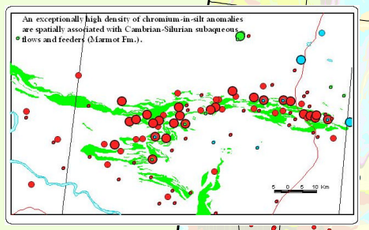
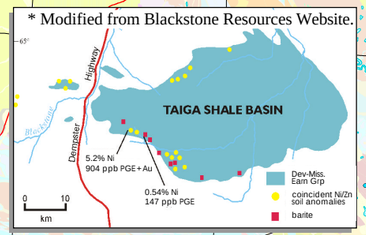
Yukon Platinum Occurrences & Potential

An exceptionally high density of chromium-in-silt anomalies are spatially associated with Cambrian-Silurian subaqueous flows and feeders (Marmot Fm.).

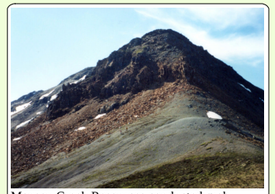


* Modified from Blackstone Resources Website.

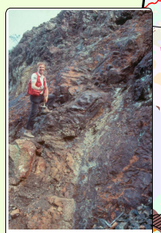


Stewart Harris (Equity Engineering) points to the massive strataform sulphide horizon on Blackstone Resource's Taiga property hosted in Earn Group black shales. Samples from this unit returned values up to 5.21% Ni and 904 ppb combined Au + PGE.

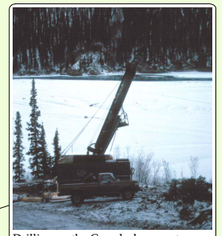
Hydrothermal barite mound in Earn Group strata on Taiga property. Drill intersections through this section returned 25.5m of 0.51% Ni and 0.41% Zn.



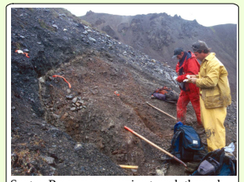
Manson Creek Resources conducted grab sampling of heavily serpentinized ultramafic flows and associated rocks on the Nad property (NTS 106C/3) adjacent to the Craig property in 2001. Sampling consistently returned elevated nickel values in the 0.10% to 0.56% range (29 grab samples). To date, these flows have been identified over a minimum strike length of eight kilometres. Whole rock geochemistry indicates that the ultramafic rocks are komatiitic; pentlandite has been positively identified under petrographic examination as the nickel-bearing sulphide phase.



Rusty weathering highly mineralized marginal gabbro in footwall sill at the Wellgreen deposit. With a production of approximately 0.36 Mg Pt+Pd and a resource of approximately 42,415 kg Pt+Pd, the Wellgreen is the Yukon's largest PGE deposit.



Drilling on the Can alask property near the White River by Archor, Cathro and Assoc. ('81) Ltd. during their 1995 exploration program. A 1973 drill hole intersected 3m of 1.8 gpt Pt+Pd, 0.94% Ni and 0.33% Cu.



Santoy Resources examine trench through Sweet Sixteen zone on their Klu property during exploration during 2000 field season were a 1.2m chip yielded 1.84 gpt Pt, 1.55 gpt Pd, 1.07 Au and 0.12% Cu.

Lisa Tulk taking notes on highly mineralized, rusty weathering marginal gabbro ore zone at the Spy showing on Klu Property where a 1.0m chip yielded 7.07 gpt Pt, 1.34 gpt Pd, 0.69 ppm Au, 0.45% Cu and 0.16% Ni.

Selected units with PGE potential

KTc	Late Cretaceous Carmacks Group intrusions
EJsU	Jurassic alkalic intrusions
MJgB	
TrG	Triassic Galena suite mafic intrusions
PTrKl2	Triassic Kluane ultramafic suite
CTc1	Mississippian - Permian Cache Creek Group ultramafic rocks
CRAL&S	Devonian - Permian Yukon-Tanana/Slide Mountain ultramafic rocks
DME	Devonian - Mississippian Earn Group black clastic rocks
CSM1-2	Cambrian-Silurian Marmot Formation volcanic rocks

Units from Yukon Digital CD - Gordey & Makepeace, 1999.

Stream Silt Anomalies

	rpm	Cumulative %	# of Occurrences
Nickel	183 - 260	98.0%	147
	261 - 338	99.0%	80
	339 - 892	99.5%	67
Cobalt	40.6 - 51.4	97.9%	123
	51.5 - 65.7	98.8%	77
	65.8 - 389	99.3%	60
Chromium	213 - 302	97.6%	121
	303 - 421	98.8%	77
	422 - 2021	99.5%	51
Coincident Nickel / Copper	Ni 191+ Cu 109+	98.2% 98.2%	109

Calculated from Geological Survey of Canada, National Geochemical Reconnaissance.

Minfile Occurrences

Name	Minfile#	Deposit Type	Major	Minor
Stride	115A 037	Alaskan type	Cr, Fe	Pt
Arch		Kluane type	Ni, Cu, PGE	
Pickhandle	115F 043	Kluane type	Cu, Ni	
Dickson	115G 005	Kluane type	Ni, Cu, Pt, Co	
Destruction	115G 006	Kluane type	Ni, Cu, Co, Pt	
Kluane	115G 099	Kluane type	Cu, Ni, PGE	
Wash	115G 100	Kluane type	Ni, Cu, PGE	Au
Linda	115G 094	Kluane type	Ni, Cu, PGE	Au
Glen	115G 016	Kluane type	Ni, Cu	Au
Canalask	115F 045	Kluane type	Ni, Cu, PGE	
Swede Johnson	115G 027	Kluane type	Au	
Wellgreen	115G 024	Kluane type	Ni, Cu, PGE	Co, Zn, Au
Airways	115G 025	Kluane type	Ni, Cu, PGE	Co
Congdon	115G 003	Kluane type	Ni, Cu, PGE	Pb, Zn
Yellow	115K 105	Kluane type	Cu	
Onion	115K 077	Kluane type	Ni, Cu, Mo	Au, PGE
Epic	115F 047	Kluane type	Cu, Mo	PGE
Mansfield (BC)		Kluane type	Ni, Cu, PGE	
Lindsay	105C 022	Ophiolitic ultramafic	Cu, Ni	Au, Ag
Squanga	105C 012	Ophiolitic ultramafic	Cr	Pt
TOG	105C 028	Ophiolitic ultramafic	Au	Cr
Marsh	105D 069	Ophiolitic ultramafic	Au	Ni, Co, Cu, W
Michie	105D 071	Ophiolitic ultramafic	Cr	asbestos
Military (Phil)	105D 178	Ophiolitic ultramafic	Cr	Au
Pyroxene	115O 116	Alaskan-type intrusive	Pt	
Sato	115H 021	Porphyry	Cu	Mo
Dunite Moutain	105F 005	Ophiolitic ultramafic	Cr	asbestos
Tam (Falcon)	105I 044	Stratiform	Zn, Ni	
Drizzle (Jet)	105O 023	Stratiform	Ba	Zn, Cu, Pb
Niddery (Jet)	105O 005	Stratiform	Zn, Ni	Ag, Ba, Cu
Sanguinetti (Taiga)	116A 024	Stratiform	Ba	Zn, Pb, Cu, V
Rein (Taiga)	116B 128	Stratiform	Ba	Zn, Pb, Cu, V
Nick	106D 092	Stratiform	Ni	PGE, Zn, Mo
Porphyry	106C 013	Wernecke Breccia	Cu, Fe	Cr
Nick	106D 092	Stratiform	Ni	PGE, Zn, Mo
Barker Creek		Placer	Au, Pe	
AR		Kluane - type	Ni, PGE	Cu
Swede Johnson Creek		Placer	Pt, Au	
Spy - Klu		Kluane - type	Ni, Cu, PGE	Au
Florence Creek		Placer	Pt, Au	

▲ Alaskan-type intrusion ▲ Ophiolitic ultramafic ▲ Porphyry ✱ Placer △ Stratiform △ Kluane - type △ Wernecke Breccia

Occurrences with MINFILE numbers from Yukon MINFILE, 1997. Occurrences without MINFILE numbers, see accompanying text.

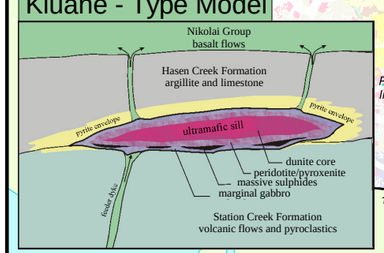
Gravity

> -35
-45 to -35
-50 to -45
-60 to -50

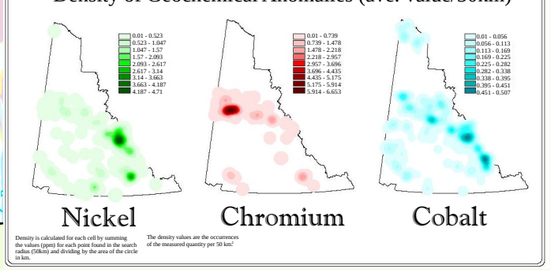
Units are milligals from GSC Open File 2525.

100 50 0 100 kilometres

Kluane - Type Model

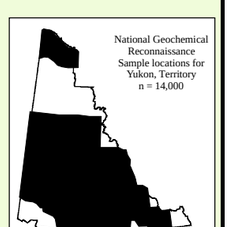


Density of Geochemical Anomalies (ave. value/50km)



Density is calculated for each cell by summing the values (ppm) for each point found in the search radius (50km) and dividing by the area of the circle in km.

The density values are the occurrences of the measured quantity per 50 km²



Alaska
Northwest Territories
British Columbia
Taiga
Reid
Sanguinetti
Nick
Porphyry
Craig
Macmillan Pass
Niddery
Drizzle
Tam (Falcon)
Tungsten
Ross River
Dawson
Mayo
McQuesten
Barker Creek
Pyroxene Mountain
Carmacks intrusions
Minto
Talbitzer Lake
Beaver Creek
Wellesley Lake
Apex Mtn
Mt. Pitts
Big Creek Batholith
Miller's Ridge
Carmacks
Yellow
Onion
Epic
Canalask
Pickhandle
Florence Ck placer Pt
Big Salmon
Swede Johnson
Airways
Wellgreen
Linda
Arch
Wash
Glen
Destruction
Kluane
Dickson
Congdon
Klu
4th of July Creek
Sato
Dunite Mountain
Haines Junction
Stride
Pyroxenite Creek Intrusion
Whitehorse
Michie
Squanga
TOG
Military (Phil)
Marsh
Lindsay
Carcross
Logtung
Watson Lake
Mansfield
ROBERT SERVICE FAULT
DAWSON THRUST
TINTINA FAULT
DENALI FAULT
TESLIN FAULT
1
2
3
4
5
6
7
8A
8B
9
10
11
12A
12B
13
14
15
A
B
C
65°
62°
61°
138°
136°
134°
132°
130°
128°

Yukon Platinum Occurrences & Potential

Craig J.R. Hart, Mike Burke and Gary Stronghill
Yukon Geology Program

This product is a derivative of Open File 2001-2
For more information visit www.geology.gov.yk.ca

Introduction

Interest in mineral occurrences containing platinum group elements (PGE - platinum, palladium, osmium, rhodium, ruthenium and iridium) has increased significantly as a result of recent dramatic price increases. PGE deposits, and even deposits with PGEs as a byproduct are not common in the northern Cordillera, with approximately 37 occurrences in Yukon reporting PGE mineralization or anomalous values. Approximately half of the known occurrences are developed in the Kluane belt in association with variably differentiated Late Triassic ultramafic sills, which intrude oceanic sedimentary and volcanic strata. The largest is the Wellgreen deposit, which has had limited production and current reserves approximating 669 150 t of 2.04% Ni, 1.42% Cu, 0.07% Co and 2.23 g/t Pd+Pt.

Kluane-type occurrences are typical in many respects to most PGE deposits worldwide in that they were formed by precipitation and gravitational accumulation of sulphide minerals in a fractionating mafic-ultramafic intrusion. These orthomagmatic sulphide occurrences probably provide the best geological targets for PGE deposits in the Yukon. There is, however, considerable evidence to suggest that other localities in the Yukon have similar potential, and unconventional styles of PGE mineralization deserve exploration consideration. Occurrences of placer PGE outside of the Kluane belt provide direct proof of other sources, whereas widespread exceptional regional geochemical results and unexplained gravity anomalies indicate further potential.

This open file provides compiled geological, geochemical and geophysical information that together identifies regions of PGE potential and highlights the possibility of unconventional PGE resources. Sources of information include Yukon Minfile (1997), the Yukon Digital Geology CD (Gordey and Makepeace, 1999) and the Bulletin on Kluane-type PGE occurrences of Hulbert (1997).

Interpretation of Regional Silt Geochemical Anomalies

The Geological Survey of Canada carried out regional silt geochemical surveys throughout Yukon, however they did not analyze the material for Platinum Group Elements. However, as elevated chromium, cobalt and nickel values are commonly coincident with orthomagmatic PGE occurrences, these elements can be used as pathfinders for PGE mineralization and may be useful in discerning favourable host rocks and prospective exploration targets. Additionally, Cu is typically associated with Ni in magmatic occurrences with sulphide mineralization, and coincident Cu-Ni anomalies are noted on the map.

Geochemical anomalies on the map that overlie rocks northeast of the Tintina Fault within the Selwyn Basin are considerably higher and more numerous than found elsewhere in the Yukon. This has the effect of reducing populations of anomalies found elsewhere, in particular in the region between the Tintina and Denali faults where numerous anomalous results occur but are below the 98th percentile cutoffs. Exploratonists attempting to display these anomalies should consider adjusting the percentile cut-offs in light of these dramatic regional variations. There are numerous intriguing anomalies in the region between the Tintina and Denali faults and explorationists are encouraged to search these anomalies out.
The following is an evaluation of the anomalous regions as defined by the anomaly clusters on the accompanying map.

1. Southern Ogilvie Mountains

An extremely high density of >99 percentile chromium-in-silt anomalies occur along the northwestern margin of the Selwyn Basin, that is south of the Dawson Thrust, approximately 60 km north of Dawson City. They trend from the Tintina Fault to north of Keno City. The anomalies have a strong spatial correlation with exposures of Cambro-Silurian subaqueous mafic volcanic flows and dykes considered to be equivalent with the Marmot Formation (see inset map). The high chromium values reflect high initial values in the volcanic rocks, but may also indicate the crystallization and accumulation of chromite within slowly cooling flows or intrusions. Several of the very high chromium values have coincident, anomalous nickel, copper or cobalt values, which increase the likelihood of a cumulate source.

2. West Hart River (south margin of Taiga Basin)

Several nickel anomalies with supporting cobalt and chromium anomalies form an east-trending belt that mimics the southern margin of the Taiga Basin (see inset map). This basin hosts Road River and Earn Group equivalent rocks of the Selwyn Basin, but is built upon the Mackenzie Platform. This strata hosts the Taiga stratabound Ni-Mo-PGE occurrence and associated showings (Butterworth and Caufield, 1998). Additionally, the Dawson Thrust may have associated mineralization.

3. Wernecke Mountains 1 (Nick Basin)

Numerous nickel anomalies, some with coincident copper, occur within a region underlain by a sub-basin of Road River and Earn Group Selwyn Basin strata. These rocks represent the Nick basin and host stratiform Ni-Zn-PGE mineralization (Hulbert et al., 1992).

4. Wernecke Mountains 2

Several high cobalt values occur in the upper Bonnett Plume River area of the Wernecke Mountains. The cobalt is probably associated with either occurrences of Wernecke Breccia, which typically have a Cu-Au-Co-U metallogenic association, or the Bear River dykes.

5. Craig

A dense assortment of nickel and chromium anomalies are co-spatial with the east-trending Dawson Fault near the Craig mineral occurrence. In this particular region, the fault hosts sheared and serpentinized ultramafic intrusions that may be equivalent to Cambro-Ordovician volcanic strata (Tempelman-Kluit, 1981).

6. Keno Hill

Sporadic occurrence of cobalt, with fewer copper and chromium anomalies occur along the northern margin of Selwyn Basin between 139° and 134° W latitude, largely between the Dawson and Robert Service thrusts. The anomalies are largely coincident with localities of the Triassic Keno Hill sills that intrude Keno Hill Quartzite. Notable exposures in the western part of the belt (near the Dempster Highway) are not anomalous, whereas sparse anomalies continue further east. These sills are recognized as being locally differentiated and may host cumulate zones and sulphide mineralization.

7. YT-NWT border

A dense cluster of nickel anomalies with associated copper are underlain by Earn Group unit DME2.

8. Macmillan Pass

Widespread, highly anomalous nickel with associated copper values and local cobalt occur throughout eastern Selwyn Basin from eastern Lansing, across Niddery Lake and into Nahanni map area. Underlying the anomalous regions are Paleozoic basinal clastic rocks of the Road River and Earn groups. Cambro-Silurian Marmot Formation submarine basalt flows occur locally within the stratigraphy.. However, unlike occurrences north of Dawson, these occurrences evidently do not have associated chromium anomalies, suggesting an alternative source for the anomalies. The sedimentary rocks are likely responsible for the anomalies. Locally, in clusters at 8A and 8B , there are coincident cobalt anomalies and a spatial association with the Triassic gabbro sills similar to the Keno Hill area. However, the sills cannot explain the more widespread anomalies, which are likely a function of extremely high background values, and stratiform Ni-Zn-PGE mineralization in the black shales of Road River and Earn Group. Notable occurrences of elevated Ni, Zn, V, Cu and Mo have been discovered with local accumulations of barite in the area.

9. Don Creek area

A 50-km-long belt of high nickel anomalies with coincident copper and supporting cobalt anomalies overlie a region underlain by Earn Group underlain by DME1. The Falcon occurrence of Zn and Ni with Ag, Cu and Mo soil samples supports the likely presence of stratiform Zn-Ni-PGE mineralization.

10. Upper Hyland River

A wide array of cobalt anomalous values underlie a large region near the NWT border west of Tungsten. Clastic rocks of the upper Proterozoic to lower Paleozoic Hyland group dominate the bedrock geology, with proximal Cretaceous intrusions and associated hornfels zones. The source of the anomalies is unknown but perhaps indicates the presence of unmapped basic igneous rocks. 10A . This northwest-trending region has a higher density of anomalies, with coincident nickel and copper anomalies, but similarly has no apparent geological explanation.

11. Simpson Ranges

Sporadic anomalies dominated by nickel occur within the region bounded by the Tintina and Frances Lake faults. The region is underlain by Yukon-Tanana Terrane and the anomalies are largely coincident with exposures of ultramafic rocks. The ultramafic rocks were previously considered to be part of obducted oceanic crust of Slide Mountain Terrane, but recent mapping and geochemistry has confirmed them to be intrusions into the sedimentary and volcanic Yukon-Tanana Terrane. Cluster 11A has a high density of nickel and chromium anomalies while 11B lacks significant chromium but has more copper.

12. North Pelly Mountains

Two clusters of nickel anomalies occur in association with ultramafic rocks that occur on the leading edge of Yukon-Tanana Terrane juxtaposed with Cassiar Terrane. A cluster of Ni anomalies north of Quiet Lake (12A) likely result from the underlying basalt and ultramafic rocks of the St. Cyr klippe that are attributed to Slide Mountain Terrane. The more northerly cluster is underlain by similar rocks of the Dunite klippe (12B).

13. Teslin Plateau

Clusters of nickel anomalies between Marsh Lake and the Teslin River overlie Cache Creek Terrane volcanic strata that are largely ophiolitic in origin. These rocks locally host chromite lenses and nickel-bearing silicates, which are characteristic of oceanic crustal rocks. The clusters of anomalies are proximal to ultramafic rocks with extremely high aeromagnetic anomalies. Cluster 13A appears to be associated with a large ultramafic body known to have cumulate textures and layering.

14. Kluane Ranges Belt

As expected nickel with coincident anomalies of other metals characterize this belt and are spatially associated with known mineralization and exposures of ultramafic sills.

15. Southern Kluane Ranges Belt

Southeast of Kluane Lake, the belt is defined by several chromite anomalies, which is unlike characteristics of the more northerly portion of the belt The significantly different geochemical character indicates either a dramatic change in the geochemistry of the Kluane ultramafic suite, or a different suite entirely. The proximal Pyroxenite Creek Alaskan-type intrusion and allied intrusions may be generating this geochemical signature.

Placer PGEs in Yukon

The occurrence of placer platinum in **Yukon River** was reported as early as 1887. Dawson (1887-88, Part R, p. 156) states that "platinum was found in association with bar gold placers on the Yukon River and on nearly all of the important tributaries that had been worked". Although platinum was reported to have been found, no production was recorded. Placer platinum has been reported a number of times from the **Teslin River**. A 1906 report (Anonymous, 1906) indicated that black sand obtained from the Teslin River and treated using gravity methods by the USGS contained recoverable platinum and osmiridium. The report indicated that the lower 15 miles of the river were staked and yielded gold and platinum. The assertions were contested by Holmes (1907), who indicated that thorough prospecting of the Teslin River gravels yielded little black sand, and assays indicated no trace of platinum group elements. Subsequently, the Yukon Territorial Assay office indicated that platinum occurs, but is extremely fine-grained (Sime pers. comm. to W.E. Cockfield, 1918). No production was recorded.

A small amount of placer platinum was recovered from **Ferguson Creek**, a tributary of the Kaskawulsh River during 1916 and 1917 (O'Neill and Gunning, 1934).

In addition to coarse-grained nuggety gold, **Burwash Creek** has associated platinum, native silver and native copper nuggets. The gold and platinum nuggets are smooth, well worn and usually flat. The coarsest platinum was about the size of duck shot, and grades of 0.0005 to 0.001 ounce per cubic yard of gravel were noted (Cockfield in O'Neill and Gunning, 1934). In addition to the creek gravels, platinum has been obtained from bench gravels on the right side of Burwash Creek. Similarly, placer platinum was reported by Cockfield on **Tetamagouche Creek** approximately a quarter mile above its mouth.

The only recent documentation of placer platinum in Yukon is contributed by Ballantyne and Harris (1991), who identified and described alluvial PGE grains from a heavy mineral concentrate from **Florence Creek,** northwest of Breaburn. "Remarkable quantities of black sand can be recovered and non-magnetic heavy fraction assays 32 opt Au and 70 ppm Pt" (Wonga in Ballantyne and Harris, 1991). The alluvium is predominantly northerly transported glaciofluvial outwash overlying morainal veneers that cover the region. Placer platinum has been reported from Barker Creek and nearby drainages, but confirmation is lacking.

In Alaska, placer platinum has been identified at **Woodchopper** and **Fourth of July** Creeks, and **Lucky Gulch** in drainages near the Charley and Seventy Mile rivers area (Mertie, 1942). Alaska also has recorded platinum production from **Lituya Bay** placers (100 km southwest of Haines), which are likely derived from the layered intrusion at Mount Fairweather (Cobb, 1973).

Gravity Anomalies

Positive gravity anomalies may indicate the presence of dense rock units such as mafic and ultramafic intrusions. Most of the southern Yukon has Bouger gravity values between -70 and -120 milligals (Geological Survey of Canada, 1992). Some regions are characterized by widespread high gravity (>-40 milligals) values such as the western Ogilvie Mountains (north of Dawson) and the Klondike Plateau between Dawson and Beaver Creek. These regions are likely underlain by shallow crust or hosts widespread occurrences of mid-crustal ultramafic rocks.
There are approximately a dozen discreet anomalies that are <100 km². Typically they have values of 10 to 40 milligals greater than surrounding background values. In southernmost Yukon an anomaly occurs in Cache Creek Terrane straddling the BC border (south of Mt. Bryde). The existing geology maps show no reason for its occurrence making the source of the anomaly uncertain. Ultramafic rocks known to occur north of the Alaska Highway do not yield a high gravity anomaly.
North-trending anomalies near the abandoned settlement of Big Salmon are in a region underlain by Late Paleozoic andesite, basalt and greenstone of the Semenoff Assemblage. Very little is known of these rocks and they are ascribed by Gordey and Makepeace (1999) to the Quesnel Terrane. They have very high magnetic susceptibilities.
The anomaly at Minto is underlain by Late Triassic Povoas Formation volcanic rocks of Stikine Terrane. There is however, an occurrence of young volcanic rocks on the west side of the river, which may have a shallow level intrusion that gives rise to the anomaly.
Large anomalies west and east of Tatlmain Lake are difficult to relate to the geology, which is dominated by Yukon-Tanana Terrane (YTT) metamorphic rocks and the Tatlmain batholith. Locally there are ultramafic rocks within Yukon-Tanana Terrane, but the anomalies are much larger than the local exposures of these rocks.
Much of the region between Dawson and Beaver Creek is underlain by a widespread positive gravity anomaly. The cause of this anomaly is uncertain, but it may reflect a region of thinned crust. Within this regional high, there are several discreet anomalies. The anomaly north of Wellesley Lake may be related to ultramafic oceanic rocks of the Windy-McKinley terrane. This sequence of rocks is poorly understood, but associated occurrences of serpentinized harzburgitic ophiolite within these rocks are known. However, none of the known occurrences have as significant a gravity anomaly. Hosted in YTT rocks near the Alaska border, anomalies in the Lower Ladue River area are co-spatial with very similar ultramafic rocks, but of the Slide Mountain Terrane. South of Dawson near the Reindeer Mountain, a similar anomaly also in YTT rocks, is without a geological foundation. The bedrock geology in the area of anomalies west of McQuesten near Ice Chest Mountain consists largely of felsic Cretaceous granite. Local occurrences of mafic, amphibolitic or ultramafic rocks are too small to account for the anomaly and may be more widespread than mapped.
The Western Ogilvie Mountains region contains the most significant gravity anomaly in Yukon, and the only one on the northeast side of the Tintina Fault. The anomalous region is >-60 milligals and is roughly parallel to the Tintina Fault. The region has a considerable amount of Paleozoic volcanic rocks in the stratigraphy, but regions with greater amounts to the east do not show the same anomaly. Within this high, there are regions with discreet anomalies to >-35 mg.

PGE Potential in Yukon: Concepts and Localities

Stratiform Ni-Zn-PGEs

The correlation of a large number of widespread nickel with coincident copper anomalies in east-central Yukon (Macmillan Pass region) is indicative of extensive regional enrichments in these metals. Locally, soil anomalies and mineralization are most commonly associated with Earn Group clastic sedimentary rocks, above its contact with the Road River Formation. However extensive anomalies also occur in drainages over the Road River Group. Mineralization associated with these rocks includes the Tiaga and Nick occurrences (described above) as well as the widespread distribution of barite occurrences.

The nature and mode of occurrence of sedex Ni-An-PGE occurrences is controversial (Hulbert et al., 1992; Goodfellow, 1996; Coveney and Chen, 1991) and their economic potential has not been demonstrated. However, the widespread and extremely high concentrations of anomalous metals in silt samples indicates a high potential for discovery of similar sedex deposits throughout the distribution of Selwyn Basin. It seems probable that the metals were accumulated by organic complexing and concentrated as a result of very low sediment deposition. Steady-state deposition was disrupted in the Upper Devonian by extensional faulting, which encouraged fluid migration and hydrothermal circulation. This also encouraged deposition of widespread barite deposits and associated biogenic blooms, which further promoted metal enrichment, giving a region of highly anomalous sedimentary rocks. Earn Group strata are also host to Zn-Pb sedex deposits (Abbott et al., 1986) targets.

Mafic Sills in North American stratigraphy

Orthomagmatic sulphide deposits with PGEs could be hosted in any of the four (or more) suites of mafic sills and dykes that occur within the miogeoclinal North American stratigraphy. 1) Middle Proterozoic (Hart River [1.38 Ga] and Bear River) intrusions occur north of the Dawson Fault; 2) unnamed Cambro-Ordovician sills intrude Hyland Group south of the Fault; 3) unnamed Middle and/or Late Paleozoic sills cut Road River on both sides of the Dawson Fault; and 4) Triassic Galena suite sills largely intrude below the Robert Service Thrust. All suites are remarkably similar despite their diverse ages (Abbott, 1995). Most sills are continuous (up to 40 km), quite thick (to 250 m), coarse to very coarse grained and dominated by clinopyroxene and plagioclase. Differentiation is apparent in all three suites with cumulates of (variably serpentinized) pyroxenite and opaques at the bases and gabbroic tops. The most pronounced differentiation occurs in those of Cambro-Ordovician age (Abbott, 1995). The Bear River dykes in the Wernecke area are age equivalent with the PGE-bearing Muskox intrusion at 1.27 Ga (Thorkelson, 2000)

Sills of Middle Triassic age (~232 Ma) occur mainly south of the Tombstone Thrust in Dawson and Larsen Creek map areas but are widespread in the footwall of the Tombstone Thrust further east in Nash Creek map area. The sills are up to 4 km long and 50 m thick and range from hornblende-augite diorite to pyroxene gabbro. Mafic sills of uncertain age have also been reported cutting Wernecke Supergroup in the Coal Creek Inlier (Thompson et al., 1992).

Marmot Formation

The rocks are dominated by vesicular and amygdaloidal basalt flows and breccias; some flows have cumulate augite megacrysts at their bases. Hypabyssal equivalents of the flows occur as dykes, which locally occur in swarms (i.e., south of the Deadman Pluton north of Dawson). Locally clinopyroxenite and gabbro intrusions are exposed in outcrop (Roots, 1988). Limited whole-rock geochemistry indicates that these rocks trend towards alkalic and tholeiitic composition, with high titanium values. These rocks are correlated with the Marmot Formation.

Alaskan-type Ultramafic Intrusions

Zoned intrusions with early or cumulate ultramafic phases in Cordilleran settings are known as Alaskan, or Ural-type intrusions and host PGE mineralization in adjacent British Columbia and Alaska. Most of these intrusive complexes are Early Jurassic or middle Cretaceous in age. Early Jurassic ultramafic intrusions with elevated PGE values occur at Joseph Creek and Butte Creek in Alaska's Eagle quadrangle; these are considered to be small bodies above Alaskan-type intrusions (Newberry, 1996). The best Yukon example is Pyroxene Mountain, but geochronological and geochemical constraints are not documented. Near Logtung, Jurassic? ultramafic and mafic rocks form a small composite stock with associated dyke swarm that vary in composition from pyroxenite, peridotite and serpentinite, through gabbro and diorite, to monzonite and syenite (Abbott, 1981). These rocks have characteristics similar to Alaskan-type intrusions. The area has a small cluster of nickel anomalies. The Big Creek Batholith near Mount Freegold is considerably larger than most Alaskan-type intrusions, but has a wide range of lithological phases that are slightly alkalic, including cumulate and layered mafic phases of pyroxenite.

Though common in BC and Alaska, the Yukon's only Cretaceous Alaskan complex is the **Pyroxenite Creek** ultramafic complex near Haines Junction, which is a 6.5 x 2.5 km composed of phases of augite-magnetite, olivine, and hornblende pyroxenite with a gabbro-diorite margin (Sturrock et al., 1980). Although mineralization has not been documented, there are proximal Ni, Co and Cr silt anomalies, and the nearby Stride occurrence (115A 037) is likely related to a coeval intrusion.

Alkalic Porphyries

PGEs are known to be associated with alkalic Au-Cu porphyry occurrences in British Columbia, in particular, those that are alkalic in geochemistry and Early Jurassic in age are most likely to have elevated PGE values.. Furthermore, these bodies are preferentially located in Stikinia and Quesnellia, Yukon examples of Early Jurassic alkalic intrusions with known Au-Cu porphyry-style mineralization include the Teslin Crossing pluton (Hart 1995) and potentially other members of the Mt. Bryde suite. Some of these alkalic intrusions have pyroxenitic margins and inclusions. Potentially, the enigmatic Minto and Williams Creek Cu occurrences, which are hosted in Early Jurassic intrusions, may also be PGE enriched? The similarities in age, geochemical affiliation, and tectonic setting between Au-Cu alkalic porphyries and Alaskan-type PGE-hosting ultramafic intrusions, suggest that there may be a continuum them.

Alkalic intrusions with known porphyry-style mineralization, but of Cretaceous age, would include the Carmacks intrusions. Also known as the Prospector Mountain suite, these variably alkalic stocks and laccoliths are coeval and cogenetic with Carmacks Group volcanic rocks and locally host or are associated with porphyry copper mineralization (Casino, Cash, Sato) in the Dawson Range. Intrusions at Mount Pitts, Prospector Mountain, Victoria Mountain, Seymour Creek may be considered prospective targets.

The flows themselves, which have very high MgO values, may also be prospective as there are numerous Ni anomalies between 40 and 150 ppm coming from drainages over thick accumulations of Carmacks Group flows in the Dawson Range near Apex Mountain, Miller Ridge and Mt. Pitts. Some of the associated intrusions are dominantly mafic and intriguing, but difficult to identify where intruding mafic volcanic rocks. Aeromagnetic anomalies may help in their identification.

Ophiolitic Sequences/Alpine-type Ultramafic Rocks

Alpine-type ultramafic rocks are most commonly part of obducted oceanic crust and are apparent in Cache Creek, Slide Mountain, Yukon-Tanana, and Windy-McKinley terranes. Those in Cache Creek Terrane are known to have associated chromite lenses; these have the best chance to host associated PGE mineralization. PGE mineralization associated with ophiolites are typically enriched in Cr and poorer in Pt and Pd. PGE mineralization in Cache Creek Terrane rocks may account for reports of Teslin River placer platinum, and placers in Ruby Creek near Atlin, and Thibert Creeks near Dease Lake.
Ultramafic rocks in Cache Creek Terrane, however, are not all Alpine-type as ultramafic rocks with intrusive contacts, coarse-grain size, cumulate phases and magmatic layering have been noted. These rocks may represent an under-recognized lithology with PGE potential more akin to Alaskan-type deposits. Larger ultramafic bodies with PGE potential occur in the Jubilee Mountain, Mitchie Creek and Squanga Lake areas.

Kluane Belt

Kluane ultramafic intrusions preferentially occur as sills along the mechanical competency contrast at the contact between the Hasen Creek and Station Creek formations. This provides a prospective prospecting target. Although thicker sills may preferentially generate larger deposits, the original sill geometries have been disrupted by deformation and original thicknesses may not be represented. Additionally, economic grades have been derived from sills that are only 150 m thick. The best mineralization is concentrated as a result of riffling of sulphide minerals along irregularities at the base of the intrusion. Locally, aeromagnetic anomalies in the belt are without co-spatial ultramafic exposures, mineral occurrences or geochemical anomalies, and thus they likely represent blind targets.

Craig

Serpentinized and quartz-carbonate-altered ultramafic rocks with basic volcanics are exposed in a series of fault-bounded lenses, each 1-2 km long, within the near-vertical, 3-4 km wide, Dawson Fault zone. The rocks are speculatively assigned to the early Paleozoic Marmot Formation (Tempelman-Kluit, 1981). Asbestos and magnetite were noted. The nickel and chromium anomalies associated with this area indicate that these ultramafic rocks warrant evaluation. The proximal Craig occurrence is a Ag-Pb-Zn vein target.

Florence Creek

Placer platinum at Florence Creek is underlain by innocuous Early Jurassic granodiorite of the Aishihik Batholith, but two proximal rock types may be prospective. Long Lake suite quartz monzonite locally has an alkalic geochemistry and may have marginal mafic or ultramafic phases akin to Alaskan-type ultramafic intrusions, such as the coeval Pyroxene Mountain intrusion and other Early Jurassic intrusions in Alaska and BC. More probable, however, is the likelihood of magmatic sulphides and PGEs being derived from cumulate phases in Lewes River Group mafic "volcanics". Clasts in outwash gravels are particularly rich in coarse-grained clinopyroxenite, typical of root zones within the volcanic arc. Proximal high magnetic anomalies occur in regions underlain by granodiorite. Inclusions of bornite-dignite inclusions in PGE placer grains suggest that copper may be a good pathfinder element.

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