pending) property to the southeast of Sulphur, completing mechanical trenching and sampling. Assay values of up to 2.3 g/t Au were returned from trench samples.

Goldstrike Resources (www.goldstrikeresources.com) conducted rock sampling, soil sampling, mechanized trenching, and ground geophysics on its **Lucky Strike** property (Yukon MINFILE 115O 170, 171) in the White Gold district. Structures identified by the geophysical survey were tested with 5 trenches totalling 450 m. Grab rock samples assayed up to 5.8 g/t Au.

Stina Resources (www.stinaresources.com) completed a high-resolution IP survey on its **Dime** gold property (Yukon MINFILE number pending), 67 km southwest of Dawson City. Mineralization at the Dime is associated with quartz sulphide veins and occurs in silicified zones in the cupola zone of an intrusion. Seven separate lines of IP were completed for a total of 2940 m over the west and east mineralized zones.

In 2013, Comstock Metals Ltd. (www.comstock-metals.com) followed up on the drilling success of 2012 with a nine-hole (2188 m) drill program at its **QV** property (Yukon MINFILE 115O 004) in the White Gold district. The best hole (QV13-014) returned 57.15 m of 1.01 g/t Au (Table 9). Mineralization at QV is hosted in felsic metavolcanic gneiss and is associated with silicified sericite-altered breccia, sharing similarities with the White Gold property to the south. The company also undertook geological mapping, geochemical sampling, ground magnetometer surveys, and prospecting on the property.

Table 9. Selected drill intercepts from Comstock Metals' QV property (compiled from Comstock Metals' July 15 and August 1, 2013 News Releases). *Intercepts determined with a 0.2 g/t Au cut-off, maximum 3.05 m internal dilution at 0.06 g/t Au.

Drillhole	Zone	Depth of intersection (m)	Intersection*
QV13-009	QV	125	1.05 g/t Au over 47.7 m
QV13-011	QV	186	1.41 g/t Au over 42.6 m
including		210	3.4 g/t Au over 12.54 m
QV13-012	QV	8.6	2.06 g/t Au over 36.4 m
including		21.96	3.24 g/t Au over 11.3 m
QV13-014	QV	88	1.01 g/t Au over 57.15 m

Northern Tiger (www.northern-tiger.com) completed a modest program on its **Korat** (Yukon MINFILE number pending) property, surrounded by the QV claim block in the White Gold district. The company undertook infill soil sampling, rock sampling, mapping, and prospecting. Results are pending.

Northern Freegold Resources' (www.northernfreegold.com) program at **Freegold Mountain** in 2013 was designed to assess the potential for epithermal gold mineralization in underexplored areas of the property. A new gold occurrence (Irene; Yukon MINFILE number pending) was discovered as a result of a 2011 IP survey. Five of six trenches at Irene crossed the mineralized zone, with one chip sample interval returning 3.0 m of 7.11 g/t Au (Fig. 14). Gold mineralization occurs in vein and breccia along a structural corridor that transects the contact between the metasedimentary rocks and an intrusive body.

Precious metals – gold/silver

Epithermal

Rockhaven Resources Ltd. (www.rockhavenresources.com) explored its **Klaza** property (Esansee; Yukon MINFILE 1151 067) with extensive excavator trenching (5000 m in 38 trenches). The Klaza property hosts eight subparallel structural zones (1-75 m wide; 250-2400 m long) with gold-silver mineralization hosted in quartz-sulphide veins, breccia, and fracture networks. BRX Zone trenching returned assay results of 71.4 g/t Au and 1310 g/t Ag over 2.25 m. The company also carried out scoping metallurgical testing on sulphide-bearing drill core. Although gravity testing produced poor recoveries, the gravity tailings used in subsequent flotation tests produced recoveries of 97.6% for gold and 98.3% for silver.

Ansell Capital Corp. (www.ansellcapital.com) conducted a program of high-resolution, closely spaced IP/Resistivity surveys across the Flex and Orloff-King zones at its **Charlotte** property in the historic Mt. Nansen district, 60 km west of Carmacks (Mount Nansen; Yukon MINFILE 1151 065). The company also carried out a mineralogical study on drill core from the Flex zone in order to characterize the mineralogy of the mineralized zone. Charlotte is an epithermal prospect, with gold and silver mineralization occurring in quartz-sulphide veins within shear zones in schist and gneiss that have been intruded by mid-Cretaceous dikes and stocks.

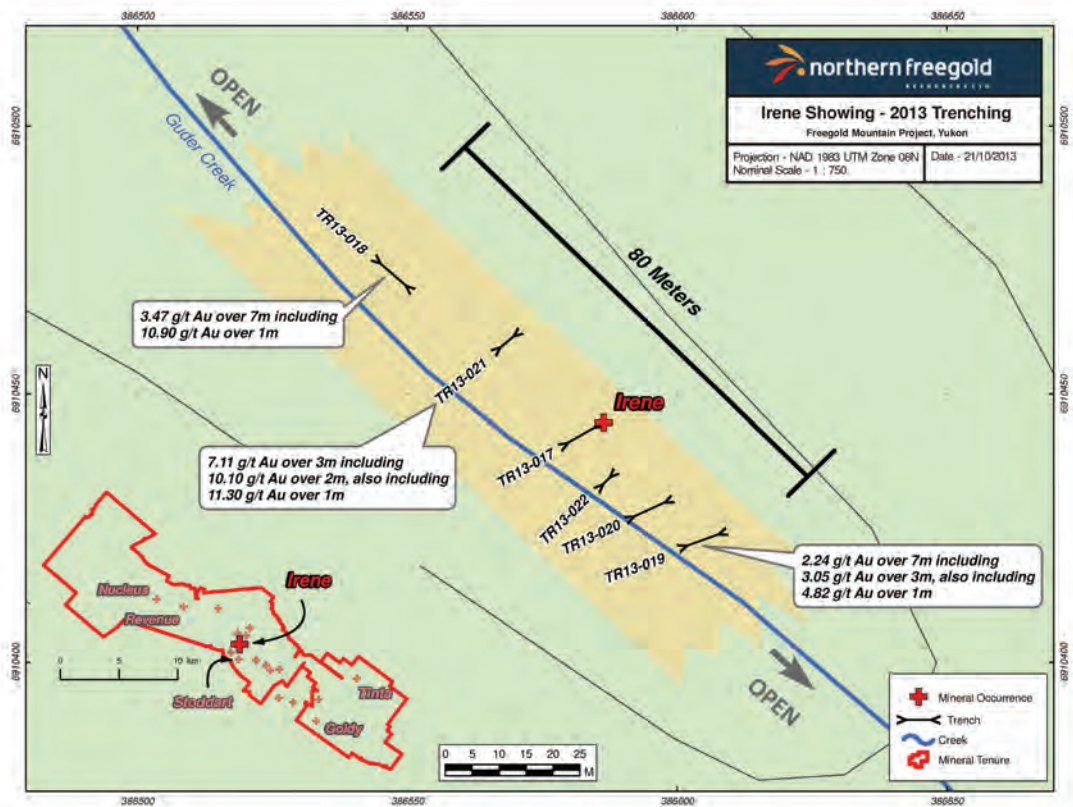


Figure 14. Location of Irene gold occurrence trenches on Northern Freegold Resource’s Freegold Mountain property. Image courtesy of Northern Freegold Resources.

Metals Creek Resources (www.metalscreek.com) completed excavator trenching and a four-hole diamond drill program (428 m) at its **Squid East** Project (Yukon MINFILE number pending), located in west Yukon (Fig. 15). Drill targets were defined by trenching over a northwest-trending gold-in-soil anomaly at the Exploits zone. Drilling intersected oxidized bedrock and returned assay results of up to 1.54 g/t Au, 114 g/t Ag, and 0.31% Pb over 21 m (drillhole SE13-002; Table 10). Mineralization is associated with brecciation, silicification, and pervasive sericite alteration.



Figure 15. Diamond drilling at Metals Creek’s previously undrilled Squid East property.

Table 10. Selected drill intercepts from Metals Creek's Squid East Project (modified from Metals Creek's October 8, 2013 News Release).

Drillhole	Zone	Depth of intersection (m)	Intersection
SE13-001	Exploits	9.0	1.699 g/t Au, 81.775 g/t Ag, and 0.312% Pb over 12 m
SE13-002	Exploits	12.0	1.547 g/t Au, 114.121 g/t Ag, and 0.315% Pb over 21 m
including		14.0	2.431 g/t Au, 185.254 g/t Ag, and 0.47% Pb over 12 m
SE13-003	Exploits	6.5	0.371 g/t Au, 39.892 g/t Ag, and 0.664% Pb over 6.5 m

Precious metals – gold

Porphyry/Sheeted Vein

Northern Freegold Resources Ltd. (www.northernfreegold.com) released an updated resource on the **Nucleus** (Yukon MINFILE 115I 107) deposit (Table 11) at its Freegold Mountain property, in January 2013. This release was followed by the completion of a Preliminary Economic Assessment in February, 2013, which updated the geological models for the two deposits on the property. The Freegold Mountain property hosts two NI 43-101 compliant resources: the Nucleus gold-copper-silver deposit and the Revenue (Yukon MINFILE 115I 042) gold-copper-molybdenum-silver deposit. The Nucleus deposit is classified as a low-grade, low-sulphidation, epithermal gold deposit with minor higher grade gold-copper massive sulphide occurrences nearby. The Revenue deposit is classified as a low-grade, bulk tonnage porphyry system.

Table 11. NI 43-101 Resource for the Nucleus Deposit, February 2013, (Campbell et al., 2013)

*Cut-off grade of 0.25 g/t Au Eq. The AuEq for the Nucleus resource is calculated based upon three-year running-average prices of \$1455 (U.S.) per ounce for gold, \$27.55 (U.S.) per ounce for silver, and \$3.65 (U.S.) per pound for copper, and assumes metallurgical recoveries of 97% for gold, 51% for silver, and 43% for copper.

Area	Classification	Tonnes (Mt)*	Au (g/t)	Ag (g/t)	Cu (%)	Contained Au (oz)	Contained Au (kg)
Nucleus	Indicated	71 904 900	0.567	0.85	0.06	1,310,039	37 139
	Inferred	60 398 000	0.41	1.5	0.04	801,000	22 708

Teck Resources (www.teck.com) explored its **Wolf** property (Yukon MINFILE number pending) in southwest Yukon with soil sampling, prospecting, geological mapping, and eight diamond drillholes (1623 m). Exploration expanded on drill results from 2012. The property, situated in southwest Yukon close to the Alaska Highway, is being explored for gold-rich porphyry-style mineralization. Teck also conducted grassroots exploration including soil and rock sampling, and geologic mapping on the nearby Bear property.

Manson Creek Resources (www.mansoncreekresources.com) worked its **Grommet** property in south Yukon (Yukon MINFILE 105B 103) for gold. The property had been explored for its molybdenum-porphyry potential in the 1980s, but never examined for gold. The 2013 exploration program included mapping, prospecting, and soil sampling over the mineralized granodiorite and intrusive contact. Two significant gold-in-soil anomalies were uncovered. One soil sample from a coincident molybdenum-copper-gold soil anomaly over the contact of the intrusion and metavolcanic rocks assayed 1.59 g/t Au.

Base metals – copper

Porphyry/Sheeted Vein

Western Copper and Gold Corp. (westerncopperandgold.com) continued to advance its bulk-tonnage copper-gold-molybdenum **Casino** deposit (Yukon MINFILE 115J 028) with the intention of making a submission to the Yukon Environmental and Socioeconomic Assessment Board for permitting. A feasibility study on the project was released in January, 2013. The study incorporates an updated mineral reserve and reports on engineering studies for the project completed at the feasibility-study level. The study characterizes the Casino project as a project with positive economics at conservative commodity prices. The company concluded a six-year engineering and baseline data collection program in support of its permit application. A total of \$8 million was spent on studies for engineering, hydrology, hydrogeology planning, fisheries research, wildlife surveys, socio-economic analysis, heritage/archaeology studies, and water quality sampling in 2013.

Copper North Mining Corp. (www.coppernorthmining.com) focused its efforts on permitting the **Carmacks Copper** Project (Yukon MINFILE 115I 008) in west-central Yukon, with a submission to the Yukon Environmental and Socioeconomic Assessment Board being planned. In March 2013, M3 Engineering and Technology Corporation was hired to complete a basic engineering study for the main power supply for the proposed mine.

BC Gold Corp. (www.bcgoldcorp.com) explored its **WS** (Taslar; Yukon MINFILE 115I 007) property in central Yukon. The exploration program was designed to enhance drill targets on the property that are believed to cover extensions of Zones 12 and 14 of the contiguous Carmacks Copper Property (Copper North Mining Corp.) to the north. BC Gold carried out a high-resolution IP survey, a limited VLF geophysical survey, biogeochemical sampling (black spruce), geological mapping, and prospecting. Work on the **Toe** (Yukon MINFILE 115I 024) property, north of WS, by optioner Kaiyue International Inc., included biogeochemical sampling (black spruce) and a VLF survey.

Strategic Metals (www.strategicmetalsltd.com) explored its road-accessible **Hopper** (Yukon MINFILE 115H 019) gold-copper porphyry/skarn property in southwest Yukon with soil sampling, mapping, and prospecting. The gridded soils outlined a 2500 by 3600 m area of anomalous copper values up to 26 000 ppm Cu. This large soil anomaly contains a core that is enriched in gold up to 996 ppb and molybdenum up to 142 ppm. The mineralized system is inferred to be a gold-copper-molybdenum porphyry with flanking sub-horizontal copper-gold skarn zones.

Volcanogenic Massive Sulphide

Base Metals - copper

The Dawson Gold joint venture of Arcus Development Group (www.arcusdevelopmentgroup.com) and ATAC Resources (www.atacresources.com) conducted a small program at the **Touleary** (Yukon MINFILE 115O 176) volcanogenic massive sulphide occurrence in west Yukon. Prospecting was carried out on anomalous copper-in-soil areas between Touleary South B and the initial VMS discovery site.

Carbonate Replacement/Manto Style

Base metals – lead-zinc-silver

Tarsis Resources (www.tarsis.ca) explored its **Tim** (Yukon MINFILE 105B 069, 140) lead-zinc-silver property in southeast Yukon. The road-accessible property has potential for carbonate-replacement manto-style lead-zinc-silver mineralization similar to the Silvertip deposit to the southwest in northern British Columbia. Historical trench T-3 was re-excavated and sampled; channel samples returned values of up to 220 g/t Ag and 4.74% Pb over 6.40 m.

Base metals – nickel + platinum group elements (PGE)

Mafic/ultramafic

Prophecy Platinum (www.prophecyplat.com) undertook a large data compilation for its **Wellgreen** Ni-PGE deposit (Yukon MINFILE 115G 024). Work included relogging over 21 000 m and assaying over 8000 m of historic drill core. Prophecy also completed a diamond drilling program of 4735 m in 29 holes (Table 12) in order to upgrade the resource, test outlier targets, and delineate shallow higher grades zones of mineralization. In order to advance the project, the company developed a predictive 3D geological model for the deposit, undertook metallurgical test work, and began environmental baseline studies.

Table 12. Selected drill intercepts from Prophecy Platinum's drilling at the Wellgreen property (modified from Prophecy Platinum's November 21, 2013 News Release). Cut-off grade of 0.2% Ni Eq. *Drill thicknesses do not represent true thicknesses. Internal dilution up to six continuous metres of less than 0.2% Ni Eq.

Drillhole	Zone	Depth of intersection (m)	Intersection*
WS-215	Far East	0.0	0.29% Ni, 0.15% Cu, 0.016% Co, 0.24 g/t Pt, 0.23 g/t Pd, and 0.05 g/t Au over 756.0 m
including		561.0 m	0.56% Ni, 0.45% Cu, 0.026% Co, 0.70 g/t Pt, 0.46 g/t Pd, and 0.17 g/t Au over 65.6 m

First Point Minerals (www.firstpointminerals.com) explored for an unusual nickel-iron alloy called awaruite in serpentinized ultramafic rocks of southern Yukon. The company worked its **Mich** claims (Yukon MINFILE 105D 070, 071, 153) with a ground magnetic geophysical survey, geological mapping, and rock sampling in order to define drill targets. Rock assays included results of >0.08% Ni-in-alloy. A large (300-450 kg) rock sample was extracted from the property for future metallurgical studies.

ACKNOWLEDGEMENTS

This overview of activities in the Yukon exploration and mining sector is based on information gathered from a variety of sources, including material provided by companies through press releases, personal communication, and property visits conducted by Yukon Geological Survey staff during the 2013 field season. We gratefully acknowledge the cooperation of companies and individuals in providing information and gracious hospitality during property visits.

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APPENDIX 1: 2013 EXPLORATION PROJECTS

Project	Optioner/Owner	Occurrence	NTS	Work type	Commodity	Deposit
PRECIOUS METALS - GOLD						
3Ace	Northern Tiger Resources	105H 066	105H09	T, SGC, RGC, P, BS	Gold	vein/breccia
Anderson East	Mayo Lake Minerals		105M11	P, G, SGC	Gold	unknown
Bonnet Plume	Cantex Mine Development Corp.			P, SGC	Gold	sediment associated
Brewery Creek	Americas Bullion Royalty Corp.	116B 160	116B01	ES	Gold	porphyry/sheeted vein
Cliff	Berdahl, Scott		115H04	P, G, GGP, SGC, RGC	Gold	vein/breccia
Coffee	Kaminak Gold Corp.	115J 110	115J14	GGP, SGC, RGC, T, DD, RC	Gold	vein/breccia
Dal	Ansell Capital Corp.		106C03	P, SGC	Gold	mafic/ultramafic associated
DDD	Strategic Metals Ltd		115I04	P, RGC	Gold	unknown
Dime	Stina Resources Ltd.		115O12	GGP	Gold	vein/breccia
Dragon	Hutton, Don		115P11	P, SGC	Gold	porphyry/sheeted vein
Eagle (Dublin Gulch)	Victoria Gold Corp.	106D 025	106D04	P, SGC, DD	Gold	porphyry/sheeted vein
Einarson	Anthill Resources		106B03	P, G, SGC, DD	Gold	sediment associated
Elko	Cathro Resources Corp.		106D06	P, G, SGC, RGC	Gold	sediment associated
Face	Rackla Metals Inc.		116C15	P, G, SGC, RGC	Gold	sediment associated
Freegold Mountain Project	Northern Freegold Resources		115I06	P, G, GGP, SGC, RGC, T, BS	Gold	porphyry/sheeted vein
Goldstar	Northern Freegold Resources	115I 053	115I06	SGC, RGC	Gold	skarn/replacement
Goldy	Northern Freegold Resources	115I 112	115I06	P, G, SGC, RGC, T	Gold	vein/breccia
Grommet	Manson Creek Resources		105B11	P, G, SGC, RGC	Gold	porphyry/sheeted vein
Hax	Pika Exploration Inc.		105D02	P, G, SGC, RGC	Gold	porphyry/sheeted vein
Hess	Ryan, Shawn		105N05	P, SGC, RGC	Gold	vein/breccia
Hess River	Cantex Mine Development Corp.		105O	P, SGC	Gold	sediment associated
Hyland Gold	Banyan Gold Corp.	095D 011	095D12	P, SGC, RGC	Gold	vein/breccia
Jubilee	All-in Exploration Solutions		105D01	P, G, SGC, RGC	Gold	porphyry/sheeted vein

Abbreviations

AC – airstrip construction	AGP – airborne geophysics	BS – bulk sampling	CR – road construction
CS – claim staking	DD – diamond drilling	ES – economic studies	G – geology
GGP – ground geophysics	MD – mine development	P – prospecting	RC – reverse circulation/percussion
RGC – rock geochemistry	SGC – soil grid geochemistry	T – trenching	UW – underground work

Appendix 1 (continued): 2013 EXPLORATION PROJECTS

Project	Optioner/Owner	Occurrence	NTS	Work type	Commodity	Deposit
Keynote	Fekete, Mark		105M14	P, SGC, RGC	Gold	porphyry/ sheeted vein
King Solomon Dome	Pacific Ridge Exploration	115O 068	115O15	GGP, SGC, RGC, T	Gold	vein/breccia
King Solomon Project	Kestrel Gold Inc.		115O15	DD	Gold	vein/breccia
Klaza	Rockhaven Resources Ltd.	115I 067	115I03	G, RGC, T	Gold	vein/breccia
Klondike Valley	Diamond Tooth Resources Inc.		116B03	P, SGC, RGC, T	Gold	vein/breccia
Korat	Northern Tiger Resources		115O05	P, G, SGC, RGC	Gold	vein/breccia
Lake	Mieras, Jeff		115P06	P, SGC, RGC	Gold	porphyry/ sheeted vein
Leota	Goldbank Mining Corp.	115O 074		T, SGC, RGC	Gold	vein/breccia
Little Hyland	Lee, Gary		105H16	P, SGC, RGC	Gold	vein/breccia
Lolita	Strategic Metals Ltd.		105O13	P, RGC	Gold	Unknown
Lone Star	Klondike Gold Corp.	115O 072	115O14	G, RGC	Gold	vein/breccia
Lucky Strike	Goldstrike Resources Ltd.		115O03	P, SGC, RGC, T, GCP	Gold	vein/breccia
Mac	Newmont Mining Corp.		105O01		Gold	sediment associated
Mahtin, May-Qu	Ryan Gold	115P 007	115P15	G, P, RGC	Gold	
Mariposa	Pacific Ridge Exploration	115O 075	115O01, 02; 115J15, 16	GGP, RGC	Gold	vein/breccia
Midas Touch (Crag)	Strategic Metals Ltd.		106C03	P, G, SGC, RGC	Gold	sediment associated
Midas Touch (Nad)	Strategic Metals Ltd.		105O13	P, G, SGC, RGC	Gold	sediment associated
Mt. Good	Cantex Mine Development Corp.		106D	P, SGC	Gold	sediment associated
Mt. Williams	Cantex Mine Development Corp.		106D	P, SGC	Gold	sediment associated
Nadaleen Trend	ATAC Resources Ltd.		106C01	SGC, RGC, T, DD	Gold	sediment associated
Nines Regional	Keefe, Ralph		115G02	P, SGC, RGC	Gold	porphyry/ sheeted vein
North Rackla	Cantex Mine Development Corp.		106C	P, SGC, RGC	Gold	sediment associated
North Stewart	Cantex Mine Development Corp.		106B	P, SGC	Gold	sediment associated

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Appendix 1 (continued): 2013 EXPLORATION PROJECTS

Project	Optioner/Owner	Occurrence	NTS	Work type	Commodity	Deposit
Ogi	Fox Exploration		116B01	P, SGC, RGC	Gold	porphyry/ sheeted vein
Oro	Colorado Resources		105O07	P, G, RGC, DD	Gold	sediment associated
Paleo	Richards, Gord		115P03	P, SGC, RGC	Gold	vein/breccia
Plateau South	Goldstrike Resources Ltd.		105N06	P, G, SGC, RGC, DD	Gold	vein/breccia
Project Area	Clayton Jones		105J07	P, G, SGC, RGC	Gold	porphyry/ sheeted vein
QV	Comstock Metals Ltd.	115O 004	115O05	P, G, GGP, SGC, RGC, T, DD	Gold	vein/breccia
Risby Creek	Manson Creek Resources		105F14	P, G, SGC, RGC	Gold	sediment associated
Rivier	Rackla Metals Inc.		105G11	P, G, SGC, RGC	Gold	porphyry/ sheeted vein
Rougue River	Cantex Mine Development Corp.		106C	P, SGC	Gold	sediment associated
Scarlet East	Strategic Metals Ltd.		106C	P, G, SGC, RGC	Gold	sediment associated
Skookum	Pacific Ridge Exploration		115J15	P, GGP, SGC, RGC, T	Gold	vein/breccia
Sky	Nokuyukon Holdings Ltd.		115H14	P, G, SGC, RGC	Gold	vein/breccia
Squid	Metals Creek Resources Corp.		115N10	SGC, T, DD, RGC	Gold	vein/breccia
Stag	Strategic Metals Ltd.		106C03	P, RGC	Gold	unknown
Stewart River	Cantex Mine Development Corp.		105N	P, SGC	Gold	sediment associated
Stoggie	Richards, Gord		115I13	P, SGC, RGC	Gold	vein/breccia
String	Strategic Metals Ltd.		105G09	P, RGC	Gold	volcanic associated
Sulphur (White Gold)	Taku Gold Corp.	New	115O10	GGP, SGC, RGC, T	Gold	vein/breccia
Summit	Goldstrike Resources Ltd.		105I06	P, SGC, RGC, T	Gold	sediment associated
Upper Grand Valley	Mieras, Jeff		115H14	P, SGC, RGC	Gold	vein/breccia
Val	Strategic Metals Ltd.		115I03	P, RGC	Gold	unknown
Van Gogh	Van Kirchbaum, Everett		105H04	P, SGC, RGC	Gold	porphyry/ sheeted vein
Wand	Strategic Metals Ltd.		106C04	P, RGC	Gold	unknown
Wells	Ryan, Shawn		115J12	P, SGC, RGC	Gold	vein/breccia

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Appendix 1 (continued): 2013 EXPLORATION PROJECTS

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Wels West	Gorilla Resources Corp.		115J05	P, RGC	Gold	vein/breccia
Whitehorse Copper Tailings (Gold)	Kryotek Arctic Innovation Inc.		105D11	GGP, RGC, RC	Gold	existing tailings
Wolf	Teck Resources Ltd.		115K01	G, SGC, RGC, DD	Gold	vein/breccia
PRECIOUS METALS - SILVER						
Charlotte	Ansell Capital Corp.		115I03	GGP, SGC, RGC, ES	Silver	vein/breccia
Keno Hill	Alexco Resource Corp.	105M 001	105M14	DD, GGP	Silver	vein/breccia
La Liga	Entourage Metals Ltd.		115K13	P, G, GGP, RGC, T	Silver	vein/breccia
Mt. Haldane	Habanero Resources	105M 032	105M13	DD	Silver	vein/breccia
Shanghai Creek	Ryan, Shawn	105M 028	105M13	P, GGP, SGC, RGC, T	Silver	vein/breccia
Silver City	Klondike Gold Corp.		116B05	P, SGC, RGC	Silver	vein/breccia
Silver Range	Silver Range Resources Ltd.	105K 078	105K11	P, G, SGC, RGC, T, DD	Silver	skarn/ replacement
BASE METALS - COPPER						
Apcar	Kreft, Bernie		105E02	P, SGC	Copper	porphyry/ sheeted vein
Casino	Western Copper and Gold Corp.	115J 028	115J10	ES	Copper	porphyry/ sheeted vein
Four Corners	Strategic Metals Ltd.	105G 146	105G01	P, RGC	Copper	volcanic associated
HDL	Strategic Metals Ltd.		105A11	P, RGC	Copper	unknown
Hopper	Strategic Metals Ltd.	115H 019	115H07	P, G, SGC, RGC	Copper	porphyry/ sheeted vein
Minto	Capstone Mining Corp.	115I 021	115I11	MD	Copper	porphyry/ sheeted vein
Tahte	Cathro Resources Corp.		115H15	P, GGP, SGC	Copper	porphyry/ sheeted vein
Toe	BC Gold Corp.	115I 124	115I11		Copper	porphyry/ sheeted vein
Touleary	Arcus Development Group Inc.	115O 176	115J14	P, SGC, RGC	Copper	volcanic associated
Whitehorse Copper (Carlisle)	H. Coyne & Sons Ltd.		105D11	RGC, DD	Copper	skarn/ replacement
WS Total	BC Gold Corp.	115I 007	115I07	GGP, SGC, G, P	Copper	porphyry/ sheeted vein

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Appendix 1 (continued): 2013 EXPLORATION PROJECTS

Project	Optioner/Owner	Occurrence	NTS	Work type	Commodity	Deposit
BASE METALS - LEAD, ZINC						
Arm Bolt Lea Off	Strategic Metals Ltd.		105G09	P, RGC	Zinc-Lead	volcanic associated
Flip	Strategic Metals Ltd.		105H02	P, RGC	Zinc-Lead	unknown
Hy(land)	Strategic Metals Ltd.	105H 010	105H07	P, RGC	Zinc-Lead	skarn/ replacement
Magnum	Strategic Metals Ltd.	116C 118	116C07	P, RGC	Zinc-Lead	volcanic associated
Michelle	Strategic Metals Ltd.	116A 016	116A13	P, RGC	Zinc-Lead	sediment associated
Mick	Strategic Metals Ltd.		116C07	P, RGC	Zinc-Lead	unknown
Off	Strategic Metals Ltd.		105G08	P, RGC	Zinc-Lead	unknown
Tim	Tarsis Resources		105B01	T, RGC	Zinc-Lead	carbonate replacement
Top	Strategic Metals Ltd.	116B 041	116B04	P, RGC	Zinc-Lead	volcanic associated
Wind	Strategic Metals Ltd.		105G08	P, RGC	Zinc-Lead	unknown
Wolverine	Yukon Zinc Corp.	105G 072	105G08		Zinc-Lead	volcanic associated
BASE METALS - TIN, TUNGSTEN, MOLYBDENUM						
Hidden	Strategic Metals Ltd.	105F 129	105F06	P, RGC	Tungsten	skarn/ replacement
Meloy	Strategic Metals Ltd.		115G08	P, RGC	Tungsten	unknown
Seagull Tin	Panarc Resources Ltd.	105B 033	105B04	P, SGC, RGC, DD	Tin	skarn/ replacement
BASE METALS - NICKEL, PGEs						
Donjek-Arch	Harris, Bill		115G05	P, G, SGC, RGC	Nickel-PGE	mafic/ultramafic associated
Dun (Kluane)	Long, Charlie		115G01	P, SGC	Nickel-PGE	mafic/ultramafic associated
Eikland Mtn	Panarc Resources Ltd.		115K07	P, G, SGC, RGC	Nickel-PGE	mafic/ultramafic associated
Mich	First Point Minerals Corp.		105D09	RGC, BS, GGP, G	Nickel	mafic/ultramafic associated
Wellgreen	Prophecy Platinum Corp.	115G 024	115G05	G, GGP, RGC, DD, CR	Nickel-PGE	mafic/ultramafic associated

Abbreviations

AC – airstrip construction	AGP – airborne geophysics	BS – bulk sampling	CR – road construction
CS – claim staking	DD – diamond drilling	ES – economic studies	G – geology
GGP – ground geophysics	MD – mine development	P – prospecting	RC – reverse circulation/percussion
RGC – rock geochemistry	SGC – soil grid geochemistry	T – trenching	UW – underground work

Appendix 1 (continued): 2013 EXPLORATION PROJECTS

Project	Optioner/Owner	Occurrence	NTS	Work type	Commodity	Deposit
UNKNOWN						
Canopus	Sumitomo Metal Mining	new	115H13	DD	unknown	unknown
CCC	Strategic Metals Ltd.		115I04	P, SGC	unknown	unknown
Clint	Strategic Metals Ltd.		116A05	P, RGC	unknown	unknown
Fresh	Strategic Metals Ltd.		116B04	P, RGC	unknown	unknown
Limestone	Strategic Metals Ltd.		105E12	P, RGC	unknown	unknown
Staff	Strategic Metals Ltd.		106D07	P, RGC	unknown	unknown

Abbreviations

AC – airstrip construction
 CS – claim staking
 GGP – ground geophysics
 RGC – rock geochemistry

AGP – airborne geophysics
 DD – diamond drilling
 MD – mine development
 SGC – soil grid geochemistry

BS – bulk sampling
 ES – economic studies
 P – prospecting
 T – trenching

CR – road construction
 G – geology
 RC – reverse circulation/percussion
 UW – underground work

APPENDIX 2: 2013 DRILLING STATISTICS

Property	Optioner/Owner	# of drillholes	# of metres
Diamond drilling			
Canopus	Sumitomo Metal Mining	10	3728
Coffee	Kaminak Gold Corp.	62	12 273
Eagle (Dublin Gulch)	Victoria Gold Corp.	4	650
Einarson	Anthill Resources	21	4500
Keno Hill	Alexco Resource Corp.	13	2829
King Solomon Project	Kestrel Gold Inc.	3	1191
Mt. Haldane	Habanero Resources	2	
Nadaleen Trend	ATAC Resources Ltd.	26	7300
Oro	Colorado Resources	13	2614
Plateau South	Goldstrike Resources Ltd.	17	2000
QV	Comstock Metals Ltd.	9	2188
Seagull Tin	Panarc Resources Ltd.	100	
Silver Range	Silver Range Resources Ltd.	7	1156
Squid	Metals Creek Resources Corp.	4	428
Wellgreen	Prophecy Platinum Corp.	29	4735
Whitehorse Copper (Carlisle)	H. Coyne & Sons Ltd.		
Wolf	Teck Resources Ltd.	8	1623
Percussive/Reverse Circulation			
Coffee	Kaminak Gold Corp.	240	43 205
Whitehorse Copper Tailings (Gold)	Kryotek Arctic Innovation Inc.	20	200

Yukon Placer Mining Overview 2013

Sydney van Loon¹ and Panya Lipovsky
Yukon Geological Survey

van Loon, S. and Lipovsky, P., 2014. Yukon Placer Mining Overview 2013. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 49-52.

Supporting an industry that has remained relatively consistent for decades, placer miners continue to explore, discover, and produce significant amounts of gold in Yukon. Despite the slow start to the season due to prolonged winter conditions, 2013 saw the highest production of crude ounces since 2007. The price of gold remained high throughout the season, providing strong revenue potential and enthusiasm throughout the industry, which encouraged placer exploration, expansion of established operations, and development of new operations.

Total production in 2013 was 56,563 crude ounces (as of Dec. 4, 2013), which represents an increase of 9.5% from last year's production of 51,679 crude ounces (Fig. 1). With the price of gold averaging US\$1330 per ounce from May 1 to December 4, 2013, this equates to a US\$60 million production value. Figure 1 illustrates a general decline in gold production over the past ten years; however production has started to increase since 2012 due to exceptionally strong gold values. Despite the slightly lower gold prices this year and some resultant vulnerability sensed by operators, the 2013 inflation-adjusted production value of US\$60 million remained strong as the tenth highest in the last 42 years.

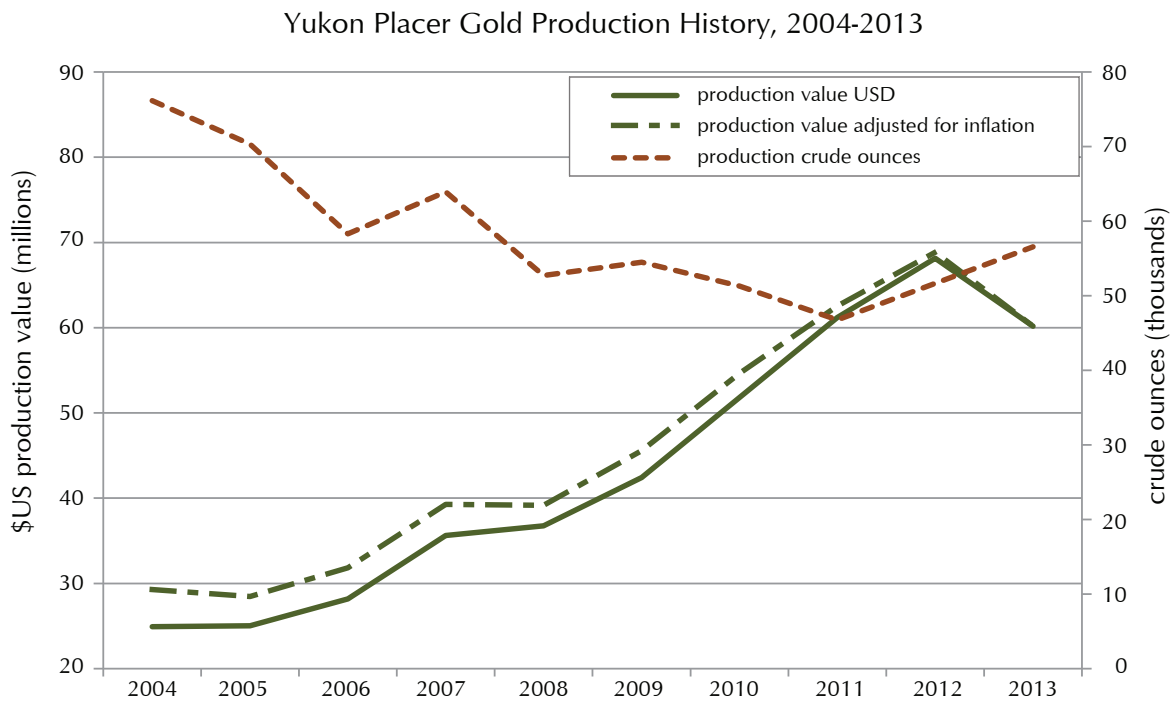


Figure 1. Yukon placer gold 10-year production history, 2004-2013.

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The top ten producing creeks in 2013, listed in order from highest to lowest reported royalties are: Indian River (8212 crude ounces), Quartz Creek (6577 crude ounces), Eureka Creek (4497 crude ounces), Sixty Mile River (4223 crude ounces), Sulphur Creek (2986 crude ounces), Hunker Creek (2854 crude ounces), Black Hills Creek (2727 crude ounces), Gold Run Creek (2416 crude

ounces), Dominion Creek (2139 crude ounces), and Bonanza Creek (1761 crude ounces).

The territory is divided into ten main placer mining districts: Indian River, Klondike, Lower Stewart, West Yukon, Clear Creek, Dawson Range, Mayo, Klwane, Livingstone, and Whitehorse South (Fig. 2).

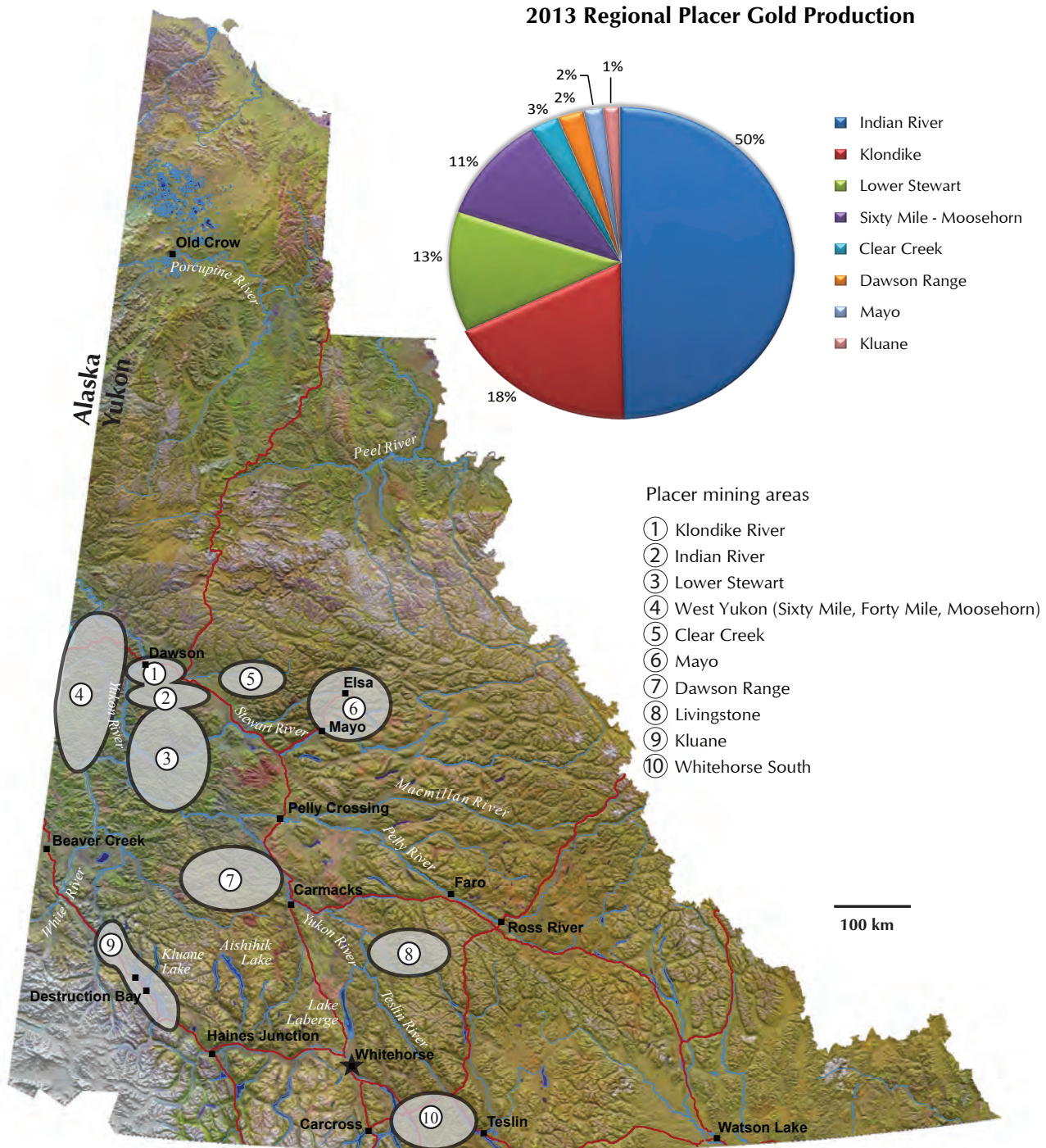


Figure 2. Yukon placer mining areas and 2013 regional production.

The Indian River district consistently ranks as Yukon's top producing region; in 2013 the total production for the district was up 31% from 2012 at 27,928 crude ounces. This represents 49% of the territorial placer gold production. Four of the territory's top five producing creeks are located in the Indian River district and these produced the majority of the district's total production. Listed in order from highest to lowest production, these are: Indian, Quartz, Eureka, and Sulphur creeks. The most significant increase in production occurred on Quartz Creek which generated 4500 ounces more than in 2012 amounting to a total of 6577 ounces.

The Klondike district contributed 18% of Yukon's total production, and remained the second highest producing district in the territory, with 10,131 crude ounces recorded in 2013. Despite an increase in recovery from Bonanza and Upper Bonanza creeks, the total ounces reported in the Klondike drainages decreased 7% in 2013. Production on Hunker Creek totalled 2854 crude ounces and was down 43% from the 4973 crude ounces produced in 2012. A handful of gold-producing hills, gulches, and pups that generated royalties last year reported little to no production in 2013.

The Lower Stewart drainage was the third largest producing district in 2013, comprising 12% of Yukon's total production. The district had 7019 crude ounces recorded, corresponding to a 2% increase from 2012. With the exception of Scroggie Creek, all creeks in the Lower Stewart drainage increased their production from 2012, particularly Thistle, Ballarat, Maisy May, and Black Hills creeks, which together comprised 70% of the district's total annual production. The highest production was recorded from Black Hills Creek, which experienced a 16% increase in production from 2350 crude ounces in 2012 to 2727 crude ounces in 2013.

In the West Yukon district (Sixty Mile, Forty Mile, and Moosehorn Range) production increased 13% to a total of 6236 crude ounces in 2013. Overall the district generated 11% of Yukon's total placer gold production. Several new creeks, that have historically produced either little or no gold, contributed to production in the district this year. West Yukon's most significant change occurred on Sixty Mile River which generated 4223 crude ounces or 67% of the district's total, nearly doubling last year's production.

Production in the Clear Creek district was down 15% from 1810 crude ounces in 2012 to 1537 crude ounces in 2013. Between the late 1990s and 2012 the region

had not produced significant amounts of placer gold, but as exploration potential in the area continues to develop more placer activity may arise. The sole producing creek in the district was Clear Creek, which comprised nearly 3% of Yukon's production in 2013.

Production from the Dawson Range drainage decreased by 5% from 1437 crude ounces in 2012 to 1368 crude ounces in 2013. The largest production change occurred on the Klaza tributaries with an increase of 298 crude ounces to a total of 500 ounces. Several new producing creeks this year, including Guder Creek, Victoria Creek, and Hayes Creek tributaries, generated a total of 167 crude ounces.

The Mayo district had nearly 30% lower production from 2012, with a total of 1025 crude ounces recorded for the 2013 season, or 2% of the territory's total production. Declining due to the absence of activity in Lightning and Thunder creeks, the primary producers were Davidson (403 crude ounces), Duncan (280 crude ounces), and Secret creeks (155 crude ounces).

Placer production reported in the Kluane district decreased 8% from 894 crude ounces in 2012 to 821 crude ounces in 2013, comprising 1.5% of Yukon's total. The most significant change occurred on Burwash Creek, which yielded 549 crude ounces in 2013 compared to 126 crude ounces in 2012. Production also continued on Gladstone, Quill, Ruby, and Wade creeks.

Seventy crude ounces were reported from the Livingstone Creek area in 2013, which is a 70% increase from last year. Summit Creek increased production from the 2012 season and was the sole producer reported in the district this year.

A slight increase in production was also recorded in the Whitehorse South area in 2013, with 22 crude ounces reported from Iron and various other creeks.

The 9.5% increase in Yukon's reported placer gold production and development of exploration on formerly unmined creeks are encouraging indicators that the territory's placer industry is continuing to thrive and grow. The increased production seen in five of the ten mining districts, as seen in Figure 3, is largely a result of the continued strength in the price of gold and the efforts of innovative and determined miners. Renewed enthusiasm brought about by high gold values and ongoing growth of Yukon's placer industry provides hope of a strong future for today's placer miners.

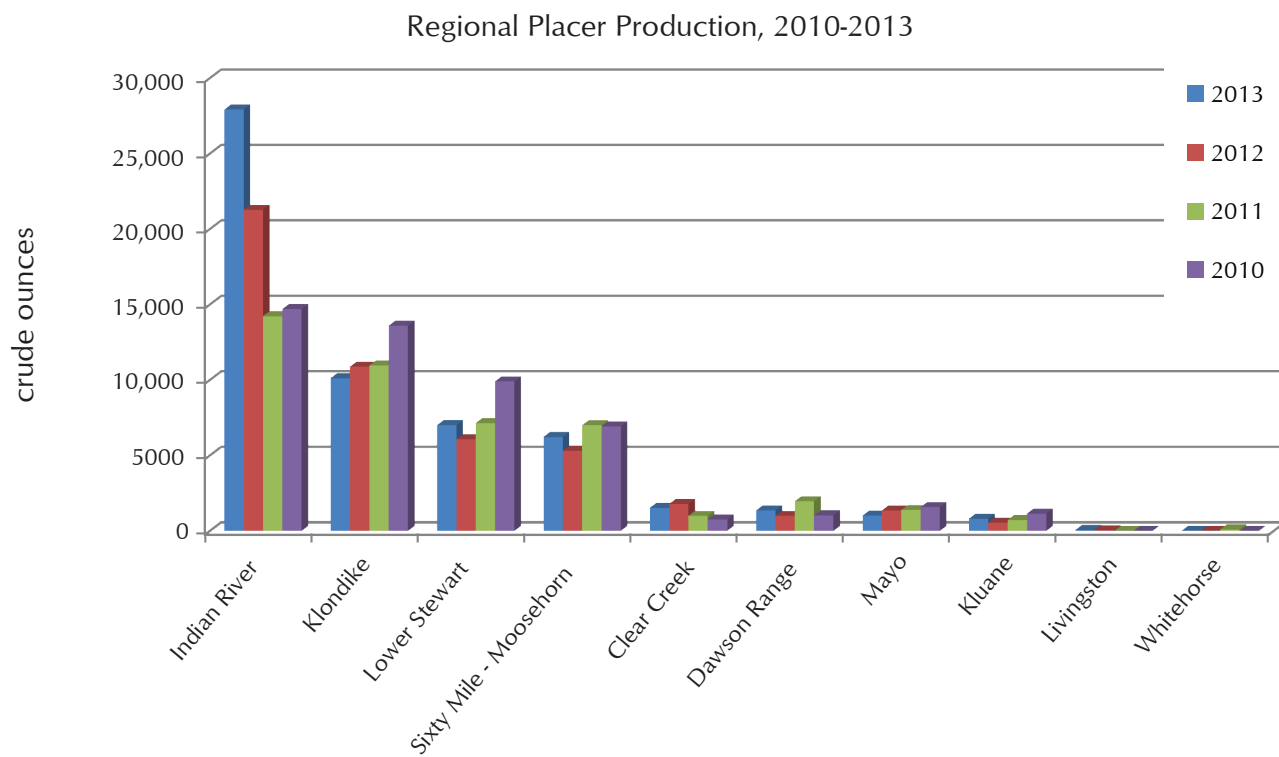


Figure 3. Regional placer production from 2010-2013.

Yukon Mining Incentive Program: 2013-14 update

Derek Torgerson¹
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Torgersen, D., 2014. Yukon Mining Incentive Program: 2013-14 update. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 53-58.

PROGRAM SUMMARY

The Yukon Mining Incentive Program (YMIP) is a funding program 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. YMIP funding has consistently demonstrated its impact as an effective economic incentive by supporting the exploration community in its efforts. This support has led to numerous discoveries, which in turn, have provided significant long term economic benefits to the territory.

YMIP funding supports placer and hardrock 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 YMIP performance. This scoring system is available to the applicants (details on our website at www.geology.gov.yk.ca/ymip.html). The program comprises three different modules of varying reimbursement rates and maximum allowable funding (Table 1 and Fig. 1).

Table 1. YMIP 2013 funding.

2013 Funding Levels	Grassroots	Focused Regional	Target Evaluation
maximum funding	\$15 000	\$15 000	\$35 000
reimbursement rate	up to 100% of eligible expenses	up to 75% of eligible expenses	up to 50% of eligible expenses
no. of approved placer applications	2	0	6
no. of approved hardrock applications	1	19	27

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YMIP 2013 At A Glance			
	Grassroots	Focused Regional	Target Evaluation
Funding	max \$15 000	max \$15 000	max \$35 000
Reimbursement rate	up to 100% of eligible expenses	up to 75% 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
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 \$200 000
Work to proceed on	on claims, leases or crown land	on claims, leases or crown land	on claims, leases, coal exploration licenses or quarry leases, not crown land
Advance of funds	advance \$2500 (\$1000 for first time applicants)	no advance	no advance
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
Holdback/ reports	15% holdback until submission of final reporting requirements		
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. 15% of funds will be held back until submission of final reporting requirements.		
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 YMIP contribution if pre-approved, drilling.
Eligible expenses	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, limited physical work.		
Reimbursement rate guidelines	Expenses reimbursed according to YTG guidelines. Private and commercial rates are provided. Private rates for heavy equipment are 75% of commercial rate as approved by YTG.		
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	GST, 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		

Figure 1. YMIP 2012 At A Glance.

UPDATE FOR 2013

The program was oversubscribed again in 2013, with 81 applicants competing for \$1.17M in funding. The amount of funding available for successful applicants was increased from the previous year which was \$570 000. The Government of Yukon recognized the capital crisis in the mining markets and increased funding by \$600 000 in 2013. This increase in funding was designed to support the exploration industry through these challenging times. In light of the current financial challenges facing the exploration industry, YMIP funding was highly successful in pushing projects forward and has resulted in several potentially significant discoveries in 2013.

The competition for YMIP funding was very tight in 2013 and many quality projects were unable to be funded due to budget constraints. Challenges to secure equity financing, especially amongst the junior mining applicants, led multiple applicants to withdraw their applications. Table 2 outlines historical funding levels for the past six years.

A total of 55 applications were offered funding. The amounts available under the grassroots and focused regional modules were unaltered from 2012. Grassroots funding was maintained at \$15 000, the Focused Regional module saw funding maintained at \$15 000, and the Target Evaluation module was increased by \$10 000 to \$35 000. Of the 55 successful applicants 3 projects were in the Grassroots module, 19 in the Focused Regional, and 33 in the Target Evaluation module. This year, most applications were funded at the maximum allowable based upon the proposed budget.

Of the 55 applications that were offered funding in 2013, hardrock projects account for 87% of the successful applications and placer projects account for the remaining 13%. Individual prospectors and private companies secured approximately 69% of available funds while public junior mining companies received approximately 31% of the funds. The breakdown between the different modules and the demographics of the applicants over the past three years is outlined in Table 3.

In 2013, the bulk of placer projects were centered in the Klondike placer district, with two projects in the Klune area and one in the McQuesten area. Hardrock projects were fairly evenly distributed throughout the territory. Gold appeared to be the most sought after commodity again this year and some clustering of projects occurred around exciting recent discoveries in the Klondike/White Gold area, with the majority of projects south of the Tintina trench. Other successful applications were located in south and central Yukon (Fig. 2). Forty-two projects targeted gold as the primary commodity (placer, structurally controlled, epithermal, intrusion related, and orogenic deposit types), two projects identified vein hosted silver as the target, five projects explored for porphyry copper potential, one for tin/tungsten skarn and greisen mineralization, and five proposals looked at magmatic massive sulphide copper/nickel/PGE prospects.

YMIP's aim is to keep a variety of projects at various stages of advancement. During the 2013 season, 35 of the projects indicated that soil/silt sampling and prospecting/geological mapping would be the primary focus of the program; 5 programs completed various ground and airborne based geophysical surveys, and 15 of the project proposals were for drilling and/or trenching.

Table 2. YMIP historical funding, fiscal years 2008-09 through 2013-14.

Historical funding	2008-09	2009-10	2010-11	2011-12	2012-13	2013-14
available funding	\$600 000	\$1.67M	\$1.67M	\$570 000	\$570 000	\$1.17M
no. of applications	58	173	165	83	79	81
approved projects	46	102	83	34	29	55
max funding level grassroots	\$10 000	\$10 050	\$15 000	\$15 000	\$15 000	\$15 000
max funding level focused regional	\$15 000	\$18 750	\$25 000	\$15 000	\$15 000	\$15 000
max funding level target evaluation	\$20 000	\$50 000	\$50 000	\$25 000	\$25 000	\$35 000

Table 3. YMIP funding statistics for fiscal year 2011-12 through 2013-14.

	2011-12		2012-13		2013-14	
Approved projects	# of approved projects	% of approved funding	# of approved projects	% of approved funding	# of approved projects	% of approved funding
approved placer	7	26%	7	28%	7	15%
approved hardrock	27	74%	22	72%	48	85%
total projects approved	34		29		55	
prospectors/ individuals	22	60%	17	59%	28	36%
private companies	4	15%	8	27%	16	33%
public companies	8	25%	4	14%	13	31%

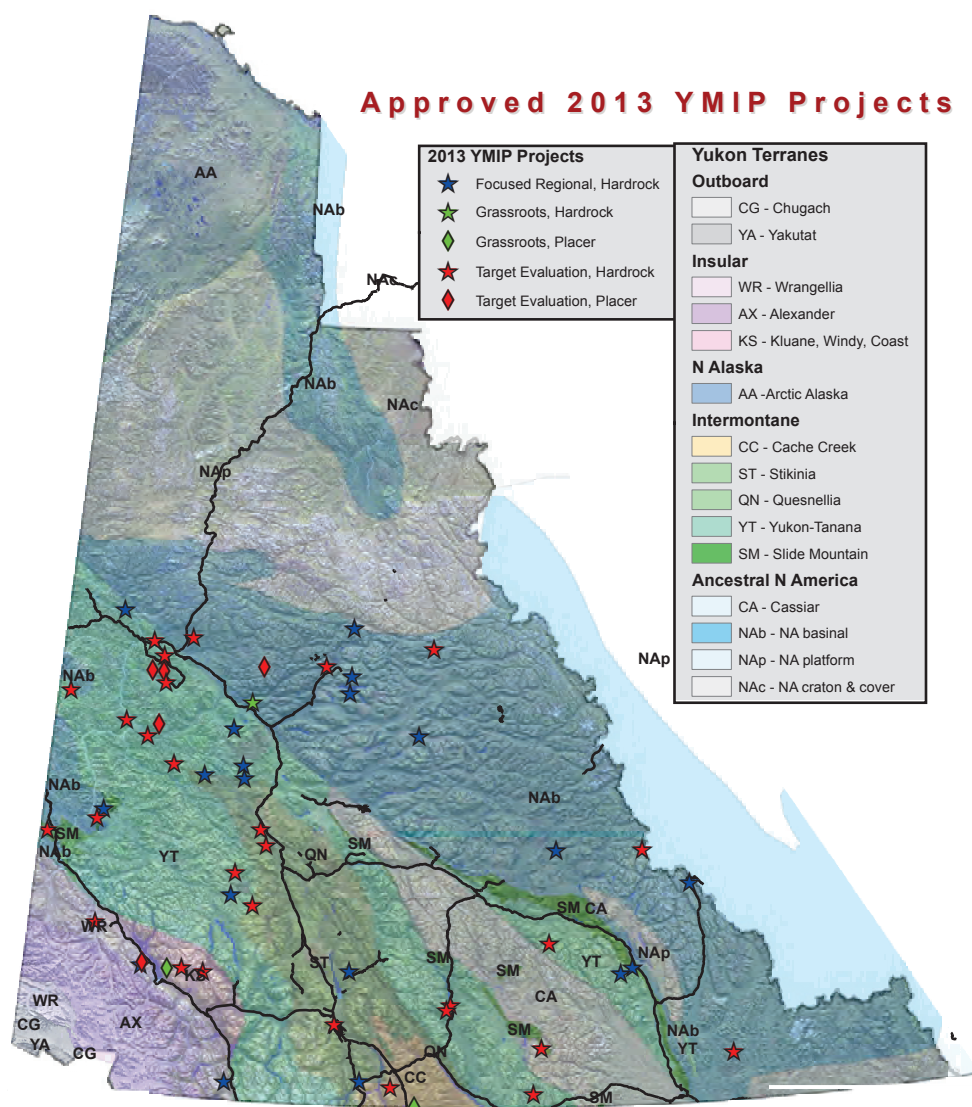


Figure 2. Yukon map of approved 2013 YMIP projects.

The success of the program can be measured by a number of indicators. In 2013, ~\$3.3M was proposed to be leveraged from YMIP funding. It was a very challenging year across the board for option agreements, as many options were returned to the vendors. However, a number of very encouraging YMIP discoveries were made in 2013 which should stimulate exploration expenditures in the years ahead. In 2013, YMIP funding contributed to the staking of approximately 300 new claims, and the discovery of 12 new potentially significant occurrences.

One applicant was able to sell his property outright to a publically traded junior exploration company. Benefits of the program can span several years: follow-up property option and/or exploration work may occur several years after the initial YMIP funding. A number of significant properties have benefited from YMIP funding in the past which has led to important expenditures. Table 4 highlights a few of these projects.

Table 4. YMIP successful options.

YMIP Successful Options (2000-2013)				
YMIP#	Property Name	Total YMIP Contribution(s)	Optioned by	Company investment or work commitment
01-011	Ice/ Red Mountain	\$12 500	AM Gold	~\$7.5M
03-079	White Gold	\$10 000	Madeilena/ Underworld/ Kinross	~\$33.2M
04-072 and 05-043	Blende	\$30 000	Blind Creek Resources	>\$5M
05-058	Andrew	\$14 400	Overland Resources	~\$5.5M
06-054	Antimony Creek	\$10 000	Logan Resources/ Golden Predator	\$0.35M
04-041 and 07-043	Coffee	\$35 000	Kaminak Gold Corp.	~\$68M
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
09-173	Shark/ True Blue	\$21 354	Great Western Minerals	~\$1M
10-097	Portland	\$14 320	Taku Gold	~\$1.25M
00-069; 06-005 and 06-006	Mariposa	\$36 000	Pacific Ridge	~\$4.5M

Program materials have been updated and posted on the YMIP website. New versions of the application form, scoring criteria, and the program's guidelines are now available for download.

YMIP is designed to meet the needs of the users of the program and is continually evolving to meet these needs.

Any additional changes to the program's guidelines and maximum funding levels will be announced when the budget for the 2014-15 program is known.

In 2014 the program will be renamed the Yukon Mineral Exploration Program (YMEP) in an effort to better reflect the mandate of the program.

Yukon Oil and Gas Overview 2013

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Oil and Gas Resources

Adilman, B., 2014. Yukon Oil and Gas Overview 2013. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 59-66.

INTRODUCTION

Yukon's Oil and Gas Resources (OGR) branch forms part of Yukon government's (YG) Department of Energy, Mines and Resources (EMR). OGR's mandate is to manage Yukon's oil and gas resources and regulate oil and gas activity in the territory. This paper provides a summary of oil and gas-related activities in Yukon over the past year, including an update of 2013 exploration and production activities, and those planned for early 2014. Activity in the oil and gas sector is growing, with continued growth projected for 2014.

Highlights of 2013 include: the completion of a four-well exploration drill program in Eagle Plain Basin in summer 2013 by Northern Cross (Yukon) Limited (NCY), which also obtained a geoscience licence to conduct a 3-D seismic program in the southern part of their permit areas; the ongoing review of a licence application for the Yukon Electrical Company Limited Watson Lake Bi-fuel Project by OGR; the submission of a proposal by Yukon Energy Corporation for a liquefied natural gas (LNG) project in Whitehorse to the Yukon Environmental and Socioeconomic Assessment Board (YESAB) for an Executive Committee screening; and the enactment of the new 'Gas Processing Plant Regulation' legislation in July 2013.

OIL AND GAS EXPLORATION AND PRODUCTION AND PIPELINE HIGHLIGHTS

EAGLE PLAIN

In 2007, NCY acquired 15 exploration permits covering a total area of 1.3 million acres and three Significant Discovery Licences in the eastern part of Eagle Plain basin in north Yukon (Fig. 1). In 2011, they signed a partnership agreement with China National Offshore Oil Corporation that provided the resources to undertake drilling operations on their permits. NCY is currently in Year 3 of its exploratory drilling program. From an initial program of six planned wells, all four southern wells adjacent to the Dempster Highway (McParlon A-25, East Chance E-78, West Chance H-28, and Ehnjuu Choo B-73) have been drilled. Drilling of the remaining two wells (North Parkin A-50 and Schaeffer Lake A-12) in the northern permit area was postponed due to inadequate snowpack along the Old Crow winter road during the 2012/13 winter (NCY, 2013a). The McParlon A-25 (main hole and sidetrack) and West Chance H-28 wells terminated in the shales of the Upper Devonian Imperial Formation, with the shallower East Chance E-78 well terminating in the Lower Pennsylvanian (Upper Carboniferous) Blackie Formation shales. The most recently spudded well, Ehnjuu Choo B-73, reached total depth in the hydrothermal dolomites of the Lower Devonian Ogilvie Formation at a depth of 2847 m total vertical depth (NCY, 2013b).

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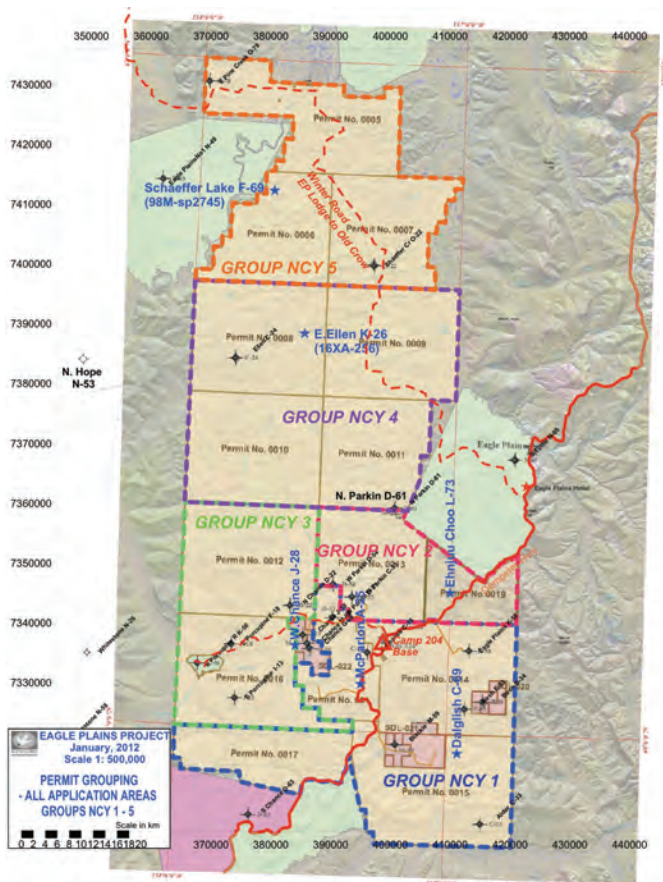


Figure 1. Map showing the permits held by Northern Cross (Yukon) Ltd. and the locations of the six well sites identified in the company's 2012-13 drill plan. Courtesy of Northern Cross (Yukon) Ltd. website (2013).

A regional, 450 km² 3-D seismic survey, planned for winter 2013/14, is anticipated to provide enhanced resolution of conventional reservoir and trap geometries, together with the identification of fractures and possible productive thickness trends for unconventional shale gas reservoirs. Additional data acquisition in 2014 is planned to focus on the collection of airborne LiDAR, methane, and temperature data to search for natural hydrocarbon seeps similar to those identified during summer 2013 fieldwork in Borrow Pit within the basin (NCY, 2013b).

The fulfillment of NCY's drilling commitment to Yukon government resulted in refunds of work deposits and permit renewal for a further four years, with a one year permit extension being approved by EMR for the winter access wells which now need to be drilled by August 30,

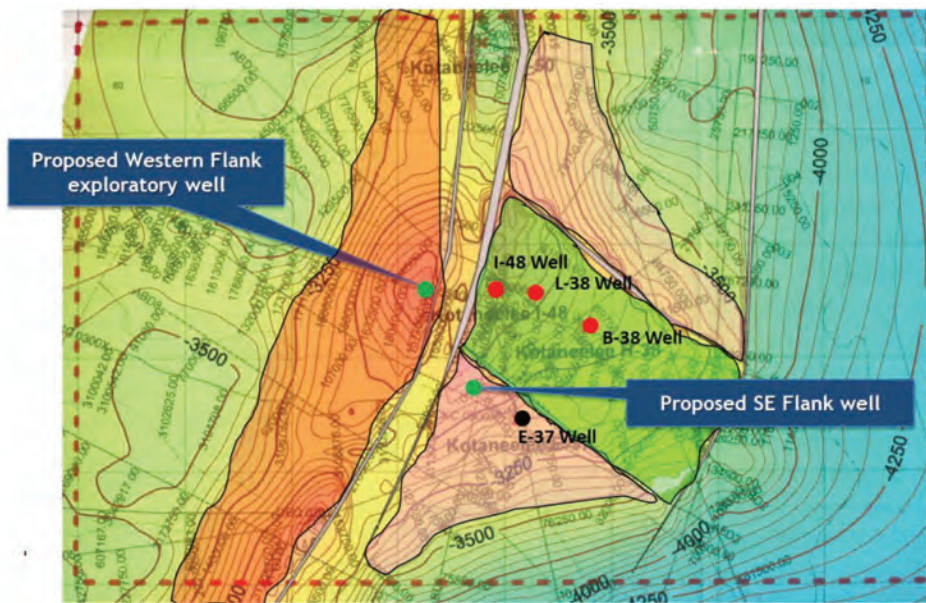
2014. EMR is also currently reviewing a request made by NCY in August 2013 for deferral of rental costs on two disposition permits pending the finalization of the Peel Watershed Land Use Plan. In November 2013, NCY outlined the benefits of oil and gas exploration in northern Yukon in a report submitted to Yukon government. The report states that benefits from its Eagle Plain project are wide-ranging, from direct employment to camp/ access road/well-site construction, catering, wildlife monitoring, communication, logistics, and fuel supply. In total, 87 Yukon businesses have benefited from this single exploration project.

While NCY has been advancing its exploration program in the Eagle Plain basin, NCY, in conjunction with OGR and the Vuntut Gwitchin First Nation, has implemented a Benefits Agreement for training, employment, and business opportunities.

LIARD BASIN

EFLO Energy Inc. (EFLO) is engaged in natural gas development, exploration, and production in Liard Basin in Yukon. Between July and October 2012, EFLO acquired the working interests of Devon Canada and Nahanni Energy in the Kotaneelee gas field. The company is currently conducting repair and maintenance activities on their infrastructure in the Kotaneelee area, with the consequence that natural gas production from Liard Basin ceased in October 2012.

EFLO's exploration program is primarily targeted at conventional natural gas plays, with proven reservoirs in hydrothermal dolomite of the Lower to Middle Devonian Nahanni Formation, and tested reservoirs in the older Arnica and younger Flett formation carbonates (Fig. 2). A presentation given by EFLO at the Yukon Geoscience Forum in November 2013 stated that 234 Bcf of gas had been recovered from the Nahanni Formation to date, and that the Kotaneelee field structure had remaining reserves in its southeast flank with further prospective resource available from its west flank in this formation. EFLO estimates flow rates of 15-30 MMcfd per well from conventional reservoirs when production resumes. In addition, Liard Basin also offers unconventional shale gas potential from the Upper Devonian-Lower Carboniferous Besa River Formation. EFLO reports current reserve estimates for the Kotaneelee gas field of 30.2 Bcf of gas (EFLO, 2013) which suggests that Liard Basin hosts sufficient resources for export as well as for satisfying Yukon's energy needs in the medium to long term.



NAHANNI STRUCTURE MAP – KOTANEELEE FIELD

Figure 2. Conventional (and unconventional) targets in the Kotaneelee field, Liard Basin. Courtesy of EFLO's presentation at Geoscience Forum 2013.

On October 19, 2013, AANDC launched a call for bids for one parcel in the Beaufort Sea with a closing date of February 25, 2014 (Fig. 3). Imperial Oil, BP, and ExxonMobil have partnered and recently submitted their drilling project description to the Environmental Impact Screening Committee. Similarly, ConocoPhillips' interest in advancing development options associated with the Amauligak field is progressing.

Since 2007, in excess of \$3 billion in work commitments have been made by Imperial, BP, Chevron, ConocoPhillips, Franklin Petroleum Ltd., and others for the offshore. These investments in exploration activity have and will provide future significant potential benefits for Yukon.

EFLO operates the only upstream gas facility in Yukon, where extracted gas is processed for delivery to market via the Spectra Energy pipeline from Kotaneelee. In response to Yukon Electrical Company Ltd's proposal to convert diesel generators in Watson Lake to dual-fuel (LNG-diesel) power generation and Yukon Energy Company's proposed Whitehorse LNG (liquefied natural gas) project (see below), EFLO is conducting feasibility studies for LNG processing and delivery infrastructure.

OFFSHORE

During 2013, Yukon government made a concerted effort to advance discussions between Canada and Yukon on the outstanding offshore (Beaufort Sea) commitments in the 1993 Canada-Yukon Oil and Gas Accord (YOGA). On September 11, 2013 officials from Yukon (EMR and the Executive Council Office) and Aboriginal Affairs and Northern Development Canada (AANDC) met to recommence these discussions. Continued dialogue was agreed to including commitments to discuss resolution of an offshore boundary between Yukon and Northwest Territories. In addition to the 1993 Accord, a 2008 Memorandum of Understanding between EMR and AANDC provides the opportunity for Yukon to provide input into industry-produced benefits plans, the 'call for nominations' process for new exploration rights, and offshore policy and planning.

PIPELINES

Despite the significant economic opportunities for the north, the Mackenzie Gas Project (MGP) and the Alaska Highway Pipeline Project are cloaked in uncertainty. The 2012 announcement by Exxon and TransCanada Pipelines regarding their pursuit of options to ship LNG from a port in south-central Alaska signalled that the Alaska Highway route via Yukon is not a current priority. Following a positive regulatory decision in 2011 and a review of the project economics, Imperial Oil Limited cut spending on the project in 2012. However, statements by Imperial in October 2013 regarding a planned revitalization of the MGP have raised the possibility that the stalled northern venture will be reborn as part of an expansive liquefied natural gas development. The National Energy Board has given the proponents until the end of 2013 to make a decision on whether to proceed with the project.

While neither pipeline project has been formally cancelled, industry is not presently working on these projects. The work Yukon government has done contributing to the regulatory process and identifying opportunities and benefits for Yukon puts the territory in a good position to re-engage if the proponents should announce renewed interest in building one or both pipelines.

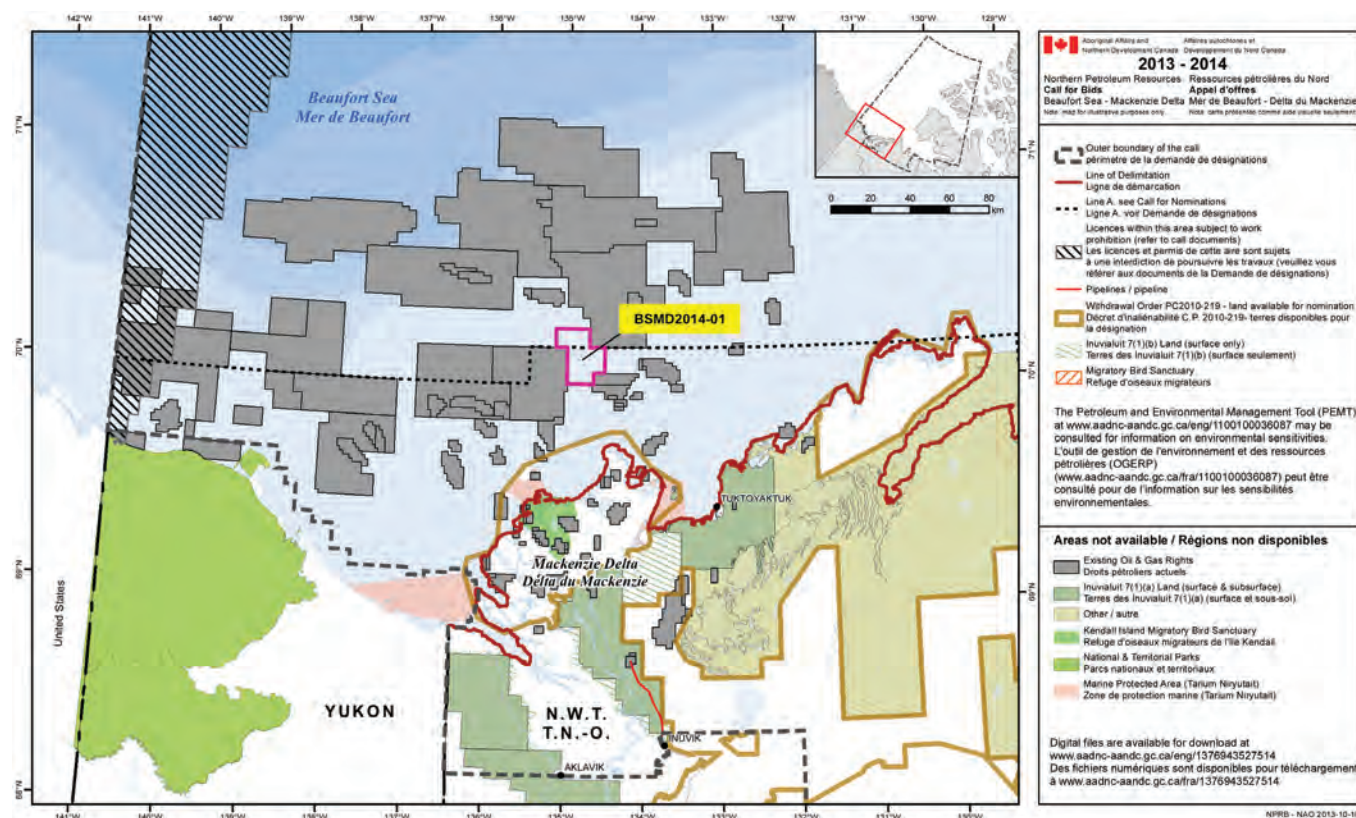


Figure 3. Map of postings in Beaufort Sea.

OIL AND GAS DISPOSITIONS

Yukon’s eight onshore sedimentary basins contain an estimated 17 trillion cubic feet (Tcf) (480 billion m³) of conventional natural gas and 770 million barrels (120 million m³) of conventional oil (Government of Yukon, 2011; Fig. 4). Its offshore conventional resources in the Beaufort Sea include an additional estimated 40 Tcf (1.5 trillion m³) of natural gas and 4.5 billion barrels (720 billion m³) of oil (Government of Yukon, 2011). Under Yukon’s Oil and Gas Act (YOGA) and Oil and Gas Disposition Regulations, the rights to explore for and develop resources in onshore sedimentary basins are obtained through a competitive disposition process.

OGR conducts two disposition processes annually, comprising four steps. The first step, the “Request for Postings” (RFP), gives industry an opportunity to identify areas in which they are interested in exploring for oil and gas. Following the receipt of Requests for Postings, a RFP Review is undertaken during which the public, First Nations, and government agencies can submit representations related to environmental, socio-economic, and access concerns regarding the areas identified in

the RFP. The submissions are reviewed by EMR, and a decision regarding which areas will be opened for exploration is made by the Minister. This is followed by a “Call for Bids”, in which industry is invited to submit bids on those areas that have been approved following the RFP Review. Oil and gas permits are then issued to the successful bidder(s).

Upon completion of the process, successful bidders are required to submit a work deposit equal to 25% of their work commitment bid. A minimum work commitment bid under the disposition process is \$400 000. The funds are reimbursed as work, equivalent to the deposit amount, is completed.

The initial term of an oil and gas permit is six years. Before commencing their exploration program, a permit holder is required to obtain all regulatory approvals and undergo environmental screening through the Yukon Environmental and Socio-Economic Assessment Board (YESAB). They are also expected to adhere to best management practices as outlined by OGR. At the end of six years, the permit may be extended a further four years if a qualifying well is drilled during the initial term.

Yukon Oil & Gas Basins

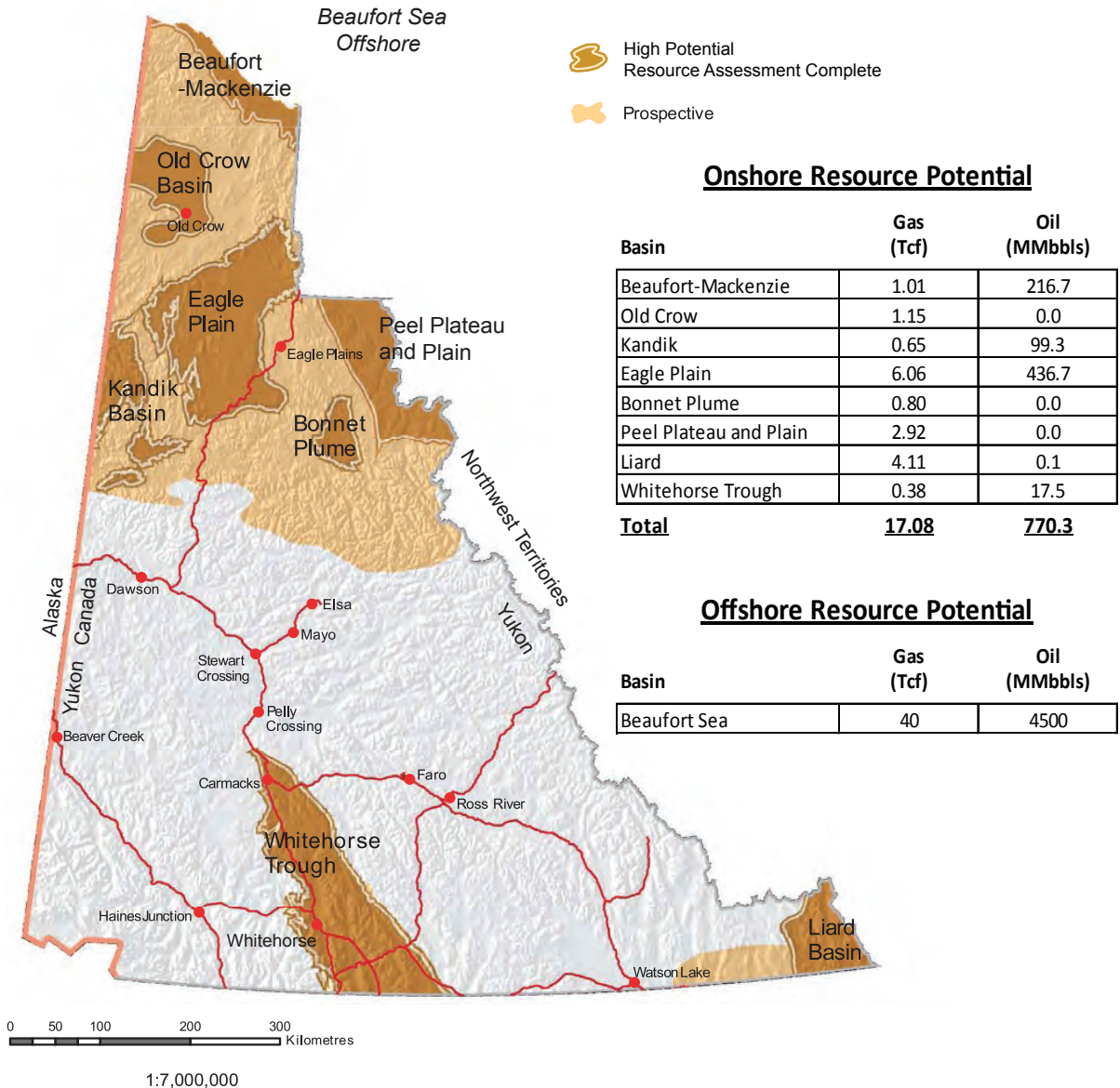


Figure 4. Map of Yukon’s sedimentary basins; resource estimates indicated.

GOVERNMENT INITIATIVES

SELECT COMMITTEE ON HYDRAULIC FRACTURING

In May 2013, in response to public expressions of concern about potential environmental impacts from the process of multi-stage hydraulic fracturing (MSHF) by extended-reach horizontal wellbores, the Yukon Legislative Assembly

established the Select Committee Regarding the Risks and Benefits of Hydraulic Fracturing. To date, no MSHF has occurred in Yukon. As part of the Select Committee briefing process, EMR, Environment Yukon, YESAB, and the Yukon Water Board, all of which function under comprehensive legislation to assess, license, and regulate projects that may use MSHF, presented overviews of their roles in the oil and gas regulatory regime in September

and October 2013. Presentations by other interested stakeholders have also been made to the committee. All information on the Select Committee, and presentations made to it, is publicly available for review on the YG website (www.legassembly.gov.yk.ca/rbhf.html).

The committee will make its recommendations to the Legislative Assembly no later than the 2014 spring sitting. If, after the committee submits its report, approval is given for the use of MSHF in Yukon, amendments to Yukon's Drilling and Production Regulations, the primary regulations associated with hydraulic fracturing, will then be proposed by EMR. EMR continues to review hydraulic fracturing regulations in other Canadian and American jurisdictions as it considers possible amendments to Yukon's Drilling and Production Regulations. An informed decision on hydraulic fracturing will contribute to increased regulatory certainty for the oil and gas industry in Yukon.

LEGISLATIVE AMENDMENTS

Over the past several years, oil and gas industry practices have experienced significant changes, including advanced methods for extracting hydrocarbons from unconventional reservoirs, improvements in and expansion of the range of exploration technologies, and advancements in the transportation and storage of oil and gas. In order to adapt to these changes and ensure Yukon remains attractive to continued oil and gas exploration investment, the Yukon government and OGR continue to update the territory's legislative framework governing the industry.

Examples of such legislative changes include a new Gas Processing Plant Regulation (passed in July 2013) that regulates liquefied natural gas facilities, such as those proposed for the Whitehorse hydroelectric plant and Watson Lake (see Energy for Yukon section below). This regulation incorporates stringent national standards and enables Yukon to have ongoing oversight of an entire gas processing facility to ensure its safe construction, operation and eventual decommissioning.

Drilling and Production Regulations will be reviewed when the Select Committee Regarding the Risks and Benefits of Hydraulic Fracturing has provided the Legislative Assembly with their report in spring 2014. The Pipeline Regulation is also currently under development, and will be applied to all constructed pipelines that operate solely within Yukon. Together with the Gas Processing Plant Regulation, the Pipeline Regulation will be necessary to facilitate proposed natural gas energy supply initiatives within the territory,

and to fulfill commitments within the "Energy Strategy for Yukon" (http://www.energy.gov.yk.ca/pdf/energy_strategy.pdf).

In addition to legislative amendments, OGR is currently reviewing the disposition, royalty, and geoscience exploration and licence administration regulations. Consultation with Yukon First Nations, the public, industry, and environmental organizations will be conducted as necessary on all proposed changes. Recommended amendments following this review will improve regulation of the industry, support responsible practices, and pave the way for further opportunities and growth in Yukon's energy sector. Continued proactive management of Yukon's oil and gas regulatory framework will ensure that the territory's environment is protected and its residents are provided with the resultant fiscal benefits.

ENERGY FOR YUKON

"Energy for Yukon" is an initiative that was started by OGR and has attracted the interest of several First Nation governments and industry. Driven by Yukon's projected energy needs and informed by Yukon government's Energy Strategy (www.energy.gov.yk.ca/energy_strategy.html) and Climate Change Action Plan (www.env.gov.yk.ca/publications-maps/plansreports.php#climate), the initiative proposes local production of Yukon gas to generate power. Use of local gas could eliminate the need to transport LNG into the territory, and create new economic opportunities for Yukon. Given Yukon Energy Corporation's (YEC's) and Yukon Electrical Company Ltd's (YECL's) interests in replacing diesel generators (see below) with natural gas-burning generators, the development of Yukon's natural gas resources has become a priority action of "Energy for Yukon."

The increasing reliance on diesel-generated power for Yukon to supplement the existing hydro grid has prompted YEC to explore alternative, more cost-effective energy solutions for the territory. In addition to increasing economic sustainability, alternatives must also reduce greenhouse emissions and be achievable within short-term durations.

Notwithstanding the increase in diesel-generated power required to sustain forecasted growth in non-industrial loads, the inclusion of both grid and off-grid loads from current and developing mine projects (e.g., Wolverine, Casino, Selwyn, Coffee, etc.) is predicted to increase territorial power demands by as much as tenfold over the next decade (Government of Yukon, 2010).

Following several studies and charrettes that considered hydro enhancement, conservation efficiency measures, biomass, wind, and diesel, YEC identified natural gas-generated power as the best short-term option for meeting this increasing demand (www.yukonenergy.ca/energy/projects/lng/). In fall 2013, YEC submitted a proposal to YESAB to install three new natural gas generators at the Whitehorse hydroelectric facility (Fig. 5). The use of LNG is reliable, affordable (about half the cost of diesel), flexible with low capital costs, and environmentally responsible.

Furthermore, the use of local gas supplies (e.g., from EFLO's potential plant at Kotaneelee in Liard Basin) would eliminate the immediate requirement for trucking the gas up from Calgary or Fort Nelson in the longer-term.

YEC is proposing to replace two ageing diesel back-up generators at the Whitehorse site with more environmentally responsible, quieter, more affordable generators that burn natural gas. New natural gas (including dual-fuel) generators under consideration boast fuel efficiencies of up to 45-55%, and output enough additional heat energy for process and space heating purposes (YEC, 2013). YEC is looking to lease land near the Whitehorse site that will provide enough room for a third generator in the near future, whilst also serving as an LNG storage facility. The Project is currently in the public review stage of an executive committee screening with YESAB. On approval, construction is scheduled to begin in May 2014 with an estimated in-service date of December 2014.

WATSON LAKE DUAL-FUEL PROJECT

In 2013, YECL and ATCO Gas applied for a licence to install a dual-fuel, diesel-natural gas generator system in their Watson Lake facility. The project will be the first to be regulated under the Gas Processing Plant Regulations that were enacted on July 31, 2013 (see previous Legislative Amendments section). The Decision Document was signed by OGR on August 21, 2013 and ATCO Gas submitted their project application for review by OGR on September 5, 2013. All parties are currently in discussion

Proposed LNG Expansion

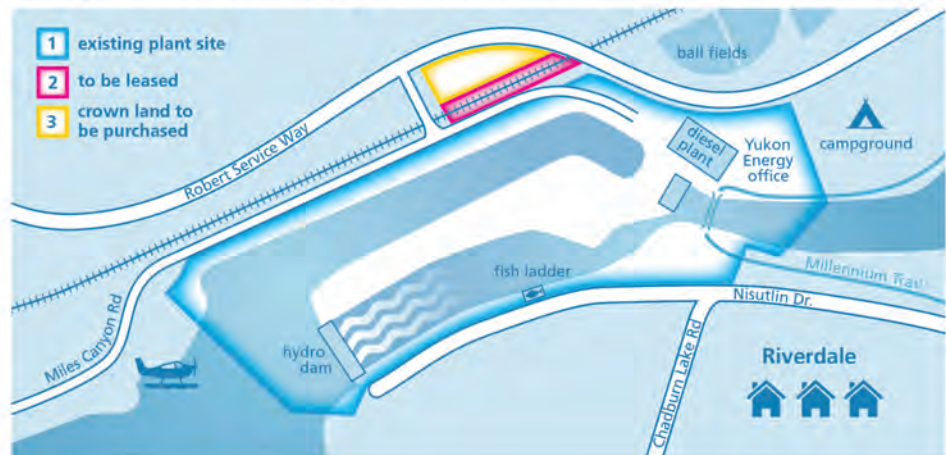


Figure 5. Image from YEC's 2013 Geoscience Forum presentation showing Whitehorse plant development plans.

as to the direction of the project this winter while ensuring that a responsible and adequate review of the license application is not compromised. A Benefits Agreement is also in place between Liard First Nation, Ross River Dena Council, YECL, and Yukon government.

2013 REQUESTS FOR POSTINGS

The spring 2013 Request for Postings resulted in two postings in Eagle Plain basin. Slightly modified postings went out to a Call for Bids following First Nation and public review, however no bids were received. The fall 2013 Request for Postings closed on July 3, 2013 with no RFPs received. The next Request for Posting closes in January 2014.

SUMMARY

OGR recognizes that public concerns over oil and gas developments, much of it fuelled by conflicting information on hydraulic fracturing, are affecting public trust and impacting industry's social licence in Yukon. Until the Select Committee reports in spring next year, short-term objectives of the department are focused on supporting exploration activities to help assess Yukon's energy inventory, with the ultimate goal of territorial energy self-sufficiency. With this in mind, OGR continues to:

- develop and modernize oil and gas regulations to achieve clarity, certainty, and transparency;

- engage and collaborate with industry, First Nations, other governments, regulators and the public on oil and gas legislation, and proposed oil and gas activities within Yukon and in the Beaufort Sea;
- offer oil and gas rights twice annually and regulate oil and gas activities;
- market Yukon's oil and gas resources by advertising, participating in trade shows, and hosting events that target industry;
- enhance training, employment, and business opportunities for Yukoners within the oil and gas sector; and
- ensure timely review and completion of Decision Documents, Benefits Agreements, and Licence Applications.

While 2013 has presented a number of challenges, it also saw significant achievements related to oil and gas opportunities in the territory. Drilling took place in Eagle Plain, a company new to Yukon continues to invest in the potential of Liard Basin and its Kotaneelee assets, and interest in Yukon's offshore continues to be strong. The alignment of these interests with Yukon Energy Corporation's focus on natural gas-powered electrical generation presents exciting opportunities.

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Robert E. Leckie Awards

Judy St. Amand¹

Mining Lands, Energy, Mines and Resources

St. Amand, J., 2014. Robert E. Leckie Awards. *In: Yukon Exploration and Geology Overview 2013*, K.E. MacFarlane and M.G. Nordling (eds.), Yukon Geological Survey, p. 67-68.

EXCELLENCE IN ENVIRONMENTAL STEWARDSHIP – QUARTZ

REGENT VENTURES LTD.

Regent Ventures Ltd. operates on the Red Mountain property, in the Clear Creek area, east of Dawson City where they undertook a small drill program in 2010. While in the area, they reclaimed several historically disturbed sites along the access route.

They removed an old placer camp at Arizona Creek, which included structures, garbage, and fuel drums, reclaiming the area. All garbage and equipment from previous operators was removed from the Saddle zone of the Red Mountain property. At the Arizona airstrip garbage and empty fuel drums from multiple users were removed. An artesian drill hole was discovered, and after days of restoration work, it was plugged using equipment on site. All fuel and waste was disposed of appropriately over many backhaul trips.

This small program benefitted the Yukon greatly, treating the environment and reclamation practices as a priority.



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EXCELLENCE IN ENVIRONMENTAL STEWARDSHIP – PLACER

BEN WARNSBY / ALEX SEELY

Mr. Warnsby and Mr. Seely acquired ground in 2011 on Bedrock Creek in the Sixty Mile area, located in the Dawson mining district. There were several unresolved legacy issues on the creek from decades earlier.

Concerns centered on approximately 10 000 litres of fuel scattered over the area in 45 gallon drums. These abandoned drums, on the verge of becoming compromised, and the vast amount of fuel they contained posed a risk to the environment with the potential to have significant detrimental impact. Mr. Warnsby and Mr. Seely indicated they would remove the fuel immediately. The effort resulted in over 30 trips to Dawson from the site.

Mr. Warnsby's and Mr. Seely's willingness to remove approximately 160 forty-five gallon fuel drums from the Bedrock and Glacier Creek areas, along with hiring equipment to drain two large fuel tanks perched at the creek, has demonstrated exemplary environmental stewardship. They are commended for being leaders in this field.



Yukon Exploration and Geology 2013 Abstracts

The following abstracts are from the Yukon Exploration and Geology 2013 volume. Full versions of the individual papers are available at the Yukon Geological Survey website, www.geology.gov.yk.ca.

PRELIMINARY STABLE ISOTOPE AND GEOCHEMICAL INVESTIGATION OF CARBONATE IN THE KLONDIKE DISTRICT

M.M. ALLAN, J.K. MORTENSEN, AND N. COOK

Carbonate is an important component of gold-bearing quartz veins in the Klondike district, and also makes up an under-recognized proportion of the Klondike schist host rocks. The predominantly metavolcanic Klondike schist contains carbonate as disseminated porphyroblasts and as coarse quartz-carbonate segregations, and also contains rare layers of marble. Chemical staining and LA-ICP-MS analyses reveal that, irrespective of paragenesis, carbonate is dominated by Mg-Fe-Mn calcite. Laser spectroscopic analyses of C and O isotopes reveal that marble is a ^{13}C -enriched isotopic reservoir compared to carbonate in micaceous schist. Carbonate in gold-stage veins has a similar isotopic signature to carbonate in metamorphic segregations and porphyroblasts in the host rocks. We tentatively interpret these results to indicate that the CO_2 component of vein carbonate has been remobilized from local sources during brittle deformation. The results of this study may bear on interpreting the scale of rock-fluid interaction during orogenic gold mineralization in the area.

PATHFINDER SIGNATURES IN PLACER GOLD DERIVED FROM AU-BEARING PORPHYRIES

R. CHAPMAN, M. GRIMSHAW, M. ALLAN, J. MORTENSEN, T. WRIGHTON, AND S. CASSELMAN

Porphyry and epithermal mineralization of early Late Cretaceous (ca. 76-74 Ma) at Casino, Revenue/Nucleus, and Sonora Gulch areas in the central and eastern Dawson Range in west-central Yukon is spatially related to numerous placer gold mining areas. Placer-lode relationships have been established through study of gold alloy compositions and associated mineral inclusion assemblages.

At Casino, hypogene gold grains are liberated by erosion and pass into the placer system without compositional modification, as evidenced by the common alloy signatures and a mineral association of Au, (Bi-Pb-Te-S) minerals and chalcopyrite. A second signature of higher-Ag, chalcopyrite-poor gold has been identified in placer populations, but this gold type also exhibited the Bi-Pb-Te-S signature. The results suggest that the placers contain a mixture of gold derived from the porphyry and peripheral or shallow level epithermal mineralization.

The Bi-Pb-Te-S association evident at Casino was also recorded at Revenue/Nucleus and Sonora Gulch. This generic signature of gold in Cu-Mo (-Au) porphyry deposits and their associated distal epithermal manifestations could be applied to exploration in areas where placer-lode relationships are unclear.

PRELIMINARY OBSERVATIONS ON THE GEOLOGY OF THE ANVIL LAKE AREA (PARTS OF NTS 105K11/12), CENTRAL YUKON

R. COBBETT

The Anvil Lake area consists of mostly contact-metamorphosed siltstone and sandstone having lesser interbedded volcanic and carbonate units that belong to the Early Paleozoic Selwyn basin, thrust northward over the Devonian-Mississippian Earn Group and Carboniferous to Triassic formations. These are intruded by the mid-Cretaceous Anvil batholith. The mapped area surrounds the Keg, a disseminated silver-base metal deposit of current interest; new bedrock information will increase the efficiency of exploration of silver bearing veins noted along stratigraphic and structural contacts regionally. It is the first season of an investigation aiming to provide more detailed revision of regional maps, with further paleontology, geochronology, and structural analysis.

FIELD DESCRIPTIONS OF THE MIDDLE-UPPER DEVONIAN CANOL FORMATION ON TRAIL RIVER, EAST RICHARDSON MOUNTAINS, YUKON

T. FRASER

The Middle to Upper Devonian Canol Formation is the focus of a new study by the Yukon Geological Survey in north Yukon. Fieldwork in summer 2013 involved locating, measuring, and sampling Canol Formation strata in the Richardson and northern Ogilvie mountains. Two hundred and twenty-nine metres of Canol Formation strata were measured on the Trail River, eastern Richardson Mountains (NTS 106L/6) in June. The Canol Formation at this location is entirely exposed, except for ~2 m at its upper contact with the overlying Imperial Formation. On Trail River, the Canol Formation is a resistant, silica-rich unit that is characterized by rhythmically bedded siliceous shale and chert comprising four lithofacies: 1) siliceous shale; 2) chert; 3) siliceous shale (>50%) and chert (10-50%); and 4) chert (>70%) and siliceous shale (10-30%). Siliceous shale is fissile, finely laminated in beds up to 10 cm thick, and may be either soft and recessive or hard and resistant. Chert exhibits conchoidal fracture and occurs in beds up to 16 cm thick. Both shale and chert are black in color on fresh surfaces, and weather grey to black, olive grey, brown with a distinct yellowish orange, dark red, and/or very minor apple-green weathering residue. The lower contact of the Canol Formation with the Road River Group calcareous shale is sharp, and marked by a concretionary bed overlain by a thin (<1 m) weathered mineralized zone, that may be in-part correlative with the Ni-Zn-PGE "Nick" horizon observed in the region. A marked lithology change occurs from the Canol to the Imperial formation where Imperial strata consist of weathered mudstones with a significantly lower silica content. Concretions up to 2.5 m long may be observed in the Canol Formation. Fossils were not identified, but possibly observed in two locations where unidentified impressions on a bedding surface could be from a biological (or mineralogical) source. Fine-grained pyrite occurs throughout the formation as disseminated grains, in thin laminations (mm-scale) and rarely, in concretionary horizons. The sampling program involved spectral gamma-radiation readings at one-metre intervals, and chip samples through two-metre intervals for Rock-Eval/total organic carbon (RE/TOC) and litho geochemistry (ICP-ES/MS). Targeted samples for microfossil biostratigraphy, vitrinite reflectance, and XRD mineralogy were also collected. Laboratory results are anticipated in 2014. This section description is part of a larger study aimed at characterizing and correlating the Canol Formation within the Yukon and to adjacent regions, and assessing the formation's regional hydrocarbon potential, both as a source rock and an unconventional shale reservoir.

GEOLOGY AND JADE PROSPECTS OF THE NORTHERN ST. CYR KLIPPE, (NTS 105F/6), YUKON

S.J. ISARD AND J.A. GILOTTI

Nephritic jade deposits have been found along faulted contacts between serpentinite and siliceous units at the King Arctic mine in southeastern Yukon. In the St. Cyr klippe near Quiet Lake south-central Yukon, serpentinite units of the Slide Mountain oceanic assemblage are thrust above phyllite units of the Cassiar terrane. This contact has the potential to contain jade deposits similar to the ones found at the King Arctic mine. However, bedrock mapping during the summer of 2013 failed to identify large jade deposits within the field area, but smaller jade deposits may have been overlooked. The absence of jade mineralization could be due to the lack of fluid migration through faults, but is more likely due to the low silica content of the phyllite.

PRELIMINARY INVESTIGATION INTO THE GEOLOGIC RELATIONSHIPS IN THE GRANITE LAKE AREA, PARTS OF NTS 115A/10, 11, 14 AND 15, SOUTHWEST YUKON

S. ISRAEL AND R. KIM

Bedrock mapping during the summer of 2013 within the Granite Lake area was completed as part of the first year of a multi-year project to investigate the geological relationships in southwest Yukon. Several different tectonostratigraphic elements were identified including rocks of the Yukon-Tanana terrane, the Kluane schist, and the Bear Creek assemblage. These were tectonically juxtaposed into a northeast dipping structural stack with the Yukon-Tanana terrane occupying the highest structural level, followed by the Kluane schist and the Bear Creek assemblage. Two plutonic phases of probable mid-Cretaceous and Late Cretaceous age were identified to intrude the Kluane schist and the Yukon-Tanana terrane respectively. A large Paleocene aged batholithic intrusive suite, the Ruby Range suite, intrudes across all tectonic boundaries.

Tectonic and stratigraphic relationships observed in southwest Yukon are strikingly similar to those found in southeast Alaska, near Juneau. These similarities increase the potential for Juneau gold-belt type mineralizing systems extending into southwest Yukon.

THE EARLY NEOPROTEROZOIC CHANDINDU FORMATION OF THE FIFTEENMILE GROUP IN THE OGILVIE MOUNTAINS

M. KUNZMANN, G.P. HALVERSON, F.A. MACDONALD, M. HODGSKISS, P.D. SANSJOFRE, D. SCHUMANN, AND R.H. RAINBIRD

Studies of biogeochemical and evolutionary change in the Neoproterozoic require a detailed understanding of stratigraphic successions and their intrabasinal correlation to integrate those records into regional and global frameworks. The early Neoproterozoic Fifteenmile Group in the Ogilvie Mountains has previously been shown to archive important information on the evolution of the biosphere, including ocean redox and early evolution of eukaryotes. Here, we formally define the Chandindu Formation, a 150-420 m-thick siltstone-dominated mixed carbonate-siliciclastic succession of the lower Fifteenmile Group in the Coal Creek and Hart River inliers. We present ten sections of the Chandindu Formation and propose a type section and formalization to promote the development of a consistent stratigraphic framework for Proterozoic successions in northwest Canada. The Chandindu Formation begins with muddy tidal flat facies, which are succeeded by shale-siltstone-sandstone coarsening-upward cycles deposited in a predominantly subtidal environment. However, carbonate occurrences throughout the entire unit suggest localized carbonate buildups, likely nucleated on fault-bound paleohighs where siliciclastic background sedimentation was low. These paleohighs originated from rift-inherited complex basin topography and syn-depositional faulting during deposition of the upper Chandindu Formation.

A FOUR STAGE EVOLUTION OF THE WHITE CHANNEL GRAVEL: IMPLICATIONS FOR STRATIGRAPHY AND PALAEOCLIMATES

R.I. LOWTHER, J. PEAKALL, R.J. CHAPMAN, AND M.J. POUND

Although the White Channel Gravel (WCG) of the Klondike district, Yukon, contains gold placers which have been exploited for over a century, few sedimentological studies have been undertaken. Here we report a four stage evolution of the WCG, comprising:

- i. An initial downcutting period which preferentially retained gold particles on the base of the strath.
- ii. An aggradational stage in which gold concentration occurred within sedimentary features.
- iii. A lacustrine layer representing a depositional hiatus.
- iv. A final more rapidly aggrading fluvial stage.

Identification of the lacustrine layer has clarified the evolution of the WCG depositional fluvial systems. Architectural element analysis and detailed sedimentological observations have been synthesized to gain a clearer understanding of the spatial variations within the WCG. Additionally, the identification of plant species from pollen within the lacustrine layer provides irrefutable evidence that the Klondike district was at least 7°C warmer during the Pliocene compared to the present.

STRUCTURAL CONTROLS ON ALTERATION AND MINERALIZATION AT THE COFFEE GOLD DEPOSITS, YUKON

D. MACKENZIE, D. CRAW, AND C. FINNIGAN

The Coffee gold deposits are controlled by East and North-striking structures that initiated in the Jurassic and were re-activated in the Cretaceous. Cretaceous igneous rocks and Jurassic-altered Paleozoic rocks were overprinted by Late Cretaceous (or younger) gold mineralization and the paragenetic sequence for the main prospects has been established. Jurassic alteration is characterized by zones of pervasive quartz sericite alteration of metamorphic minerals and disseminated brassy pyrite. Jurassic pyrite is locally anomalous in gold, but is generally barren. Cretaceous gold mineralization overprints Jurassic sericite alteration and is characterized by veins and breccia infilled with gold-bearing, dark grey, 'sooty' arsenian pyrite. In biotite-rich host gneiss, disseminated arsenian pyrite extends outwards from fracture zones along biotite-rich metamorphic foliation and pre-existing Jurassic shears. In altered Late Cretaceous igneous rocks, gold-bearing arsenian pyrite replaces primary biotite. Compared to other nearby prospects, the Coffee gold project is most similar to the Boulevard project but textures suggest it formed at shallower levels.

U-PB AGE, WHOLE-ROCK GEOCHEMISTRY AND RADIOGENIC ISOTOPIC COMPOSITIONS OF LATE CRETACEOUS VOLCANIC ROCKS IN THE CENTRAL AISHIHIK LAKE AREA, YUKON (NTS 115 H)

G.A. MORRIS, J.K. MORTENSEN, AND S. ISRAEL

Geochemical, isotopic and U-Pb dating studies of volcanic rocks of the Tlansanlin Formation in central Aishihik Lake map area (115H) show that these are Late Cretaceous (75.8 ± 0.4 Ma to 77.3 ± 1.3 Ma), relatively primitive magmas that were emplaced in a continental arc setting. Intrusive rocks in the immediate area, associated with the Hopper porphyry and skarn and Sato porphyry occurrences (Yukon MINFILE occurrences 115H 019, 021, respectively), are similar in age and composition to the Tlansanlin Formation rock units, confirming the presence of a significant Late Cretaceous igneous and mineralizing event in the area. Significant porphyry and skarn occurrences associated with the Late Cretaceous intrusions in the Aishihik Lake area, as well as the important mineral deposits and occurrences associated with this magmatic event in the Dawson Range to the northeast (e.g., Casino, Revenue-Nucleus, Sonora Gulch), underscore the metallogenic potential of this previously poorly recognized magmatic event.

BEDROCK GEOLOGY OF NTS 106B/04, EASTERN RACKLA BELT

D. MOYNIHAN

The NTS 106B/04 map area straddles the upper reaches of the Stewart River in east-central Yukon. The area north of the Stewart River is underlain by Ediacaran clastic and carbonate continental slope deposits of the uppermost Windermere Supergroup, and by Ediacaran-Cambrian rocks of the Hyland Group (Selwyn basin). The area south of the Stewart River is dominated by the Cambrian Gull Lake Formation and Cambrian (-Silurian?) volcanic rocks of the Old Cabin Formation. The main structures in 106B/04 define an arcuate pattern; they are oriented NW-SE in most of the area, but are approximately E-W in the westernmost part of the map area. These structures include upright, gently-plunging folds and steeply-dipping, axial-planar cleavage. Folding was locally accompanied by thrusting. Late structures include a steeply-dipping sinistral fault that transects the central part of the map area and numerous NW-WNW-trending, normal (\pm dextral) faults. Stratigraphic relationships suggest correlation of the upper Yusezyu, Algae, and Narchilla formations of the Hyland Group (Selwyn basin) with the upper Blueflower, Risky, and Ingta formations of the Windermere Supergroup (Ogilvie and Mackenzie platforms). Gold mineralization has recently been discovered in the Algae Formation, which has also been explored for Mississippi-valley-type, lead-zinc-silver mineralization elsewhere in the area.

GEOCHEMISTRY AND U-PB ZIRCON GEOCHRONOLOGY OF MID-CRETACEOUS TAY RIVER SUITE INTRUSIONS IN SOUTHEAST YUKON

L.C. PIGAGE, J.L. CROWLEY, C.F. ROOTS, AND J.G. ABBOTT

Reconnaissance geological mapping in the Coal River map area of southeastern Yukon investigated several small mid-Cretaceous plutons. The intrusions are composed of unfoliated or incipiently foliated, fine to coarse-grained, equigranular and porphyritic, biotite \pm hornblende quartz monzodiorite to granodiorite. They are metaluminous to peraluminous and have reduced to oxidized geochemical characteristics. The composition of selected samples is consistent with magma formation from partial melting of infracrustal source rocks.

U-Pb ages were obtained for nine plutons from five or six zircon single-grain analyses by the isotope dilution thermal ionization mass spectrometry method with chemical abrasion (CA-TIMS). All interpreted ages are concordant within statistical uncertainty. The plutons range in age from 99.80 ± 0.03 to 97.70 ± 0.03 Ma. Given the primarily unfoliated nature of the plutons, contractional, fabric-forming deformation within the Cordilleran orogeny must therefore have largely ceased at the present level of exposure in the Coal River area by the time of intrusion (97 Ma).

The ages and compositions of the plutons in Coal River map area are consistent with their being part of the Tay River Plutonic Suite, a northwest-trending belt of coeval and compositionally similar plutons and local volcanic rocks (South Fork Volcanic Suite) that, when augmented by the addition of the Coal River plutons, extends approximately 465 km with a width of up to 150 km.

SEDIMENTARY PYRITE AS A GOLD-SOURCE IN SEDIMENT-HOSTED GOLD OCCURRENCES IN THE SELWYN BASIN AREA, EASTERN YUKON

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Intrabasinal sedimentary pyrite has recently been proposed as a potential gold source for sediment-hosted gold deposits. To evaluate this concept in the Selwyn basin area of eastern Yukon, we use laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS) to analyse pyrite from the Carlin-type Conrad, and orogenic gold 3Ace occurrences. We texturally and chemically characterize four generations of pyrite in grey to black mudstones and siltstones, but focus 83% of our analyses on early and late diagenetic pyrite. Diagenetic pyrite from the Conrad occurrence is trace element poor with respect to deposit-proximal pyrite from shales in the Northern Carlin Trend of Nevada, but is similar in composition to distal diagenetic pyrite in these Nevada shales. Diagenetic pyrite from the 3Ace occurrence is very similar in composition to pyrite around the giant Sukhoi Log deposit in eastern Russia. This paper preliminarily concludes that the trace element composition of diagenetic pyrite from the Conrad and 3Ace occurrences is permissive of a locally derived intrabasinal sedimentary pyrite gold source.

BATHYMETRIC AND GEOPHYSICAL SURVEYS OF THE SOUTHERN END OF KLUANE LAKE, YUKON

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Initial observations of lakebed geomorphology and morphodynamic processes operating at the southern end of Kluane Lake are presented here. We used multibeam and parametric echo sounding to map, with high resolution, the bathymetry and sub-bottom stratigraphy of the lakebed, and an acoustic Doppler current profiler and laser grain size analyser to measure flow and sediment transport over the Slims River delta in August 2013. A series of low-angle asymmetric sediment waves were observed on the delta top, as well as buried within the delta sediments. These older bedforms were buried as the delta prograded into the lake in the past three centuries. Other delta surface features include small scarps and channels. Drowned terraces observed on the eastern margin of the lake indicate the lake level was stable and lower than present at least four times during the Holocene, to a maximum of 47 m below present datum.

2013 LIST OF PUBLICATIONS AND MAPS

2013 YGS PUBLICATIONS

YGS released 21 publications in 2013: 2 Annual Reports, 1 Geoscience Map, 2 Miscellaneous Reports, and 17 Open Files.

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