W SKARNS K05

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Modified for Yukon by A. Fonseca
Refer to preface for general references and formatting significance.
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IDENTIFICATION

SYNONYMS: Pyrometasomatic or contact metasomatic tungsten deposits.

COMMODITIES (*BYPRODUCTS*): W (*Mo, Cu, Sn, Zn*).

EXAMPLES: **(Yukon): Bailey (105A 017), Stormy (105F 011), Risby (105F 034), Mactung (105O 002), Ray Gulch (106D 027)**;
(British Columbia - *Canada/International*): Emerald Tungsten (082FSW010), Dodger (082FSW011), Feeney (082FSW247), Invincible (082FSW218), Dimac (082M123); *Fostung (Ontario, Canada), Cantung (Northwest Territories, Canada), Pine Creek and Strawberry (California, USA), Osgood Range (Nevada, USA), King Island (Tasmania, Australia), Sang Dong (South Korea).*

GEOLOGICAL CHARACTERISTICS

CAPSULE DESCRIPTION: Scheelite-dominant mineralization genetically associated with a skarn gangue.

TECTONIC SETTING: Continental margin, synorogenic plutonism intruding deeply buried sequences of eugeoclinal carbonate-shale sedimentary rocks. Can develop in tectonically thickened packages in back-arc thrust settings.

GEOLOGICAL SETTING: MacTung and CanTung in Yukon and NWT, the two largest tungsten deposits in the Northern Cordillera, are hosted by rocks of the Selwyn Basin, near the edge of the Mackenzie Platform.

AGE OF MINERALIZATION: Mainly Mesozoic, but may be any age. Over 70% of the W skarns in British Columbia are related to Cretaceous intrusions. **In Yukon, most tungsten occurrences are related to Cretaceous intrusions. Two tungsten anomalies in northern Yukon are associated with Devonian intrusive rocks, and may be related to tungsten skarns.**

HOST/ASSOCIATED ROCK TYPES: Pure and impure limestones, calcareous to carbonaceous pelites. Associated with tonalite, granodiorite, quartz monzonite and granite of both I and S-types. W skarn-related granitoids, compared to Cu skarn-related plutonic rocks, tend to be more differentiated, more contaminated with sedimentary material, and have crystallized at a deeper structural level. **Silty-banded limestone of Upper Proterozoic to Early Cambrian Yusezyu Formation and Cambro-Ordovician Rabbitkettle Formation host the most significant tungsten skarn deposits in Yukon.**

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DEPOSIT FORM: Stratiform, tabular and lens-like ore bodies. Deposits can be continuous for hundreds of metres and follow intrusive contacts.

TEXTURES: Igneous textures in endoskarn. Coarse-to fine-grained, massive granoblastic to mineralogically layered textures in exoskarn. Biotite hornfelsic textures common.

ORE MINERALOGY (Principal and *subordinate*): Scheelite ± molybdenite ± chalcopyrite ± pyrrhotite ± sphalerite ± arsenopyrite ± pyrite ± powellite. May contain *trace wolframite, fluorite, cassiterite, galena, marcasite and bornite.* Reduced types are characterized by pyrrhotite, magnetite, bismuthinite, native bismuth and high pyrrhotite:pyrite ratios. Variable amounts of quartz-vein stockwork (with local molybdenite) can cut both the exo- and endoskarn. The Emerald Tungsten skarns in British Columbia include pyrrhotite-arsenopyrite veins and pods that carry up to 4 g/t Au.

ALTERATION MINERALOGY: Exoskarn alteration: Inner zone of diopside-hedenbergite (Hd_{60-90}, Jo_{5-20}) ± grossular-andradite (Ad_{10-50}, $Spess_{5-50}$) ± biotite ± vesuvianite, with outer barren wollastonite-bearing zone. An innermost zone of massive quartz may be present. Late-stage spessartine ± almandine ± biotite ± amphibole ± plagioclase ± phlogopite ± epidote ± fluorite ± sphene. Reduced types are characterized by hedenbergitic pyroxene, Fe-rich biotite, fluorite, vesuvianite, scapolite and low garnet:pyroxene ratios, whereas oxidized types are characterized by salitic pyroxene, epidote and andraditic garnet and high garnet:pyroxene ratios. Exoskarn envelope can be associated with extensive areas of biotite hornfels. Endoskarn alteration: Pyroxene ± garnet ± biotite ± epidote ± amphibole ± muscovite ± plagioclase ± pyrite ± pyrrhotite ± trace tourmaline and scapolite; local greisen developed.

ORE CONTROLS: Carbonate rocks in extensive thermal aureoles of intrusions; gently inclined bedding and intrusive contacts; structural and/or stratigraphic traps in sedimentary rocks, and irregular parts of the pluton/country rock contacts.

ASSOCIATED DEPOSIT TYPES: Sn (K06), Mo (K07) and Pb-Zn (K02) skarns. Wollastonite-rich industrial mineral skarns (K09).

COMMENTS: W skarns are separable into two types (Newberry, 1982): reduced skarns (e.g. Cantung, Mactung), formed in carbonaceous rocks and/or at greater depths, and oxidized skarns (e.g. King Island), formed in hematitic or non-carbonaceous rocks, and/or at shallower depths. Late retrograde alteration is an important factor in many W skarns because, during retrogression, the early low-grade mineralization is often scavenged and redeposited into economic high-grade ore zones (e.g. Bateman, 1945; Dick, 1976, 1980). Dolomitic rocks tend to inhibit the development of W skarns; consequently magnesian W skarns are uncommon. In British Columbia they are preferentially associated with Cretaceous intrusions and hosted by calcareous, Cambrian age cratonic, pericratonic and displaced continental margin rocks in the Cassiar, Kootenay-Barkerville, Dorsay and Ancestral North American terranes. **In Yukon and Northwest Territories, tungsten skarn deposits are preferentially associated with Cambro-Ordovician Rabbitkettle Formation silty limestone intruded by mid-Cretaceous granitic rocks.**

EXPLORATION GUIDES

GEOCHEMICAL SIGNATURE: W, Cu, Mo, As, Bi and B. Less commonly Zn, Pb, Sn, Be and F geochemical anomalies.

ECONOMIC FACTORS

GRADE AND TONNAGE: Grades range between 0.4 and 2 % WO_3 (typically 0.7 %). Deposits vary from 0.1 to >30 Mt. **The MacTung deposit in Yukon contains reserves of 25.3 million tonnes grading 0.88% WO_3.**

IMPORTANCE: Skarn deposits have accounted for nearly 60 % of the western world's production, and over 80 % of British Columbia's production.

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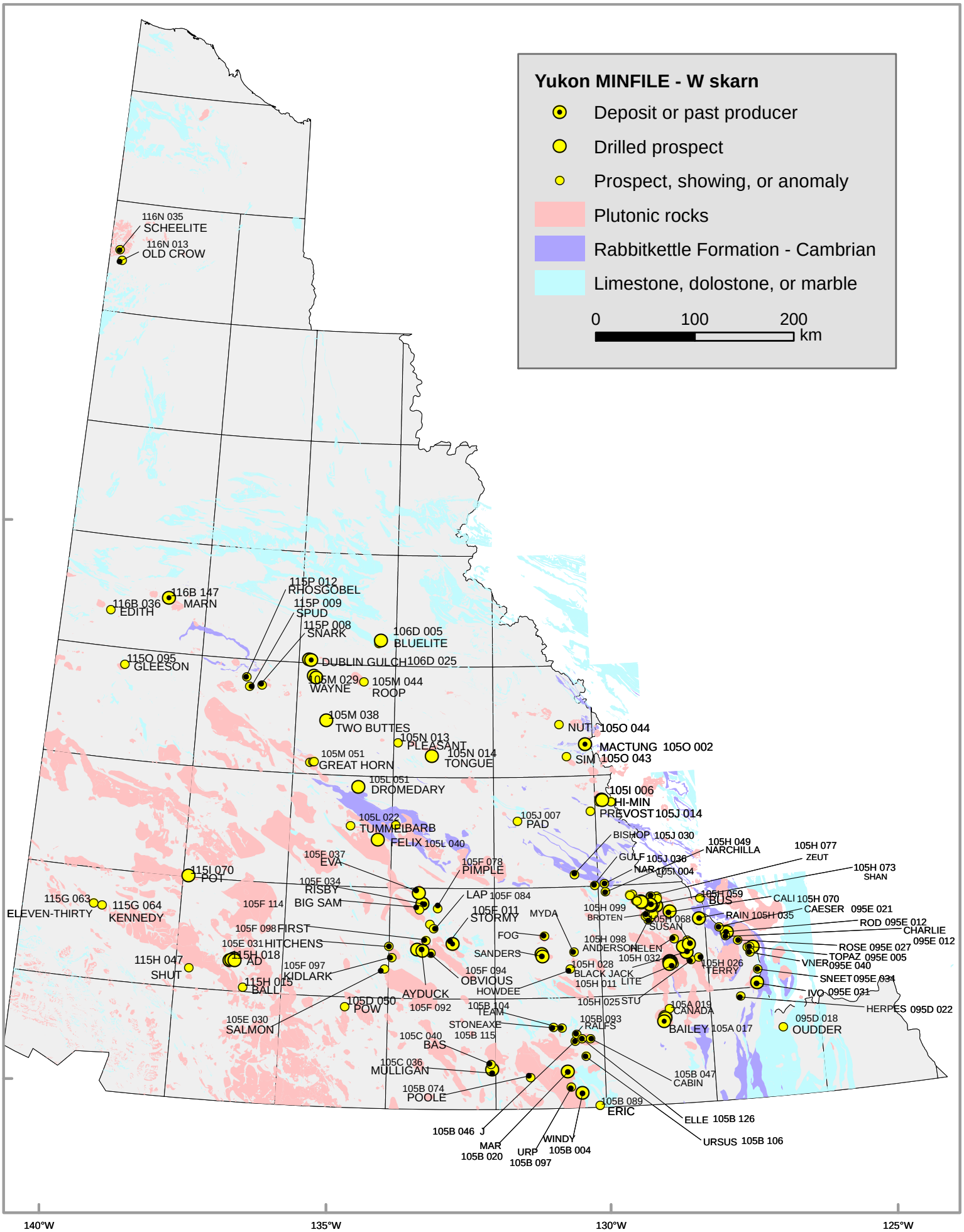
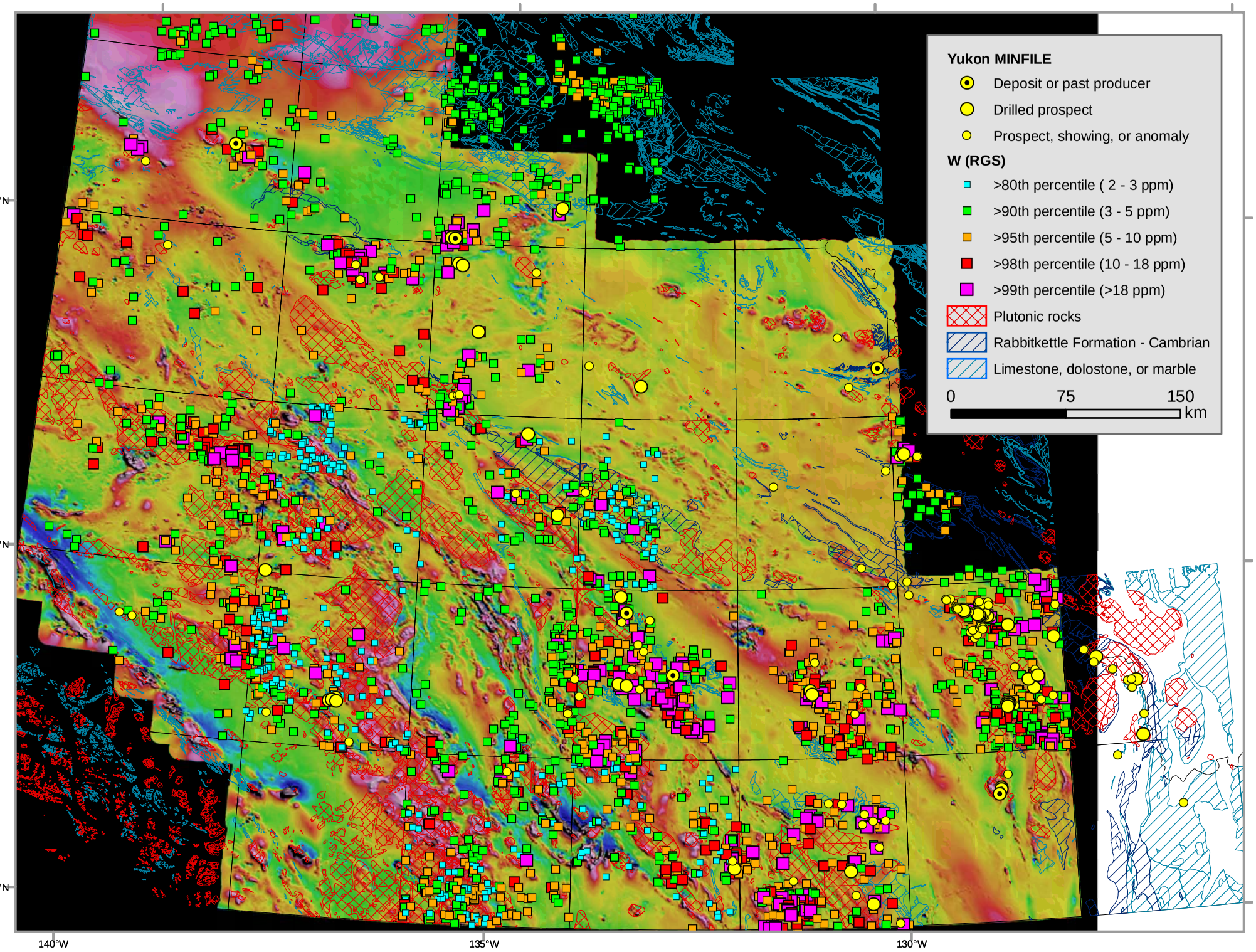
Deposit	Country	tonnes	WO_3
Clea	CNYT	100 000	1.50
Baker	CNNT	120 000	1.40
Bailey	CNYT	405 455	1.00
Lened	CNNT	1 000 000	1.20
Salmo District	CNBC	1 500 000	0.50
Risby	CNYT	2 700 000	0.81
Ray Gulch	CNYT	5 440 000	0.82
Cantung	CNNT	9 000 000	1.42
Fostung	CNON	16 200 000	0.23
Mac Tung	CNYT	63 000 000	0.96

Yukon MINFILE

MINFILE	NAMES	STATUS
105A 017	BAILEY, PAT	DEPOSIT
105F 011	STORMY	DEPOSIT
105F 034	RISBY	DEPOSIT
105O 002	MACTUNG	DEPOSIT
106D 027	GARNET, RAY GULCH	DEPOSIT
095E 005	ISO, BLUE, KOKO, OLLIE, CAR, JEFF, HAT, LABELLE	DRILLED PROSPECT
095E 031	IVO	DRILLED PROSPECT
105B 004	FIDDLER, BACH, TUNGSTEN, LUM, HOPE, LUCK	DRILLED PROSPECT
105B 020	BLUE HEAVEN, NIGHT, NITE	DRILLED PROSPECT
105C 036	MULLIGAN	DRILLED PROSPECT
105F 037	EVA	DRILLED PROSPECT
105F 092	AYDUCK	DRILLED PROSPECT
105G 019	BOOT	DRILLED PROSPECT
105G 104	SANDERS	DRILLED PROSPECT
105H 042	TANYA	DRILLED PROSPECT
105H 068	SUSAN	DRILLED PROSPECT
105H 070	CALI	DRILLED PROSPECT
105H 072	WOAH	DRILLED PROSPECT
105H 073	TAI	DRILLED PROSPECT
105I 006	CLEA, HI-MIN, OMO	DRILLED PROSPECT
105J 007	DRAGON, PAD	DRILLED PROSPECT
105L 040	FELIX	DRILLED PROSPECT
105L 051	DROMEDARY	DRILLED PROSPECT
105M 038	TWO BUTTES	DRILLED PROSPECT
105M 060	NEWRY, AUREX	DRILLED PROSPECT
105N 014	TONGUE	DRILLED PROSPECT
106D 084	BLUELITE	DRILLED PROSPECT
115P 012	RHOSGOBEL	DRILLED PROSPECT
095E 027	DOOSHKA, ROSE	PROSPECT
095E 032	UPPER COAL, CHARLIE	PROSPECT
095E 036	ROYALL, CREAM	PROSPECT
105B 115	STONEAXE	PROSPECT
105F 033	HAM	PROSPECT
105F 114	BIG SAM	PROSPECT
105G 071	MYDA	PROSPECT
105H 026	TERRY	PROSPECT
105H 049	NARCHILLA	PROSPECT
105H 059	BUS	PROSPECT
105J 014	PREVOST	PROSPECT
105M 040	GREAT HORN	PROSPECT
105M 051	FRIESEN	PROSPECT
115P 009	LUGDUSH, SPUD	PROSPECT
095E 021	CAESER	SHOWING
095E 039	KOMISH, TOPAZ, BING	SHOWING
105A 019	CANADA	SHOWING
105B 046	TUNG, ON, J	SHOWING
105B 089	TOOTSEE, HOT, ERIC, CARL	SHOWING
105B 097	URP	SHOWING
105B 104	TEAM	SHOWING
105B 106	URSUS	SHOWING
105B 126	ELECTRICITY, ELLE	SHOWING
105E 030	SALMON	SHOWING
105E 031	HITCHENS	SHOWING
105F 078	PIMPLE	SHOWING
105F 084	LAP	SHOWING
105F 094	OBVIOUS	SHOWING
105F 097	KIDLARK	SHOWING
105F 098	FIRST	SHOWING
105G 097	FOG	SHOWING
105G 102	HOWDEE	SHOWING
105H 025	STU	SHOWING
105H 041	BR	SHOWING
105H 043	GUY	SHOWING
105H 051	YUSEZYU	SHOWING
105H 055	ZEUS	SHOWING
105H 056	CARBIDE, AURORA	SHOWING
105H 077	ZEUT	SHOWING
105H 084	CHAP	SHOWING
105H 086	CERRO	SHOWING
105H 088	BILLINGS	SHOWING
105H 090	WE	SHOWING
105H 098	ANDERSON	SHOWING
105H 099	BROTEN	SHOWING
105H 100	MINI	SHOWING
105I 064	ROOK	SHOWING
105J 036	GULF	SHOWING
105K 111	UNION, STONE, BARB	SHOWING
105L 022	TUMMEL	SHOWING
105M 044	ROOP	SHOWING
105N 013	PLEASANT	SHOWING
105O 043	SIM	SHOWING
105O 044	NUT	SHOWING
106D 005	FLAT RIDGE	SHOWING
115G 063	ELEVEN-THIRTY	SHOWING
115G 064	KENNEDY	SHOWING
095E 034	SNEET, SNOT	ANOMALY
095E 040	VNER	ANOMALY
105B 047	CABIN, ELLE	ANOMALY
105I 059	PHEASCO	ANOMALY
115O 095	GLEESON	ANOMALY
095D 018	OUDDER	UNKNOWN
095D 022	HERPES	UNKNOWN
105B 093	RALFS, CABIN	UNKNOWN
105H 030	MONTSE	UNKNOWN
105H 032	HELEN	UNKNOWN



Map of Yukon showing W-skarn occurrences and the distribution of plutonic rocks, carbonate rocks and the Rabbitkettle Formation



Map of Yukon showing W skarn occurrences, W geochemistry, regional magnetics and the distribution of plutonic rocks, carbonate rocks and the Rabbitkettle Formation