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Comparison of Uranium Occurrences
on the Deadman and Tombstone
Properties, Yukon Territory

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INTRODUCTION

The Chevron Canada Ltd. Deadman property and Ukon Joint Venture Tombstone property cover uranium mineralization associated with Cretaceous alkalai igneous complexes. These zoned intrusions, informally referred to as the Deadman Stock and Tombstone Batholith, are located 53 km north and 52 km northeast of Dawson City, respectively. The best mineralization is related to an unusual peralkaline rock, referred to as tinguaitite.

PREVIOUS WORK

The Deadman property, staked in 1975, was explored by geological mapping and hand trenching in 1976 and further geological mapping and 226 m of diamond drilling (6 holes) in 1977. The work is summarized in the 1977 "Geological Report on the Rackla Project U435" by G. Walton. D. Eaton visited the property briefly in 1976 and again in 1980. The Tombstone property was staked in 1976 and explored by geological mapping and hand trenching in 1977 and 1978 and 1774 m of diamond drilling (17 holes) in 1979. This work is compiled in the 1979 "Ukon Joint Venture Final Report" by A.R. Archer and D. Eaton. Eaton is currently working on an M.Sc. thesis at the University of British Columbia, concerned with petrological and structural controls of mineralization on Tombstone property.

GEOLOGICAL SETTING

Both properties lie above treeline and exhibit mountainous terrane which has been deeply incised by Pliocene to recent alpine glaciation, characterized by broad U-shaped valleys with cirques at their heads. Elevations typically range from 1200 m on the valley floor to 2100 m on the peaks. Most hillsides are obscured by talus and the valley bottoms are largely blanketed by glacial debris.

The Deadman Stock intrudes a thick section of Hadrynian and/or Cambrian clastics and volcanics, whereas the Tombstone Batholith cuts late Paleozoic to Mesozoic clastics and carbonates. The intrusive-wallrock contacts are sharp and hornfels and skarns are commonly developed peripheral to the intrusions. Sedimentary and volcanic rafts and xenoliths are abundant within the intrusions and many have been recrystallized and partially assimilated.

The Deadman Stock and Tombstone Batholith are both crudely zoned with syenites and peralkaline microsyenites, known as tinguaites, on the margins and monzonites and quartz monzonites in the core. In general, the rocks are coarse grained and lack prominent textures, aside from vertical orientations of tabular crystals; however, the tinguaites exhibit a wide range of grain sizes and textures. Early mapping suggested that the tinguaites were a late stage differentiate but detail mapping and petrographic studies have shown that these rocks were the first intrusive phase and were formed when fluids enriched in H₂O, potassium and uranium collected near the top of the magma chamber. Thus, many tinguaites which were initially mapped as dykes or pipes have been reinterpreted as xenoliths. Four main types of tinguaites are recognized on the Tombstone

property: 1) pseudoleucite tinguaites; 2) sheared tinguaites; 3) aphanitic tinguaites; and, 4) coarse grained tinguaites. Although all exhibit similar mineralogy, each has a distinctive texture which reflects upon its genesis.

Pseudoleucite tinguaites contains 5 to 30%, 3 to 20 mm, white, subhedral to euhedral pseudoleucite phenocrysts and 1 to 5%, 1 to 10 mm, white, euhedral orthoclase phenocrysts in a medium grey, aphanitic groundmass of predominately orthoclase and biotite. These rocks are apparently unaffected by post-crystallization textural overprinting and normally occur as large bodies.

Sheared tinguaites is a sugary, moderate to strongly foliated rock in which pseudoleucite phenocrysts are elongated or totally obscured. Although biotite is generally preserved, it is in some cases altered to hornblende. Sheared tinguaites commonly occurs as xenoliths surrounded by syenite or monzonites or in broad zones paralleling contacts between pseudoleucite tinguaites and syenites. Stress studies indicate that the foliation resulted from forceful injection of syenite which cut the tinguaites in the cupola during what may have been an explosive event.

Aphanitic tinguaites contains few or no pseudoleucite phenocrysts and proportionally more biotite than tinguaites. It occurs in tabular zones ranging from a few centimeters to tens of metres in width which appear to be channel ways in which the latest phase tinguaites fluids crystallized.

Coarse grained tinguaites is difficult to recognize, as pseudoleucite phenocrysts boundaries are poorly defined except where highlighted by weathering. These rocks are restricted to small xenoliths in which extensive recrystallization has occurred.

Only pseudoleucite and sheared tinguaitite have been observed on the Deadman property where they are referred to as pseudoleucite and biotite, biotite-hornblende or hornblende syenites, respectively. The subunits are all assigned to a larger unit, referred to as flow banded syenites.

The syenitic and monzonitic rocks on both properties are generally similar, although the larger Tombstone Batholith has a small granitic core that is not exposed at the Deadman Stock's present level of erosion. The intrusions show little evidence of post-intrusive faulting or folding.

MINERALIZATION ON TOMBSTONE PROPERTY

Although all phases of the Tombstone Batholith exhibit anomalous radioactivity and unusually high uranium backgrounds, only tinguaitite and narrow, syenite dykes cutting the tinguaitite contain significant uranium concentrations. Based on 1979 drill results, the average uranium content of tinguaitite in the Tombstone Batholith is estimated to be between 50 and 60 ppm U_3O_8 of which 50 to 90% appears to be extractable. Thin section and scanning electron microscope examination indicates that most uranium occurs with biotite, zircon and interstitial purple fluorite in typical tinguaitite specimens.

Six environments that host uranium concentrations have been identified:

- 1) dyke-like aphanitic tinguaitite zones;
- 2) veins paralleling foliation in sheared tinguaitite in the contact zone between pseudoleucite tinguaitite and syenite;
- 3) veins in sheared tinguaitite xenoliths surrounded by syenite;

- 4) irregularly shaped pods of biotite- and purple fluorite-rich tinguaites which grade into normal tinguaites;
- 5) contacts between tinguaites and the wallrock sediments; and,
- 6) narrow syenite dykes intruding tinguaites.

All of the above environments have produced surface assays exceeding 2 lb/ton U_3O_8 however drilling has shown that most exhibit little vertical continuity. The best surface, as from the Tombstone property, returned 21.2 lb/ton U_3O_8 over one metre from a trench cutting a dyke-like aphanitic tinguaites zone. Drill holes which should have intersected this structure 15 to 30 m below surface produced only background uranium values. The best intersection, 8.2 m grading 0.705 lb/ton U_3O_8 , was obtained from an irregular pod in the tinguaites.

The uranium concentrations in tinguaites usually occur as disseminated uraninite in close association with purple fluorite and biotite or in fractures as uraninite, sooty pitchblende, or yellow secondary uranium minerals. Uranium to thorium ratios are usually greater than 1:1 in the tinguaites. There are no associated concentrations of rare earth elements or niobium. Most tinguaites-hosted uranium occurrences contain only minor pyrrhotite and/or pyrite, however, sheared tinguaites occurrences are commonly gossanous and contain up to 5% pyrrhotite.

Syenite dykes with anomalous uranium contents are often gossanous. Although pyrrhotite is the only sulphide commonly seen at surface, drilling has shown that the dykes also contain abundant, disseminated and fracture-filling chalcopyrite, pyrite, pyrrhotite and arsenopyrite with minor molybdenite, sphalerite and galena. The largest dyke of this type assayed 0.22% Cu, 0.27 oz/ton Ag, and 0.11 lb/ton U_3O_8 across 88.4 m. Most uranium in these dykes is associated with purple fluorite and uranium to thorium ratios average 1:2.

These dykes may be related to a deeper porphyry system.

MINERALIZATION ON DEADMAN PROPERTY

Of the six environments exhibiting uranium concentrations at the Tombstone property, only those hosted by sheared tinguaites have been observed on the Deadman property. These zones, referred to as Type 1 mineralization, exhibit nearly identical mineralogy, textures, geometry and grades to those at Tombstone (zones UG 1,2, and 3 and S11 and 15 described in the 1978 UJV Final Report). Included in this category are Showings 1, 2, 3, 4 and the Hump occurrences. These zones are characteristically lense-shaped bodies which rarely exceed 2 metres in width and 50 m in length and contain irregularly distributed veins or veinlets of pitchblende, with or without yellow secondary uranium minerals. The veins normally parallel foliation in the sheared tinguaites. The abundance of uranium is directly proportional to the abundance of biotite and purple fluorite in the host rocks. Although they locally produce encouraging assays, they exhibit limited lateral and vertical continuity. The largest zone, Showing 1, produced assays up to 30 lb/ton U_3O_8 from surface and hand trenches, but drill results returned only background values at a depth of 15 metres. Work on the Tombstone property has shown that the sheared tinguaites hosting these occurrences have much lower uranium backgrounds (10 to 20 ppm) than pseudoleucite tinguaites, suggesting that the uranium was probably remobilized during the deformation. The better zones are weakly to moderately gossanous and contain finely disseminated pyrrhotite.

Types 2 and 3 anomalies, spot high and fracture anomalies, respectively, are common to both properties but are too small to be of economic significance.

The thorite occurrence at the Deadman property has no parallel at Tombstone.

CONCLUSIONS

Exploration on both the Tombstone and Deadman properties has shown that all environments hosting relatively high grade uranium mineralization (i.e. greater than 2 lb/ton U_3O_8) have limited tonnage potential and are of little economic significance. If the price of uranium were to show a dramatic increase, some bulk tonnage potential may exist at Tombstone for uranium zones hosted by pseudoleucite tinguaite or copper-silver-uranium-bearing syenite dykes. Mineralization of this type is not known to exist on the Deadman property. The bulk tonnage potential of the sheared tinguaite hosting the Deadman occurrences has not been evaluated, but these units have little potential at Tombstone.

Respectfully submitted,

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