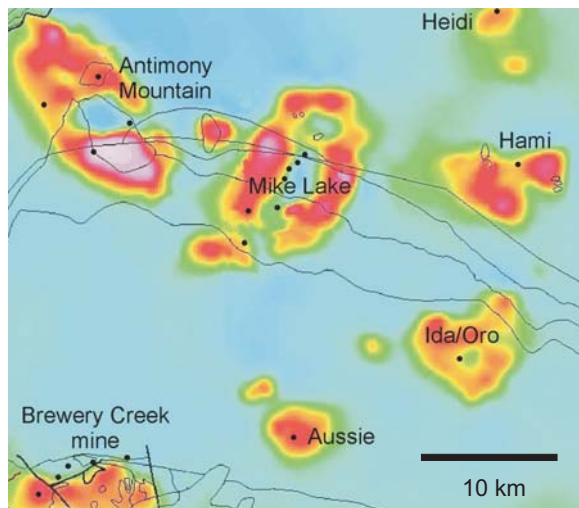


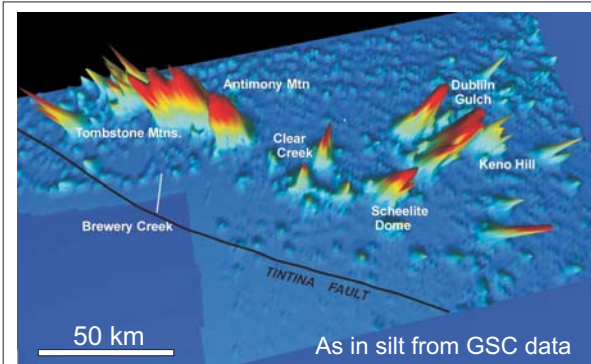
## Exploration

Exploration for intrusion-related gold deposits in the Tombstone Gold Belt remained modest until the late 1980s with the discovery of the Brewery Creek mine near Dawson City (resource of 40 Mt of 1.4 g/t Au) and Fort Knox mine (169 Mt of 0.93 g/t) near Fairbanks. The belt remains grossly under explored, however, due to low exploration levels through much of the 1990s. This, combined with the recognition of the various mineralization styles and similar mineralizing events associated with other mid-Cretaceous plutonic suites in Yukon, provides explorationists with a plethora of geological settings in which to make new discoveries.

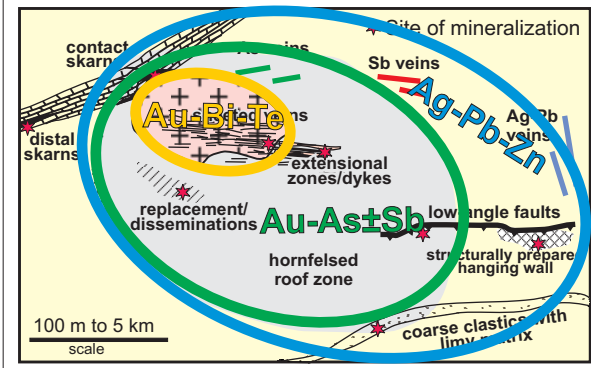
Traditional exploration methods such as mapping, prospecting, and aeromagnetic, regional stream sediment and soil geochemical surveys are all effective. Since mineralization is typically focused in regions at the top of plutons, target areas should include locations where plutons are not exposed. These may be detected by regional aeromagnetic surveys that may respond to either pyrrhotite-rich hornfels, or low levels of magnetite in the case of the Tombstone suite alkalic intrusions.



Regional total field aeromagnetics. Black lines are geological contacts



Regional stream geochemistry is an effective method of identifying intrusion-related gold systems. Although these deposits are characterized by a Au-Bi-Te signature, the As enriched, variably mineralized hornfelsed aureole provides the most robust geochemical signal. At the deposit scale (below), the geochemical response is highly zoned reflecting cooling and the distance away from the mineralizing intrusion.



## Further Reading

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For more information, check the Yukon Geological Survey website:

[www.geology.gov.yk.ca](http://www.geology.gov.yk.ca)



Yukon Geological Survey  
Department of Energy, Mines  
and Resources  
Yukon Government  
Box 2703  
Whitehorse, Yukon  
Canada Y1A 2C6

phone: (867) 667-8508  
fax: (867) 393-6232

Information compiled by  
Craig J.R. Hart

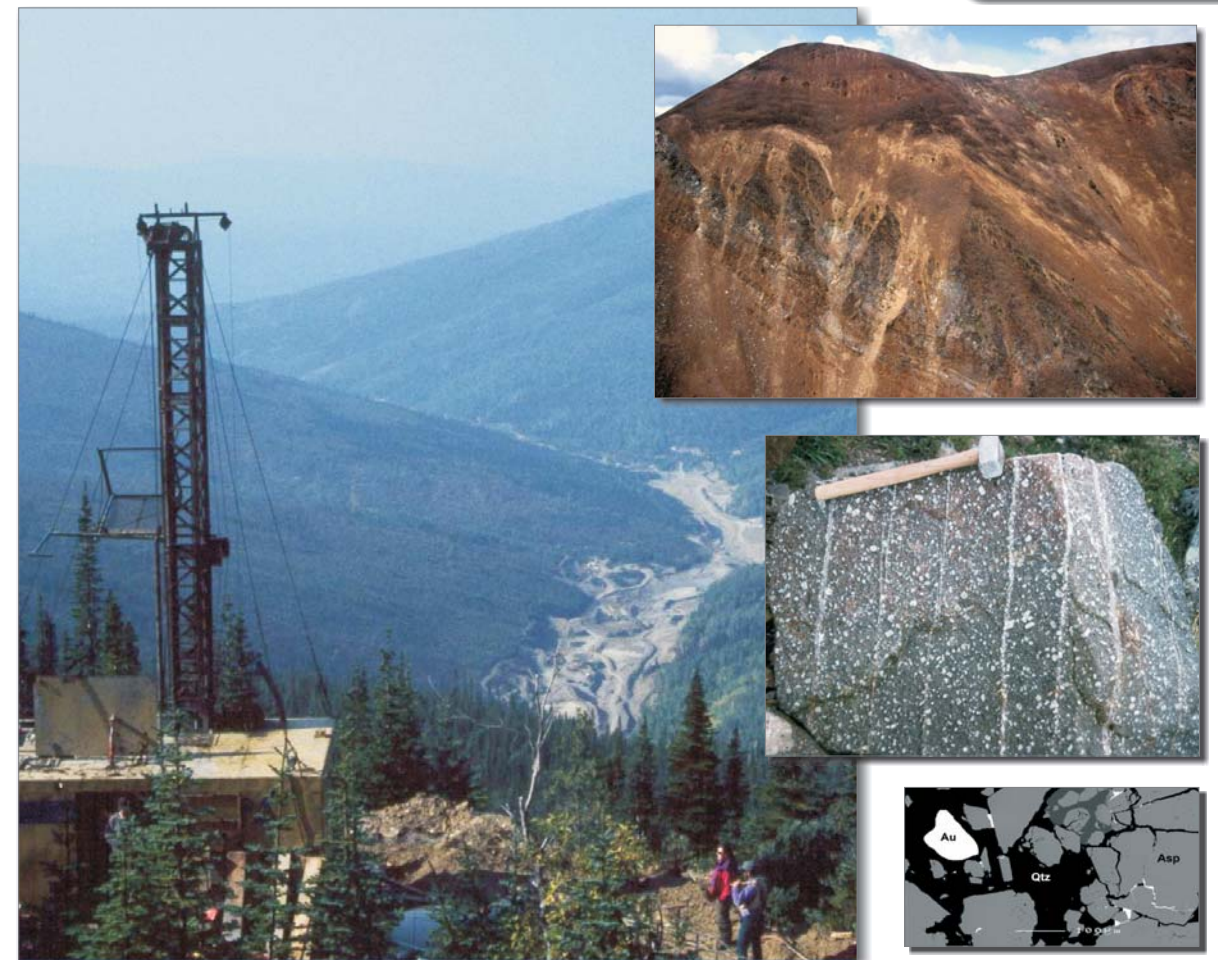
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# INTRUSION-RELATED GOLD

## Tombstone Gold Belt

YGS Brochure 2006-6



- ▶ Tombstone Gold Belt is one of several mineral districts that comprise the Tintina Gold Province.
- ▶ The Tombstone Gold Belt is the type area for the intrusion-related gold system (IRGS) mineral deposit model.
- ▶ Several styles of gold mineralization are associated with three mid-Cretaceous (90-98 Ma) plutonic suites (Tombstone, Mayo, Tungsten) that intruded Selwyn Basin.

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# Introduction

The Tombstone Gold Belt is one of several gold-rich mineral districts that make up the broader Tintina Gold Province that spans Yukon and Alaska. The Tombstone Gold Belt forms a 600-km-long belt of gold deposits and occurrences that are directly associated with numerous mid-Cretaceous plutons, sills and dykes that intrude along the northern margin of the Selwyn Basin in central Yukon.

Gold deposits such as Dublin Gulch, Scheelite Dome and Clear Creek, as well as the Fort Knox deposit in Alaska which has been offset along the Tintina Fault, are all type examples of the intrusion-related gold system (IRGS) deposit model. Intrusion-hosted, proximal and distal styles of associated gold mineralization characterize these systems (see Fig. 1).

Gold deposits are developed in plutons that also contain tungsten, either in skarns or veins; and many plutons have associated placer gold deposits.

# Nature of Intrusions



Tombstone Gold Belt deposits and occurrences are preferentially associated with the plutonic suites that form an 800-km-long belt of several hundred relatively small stocks, dykes and sills. These intrusions form the youngest and most inboard belt of Yukon's mid-Cretaceous Selwyn magmatic episode.

The plutons mostly have a reduced primary oxidation state and form ilmenite or titanite instead of magnetite, and therefore have a low magnetic response. These plutons have a lithophile metallogeny enriched in tungsten and low in copper, which is typical of reduced magmas.

Each plutonic suite has a characteristic metallogenic association. Plutons of the Tombstone plutonic suite have alkalic compositions (syenites) and associated gold, bismuth and copper. Plutons of the Mayo suite have metalluminous compositions (hornblende monzonites) and the strongest gold association. Plutons of the Tungsten suite are slightly peraluminous (biotite granite) and are associated with tungsten ± copper, zinc and molybdenum mineralization. Gold and arsenic are associated with some plutons. Mineralized plutons typically have associated pegmatites, aplites, miarolitic cavities and tourmaline veins, which are all indicative of volatile saturation and development of hydrothermal phases.

Cover photos: (large) Drilling mineralized hornfels at Scheelite Dome, placer workings in the distance; (top) Hornfels roof zone above pluton at Red Mountain; (middle) Sheeted veins from Clear Creek; (bottom) SEM image of gold-rich ore from Scheelite Dome

# Styles of Mineralization

The IRGS model is characterized by a wide range of mineralization styles that vary in a predictable manner in concentric zones outward from a central mineralizing intrusion. IRGS deposits and occurrences are either intrusion-hosted, proximal in contact with the pluton, within the thermal aureole, or in distal settings beyond the hornfels zone. The most characteristic type of mineralization associated with IRGS are intrusion-hosted sheeted quartz vein arrays (A), such as those that comprise the Eagle Zone at Dublin Gulch, and at the Fort Knox mine, Alaska. The quartz ± K-feldspar-mica veins host sparse pyrite (or pyrrhotite), scheelite and bismuthinite. Rock containing the veins have values up to 30 g/t Au and a gold-bismuth-tellurium-tungsten signature. Overall grade depends on vein density.

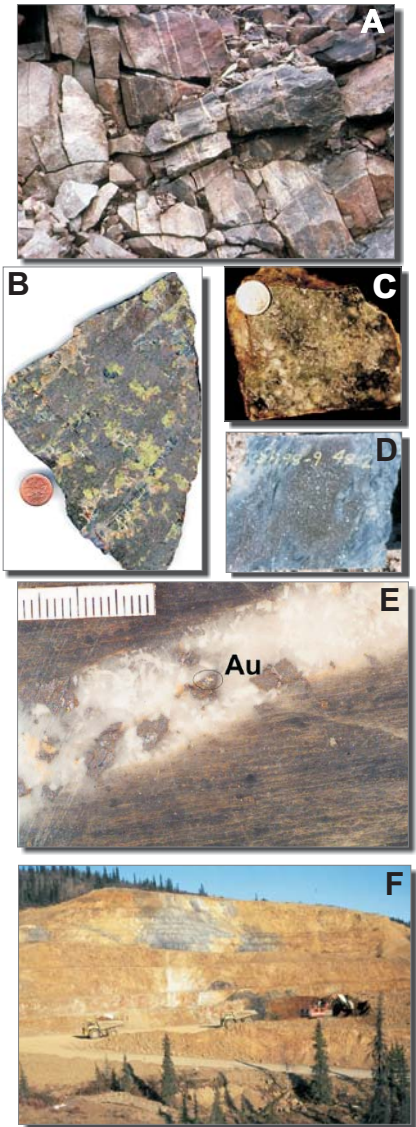
For example, at Dublin Gulch there are 3-5 veins per metre and an overall grade of ~1 g/t Au.

Skarns proximal to intrusions typically have reduced, pyroxene-rich, garnet-poor assemblages with high-grade Au±Bi-Cu-W-As mineralization (B). The Marn deposit has an average grade of 8.6 g/t Au; samples from the Tom Zone at Scheelite Dome contain >100 g/t Au. Skarns associated with alkalic plutons of the Tombstone suite are more copper-rich, whereas others are tungsten-rich.

Skarns distal to intrusions may be lower grade, but are potentially larger, such as those at the McQuesten/Aurex occurrence. These skarns may be arsenic-rich and lack tungsten. Calcareous grits may form arsenic-rich skarns (C).

Hornfelsed aureoles host vein stockwork, replacement (D) and disseminated sulphide minerals, and weakly mineralized skarn. Gold-bearing arsenic and antimony-rich quartz veins may also occur in the hornfels zones (E). Ag-Pb-Zn veins typically occur beyond the hornfels zones.

Epizonal mineral deposits or occurrences form at shallow levels, likely above shallowly emplaced plutons. Brewery Creek (F) and Donlin Creek, Alaska are prime examples of this deposit type, with sulphide-rich, quartz poor refractory ores and a characteristic Au-As-Sb-Hg signature in sills and in sedimentary host rocks. The upper oxidized portions of the deposits have been mined at Brewery Creek.



## Mineralization

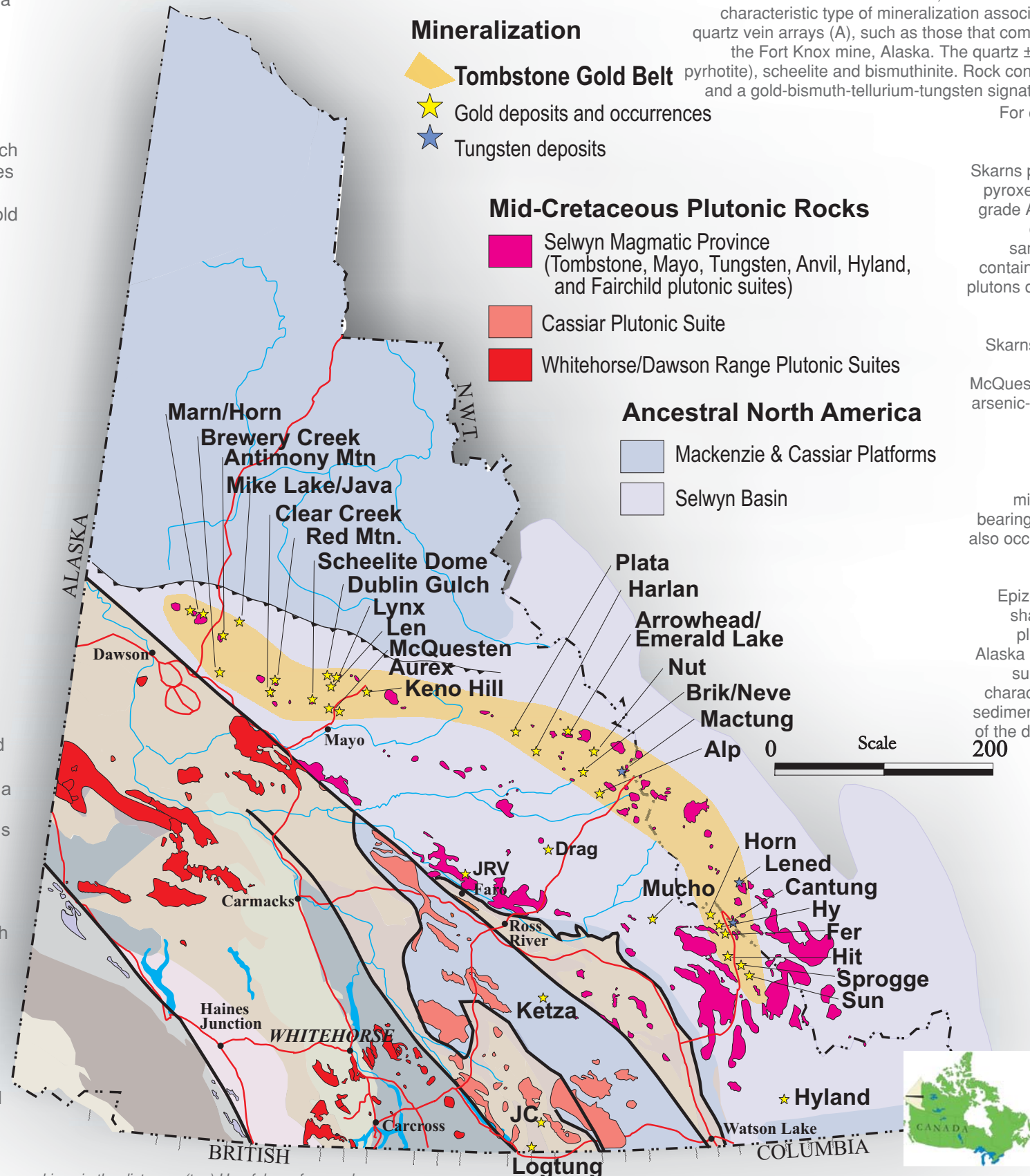
- ◆ Tombstone Gold Belt
- ★ Gold deposits and occurrences
- ★ Tungsten deposits

## Mid-Cretaceous Plutonic Rocks

- Selwyn Magmatic Province (Tombstone, Mayo, Tungsten, Anvil, Hyland, and Fairchild plutonic suites)
- Cassiar Plutonic Suite
- Whitehorse/Dawson Range Plutonic Suites

## Ancestral North America

- Mackenzie & Cassiar Platforms
- Selwyn Basin



# IRGS Model

Figure 1. Styles of mineralization for the Intrusion-Related Gold System mineral deposit model

