

Summary

Exploration Targets:

- ✍ Uranium occurs with IOCG-type mineralization in Proterozoic Wernecke Breccia.
- ✍ There is potential for unconformity-style uranium deposits where Jura-Cretaceous clastic strata overlie older black shales on the North American Platform.
- ✍ Potential for uranium deposits exists in Cretaceous plutonic rocks, Mississippian and Proterozoic syenites, and early Tertiary felsic intrusive rocks, especially where these units are intersected by major faults.
- ✍ Potential exists for low-grade, bulk-tonnage uranium deposits in the Tombstone Suite. Uranium minerals (up to 2% U_3O_8) are disseminated and occur in veins in these intrusive rocks.

Exploration Tips:

- ✍ Regional geochemical stream sediment surveys highlight anomalous uranium in Proterozoic Wernecke Breccia, Paleozoic black shales, and early Tertiary and Mesozoic felsic intrusive rocks.
- ✍ Uranium is associated with metal-enriched Paleozoic shales of the Selwyn Basin.
- ✍ Pathfinder elements for uranium vary depending on deposit type. High thorium, fluorine and REE concentrations are indicators of uranium enrichment. Base metals are associated with specific uranium deposits, e.g., molybdenum are associated with intrusion-hosted deposits.

Further Reading

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- Nash, J.T., 1978.** Special issue devoted to the geology and geochemistry of uranium. Economic Geology, vol. 73, no.8, p.1401-1792.
- Olade, M.A. and Goodfellow, W.D., 1978.** Litho-geochemistry and hydrogeochemistry of uranium and associated elements in the Tombstone Batholith, Yukon, Canada. Geological Survey of Canada, Paper 78-1A, p. 407-428.
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- Sibbald, T.I.I. and Petruk, W., 1985.** Geology of uranium deposits. Canadian Institute of Mining and Metallurgy, Special Volume 32.

For more information, check the Yukon Geological Survey website:

www.geology.gov.yk.ca



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URANIUM



Yukon Uranium Potential

YGS Brochure 2006-5



- ▶ Models for uranium exploration in Yukon include unconformity-associated, vein/intrusive-type and IOCG (iron-oxide-copper-gold) + uranium.
- ▶ Uranium is associated with Proterozoic Wernecke Breccia, Paleozoic black shales and fractionated felsic intrusive rocks.

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Exploration Models

Uranium deposit models in Yukon include 1) unconformity-associated, 2) intrusion-related, and 3) IOCG (iron-oxide-copper-gold) ± U. Uranium enrichments are associated with faults, reducing environments and structural traps.



Unconformity-associated model

- Uranium occurs within sedimentary rocks near major unconformities.
- Saline, oxidized, uranium-rich basinal brines precipitate uranium in reducing environments (e.g., carbonaceous strata).
- Associated elements: Au, Ni, Co, Cu, Pb, As, V, Se, Mo, Zn, and platinum group elements (PGEs).
- Associated minerals: quartz, sericite/illite, chlorite, tourmaline and carbonate minerals.
- Alteration minerals: chlorite, hematite, kaolinite, illite and quartz.
- Examples: McArthur River, Sask. (436.5 million pounds U₃O₈, average grade 24.7%); Rabbit Lake, Sask. (12.5 million pounds U₃O₈, average grade 1.3%).
- Favourable targets are in the Wernecke Supergroup, and the Richardson Trough where Paleozoic black shales are unconformably overlain by younger sedimentary strata.

Iron-Oxide-Copper-Gold (IOCG) + uranium model

- Uranium ± Cu ± Au ± Co occurs in, and near, hematite and/or magnetite breccia zones hosted by sedimentary, intrusive and/or volcanic rocks adjacent to regional-scale fault systems in extensional environments.
- Associated elements: Cu, Co, Au, Ag, La, Ce, F and Ba.
- Associated minerals: quartz, feldspar, sericite, fluorite, barite and carbonate minerals.
- Alteration minerals: hematite, sericite, albite and scapolite (sodic) and/or K-feldspar & biotite (potassic) and/or carbonate minerals.
- Example: Olympic Dam, Australia (2320 Mt, average grade 0.4 kg/t U₃O₈, 1.3% Cu, 0.5 g/t Au, 2.9 g/t Ag).
- Favourable targets are Wernecke Breccias that have intruded Paleoproterozoic Wernecke Supergroup rocks, primarily in the Wernecke and Ogilvie Mountains.

Intrusion-related model

- Uranium is disseminated and/or occurs in veins in association with felsic intrusive rocks.
- Carbonate ± quartz veins cutting host rocks are structurally controlled.
- Associated elements: Ag, Ni, Co, Pb, Zn, Au, PGEs, Bi, As, Se, Ba, Cu, Mo, F and V.
- Alteration minerals: chlorite, hematite and feldspars.
- Example: Ace-Fay-Verna, Sask. (9 Mt, of 0.21% U).
- Favourable targets are fractionated or alkalic Mesozoic and Cenozoic intrusive rocks, e.g., Tombstone, Cassiar, Selwyn and Nisling Range suites.



Brannerite in Wernecke Breccia

Unconformity-associated

1 - Richardson Trough

Unconformity-related uranium (and phosphate mineralization?) occurs in permeable zones above and below an unconformity separating Cambrian-Devonian Road River Group shale, chert, quartzite and carbonate rocks from younger sedimentary strata, e.g., *Bizard* (Yukon MINFILE 117A 002).

2 - North American Platform

Potential for Paleozoic unconformity-style uranium occurs where Cretaceous clastic rocks unconformably overlie Devonian to Permian Imperial and Ford Lake Group shales.

3 - Wernecke Mountains

Potential for unconformity-style uranium occurs in the Wernecke Mountains at, or below the unconformable contact between deformed Wernecke Supergroup rocks and overlying Pinguicula Group clastic rocks.

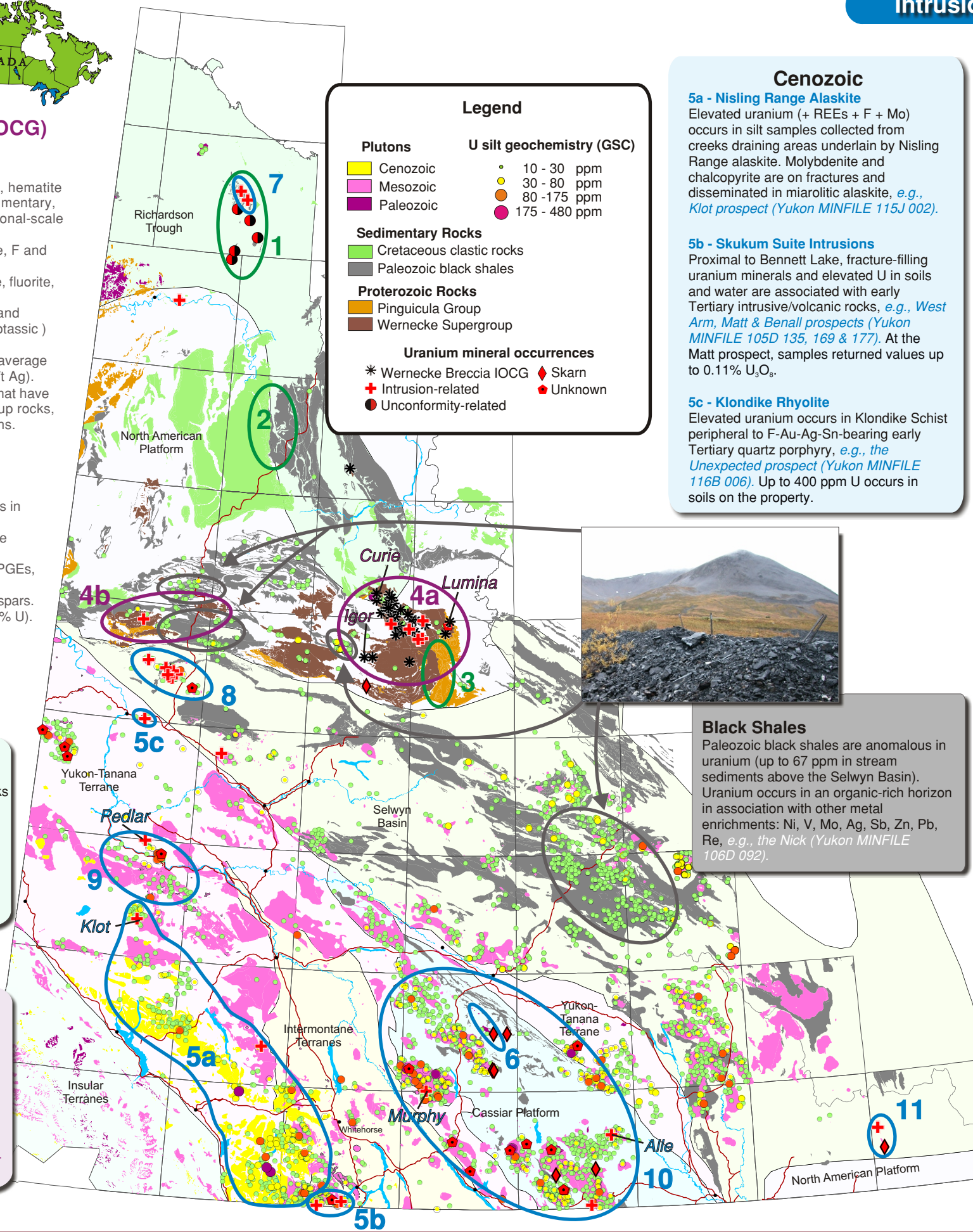
IOCG + Uranium

4a - Wernecke Mountains

Uranium occurs in veinlets, on fractures and disseminated with iron-oxide, copper and gold minerals in Proterozoic Wernecke Breccia. At the *Igor prospect* (Yukon MINFILE 106E 009), pitchblende occurs in fractures/joints, and uranium is disseminated in the matrix and in chalcocyanite-rich massive magnetite. Drilling results include 10.6 m of 0.089% U₃O₈. At the *Lumina property* (*Pierd* - 106C 069) pitchblende occurs in fractures; samples have assayed up to 7.67% U₃O₈. At the *Curie property* (*Darney* - 106E 031) float samples stained with carnotite(?) assayed up to 54.3% U₃O₈.

4b - Ogilvie Mountains

Wernecke Breccia in the Ogilvie Mountains have the potential to host uranium (e.g., *Yukon Olympic property* - 116G 082)



Black Shales
Paleozoic black shales are anomalous in uranium (up to 67 ppm in stream sediments above the Selwyn Basin). Uranium occurs in an organic-rich horizon in association with other metal enrichments: Ni, V, Mo, Ag, Sb, Zn, Pb, Re, e.g., the *Nick* (Yukon MINFILE 106D 092).



Intrusion-related

Cenozoic

5a - Nisling Range Alaskite

Elevated uranium (+ REEs + F + Mo) occurs in silt samples collected from creeks draining areas underlain by Nisling Range alaskite. Molybdenite and chalcocyanite are on fractures and disseminated in miarolitic alaskite, e.g., *Klot prospect* (Yukon MINFILE 115J 002).

5b - Skukum Suite Intrusions

Proximal to Bennett Lake, fracture-filling uranium minerals and elevated U in soils and water are associated with early Tertiary intrusive/volcanic rocks, e.g., *West Arm, Matt & Benall prospects* (Yukon MINFILE 105D 135, 169 & 177). At the *Matt prospect*, samples returned values up to 0.11% U₃O₈.

5c - Klondike Rhyolite

Elevated uranium occurs in Klondike Schist peripheral to F-Au-Ag-Sn-bearing early Tertiary quartz porphyry, e.g., the *Unexpected prospect* (Yukon MINFILE 116B 006). Up to 400 ppm U occurs in soils on the property.

Mesozoic

8 - Tombstone Suite

Uranium (up to 2% U₃O₈) occurs in veins and is disseminated in tinguaita, the earliest phase of the mid-Cretaceous alkaline Tombstone Plutonic Suite. The uranium is associated with fluorite, molybdenite, galena and sphalerite, e.g., *Sumting, Ting, Tombstone and Teta prospects* (Yukon MINFILE 116B 107, 109, 151 & 152). The tinguaita is a large, low-grade, uranium resource, with potential for bulk tonnage deposits.

9 - Dawson Range Suite

Uraninite-magnetite veinlets and elevated levels of uranium in soil and water occur over high-level felsic intrusive rocks of the Dawson Range Suite, e.g., *Pedlar (Hasl) prospect* (Yukon MINFILE 115J 092). Samples of water, stream sediment & soil samples returned values of up to 304 ppb, 1853 ppm & 4790 ppm U, respectively.

10 - Cassiar Suite

Elevated levels of U (+ Ag + F + V + W) occur in silt samples collected from creeks draining areas underlain by Cassiar suite intrusive rocks. Uranium (+ Mo + W ± Cu ± Pb) occurs in granitic rocks, and associated skarn zones contain elevated levels of U (+ Mo + Cu ± W). Samples at the *Alle (Electricity) prospect* (Yukon MINFILE 105B 126) returned up to 2.1% U₃O₈. Granitic samples at the *Murphy prospect* (105F 079) returned up to 0.23% U₃O₈. Uranium occurs on fractures in granite at the *Lampert, Englishman & Canoxy prospects* (105C 031, 035 & 105F 100).

11 - Pool Creek Suite

In southeast Yukon, uranium + REEs occur in pods in Cretaceous syenite and in skarn peripheral to the syenite, e.g., *Dunn* (Yukon MINFILE 095C 051). Uranium (+ Pb + Ag + Zn + Mo) also occurs in veins in brecciated sedimentary rocks at the syenite contact, e.g., *Ginn* (095C 053).

Paleozoic

6 - Mississippian Syenite

Elevated levels of U and REE occur in veins cutting Mississippian trachyte and tuff, and in skarn zones peripheral to Mississippian syenite, e.g., *Guano & Nokluit* (Yukon MINFILE 105F 080 & 081).

7 - North Yukon

Intrusion-related U, Mo, W and Au are associated with Devonian biotite granite that intruded Road River Group shale, e.g., *Fitton* (Yukon MINFILE 117A 020) & *Hoidahl* (117A 021). Fluorite-rich Devonian syenite contains radioactive zones, and soil samples returned up to 95 ppm U at the *Carswell prospect* (116O 057).