

# THE BILL PROPERTY - A MESOTHERMAL GOLD TARGET IN NORTH-CENTRAL BC

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**KEYWORDS:** *Gold, Toodoggone, Devonian-Permian Asitka, Group, Jurassic intrusions, carbonitization, sericitization, silicification, mesothermal gold veining, intrusion-related gold veining.*

## INTRODUCTION

The Bill property lies on the Spatsizi Plateau in the Liard Mining Division of north-central British Columbia, approximately 150 kilometres southeast of Dease Lake and 330 kilometres north of Smithers (Figure 1). The Bill property covers two distinct gold-bearing prospects. The T-Bill prospect is a 3 km<sup>2</sup> area of carbonate alteration, highly anomalous Au-As soil geochemistry and gold-bearing quartz-sulphide veining. The Park prospect, located 3 kilometres to the north, is a poorly explained 0.5 km<sup>2</sup> Au-Cu soil geochemical anomaly centred on a prominent gossan.

## PROPERTY EXPLORATION HISTORY

Exploration leading to the discovery of the T-Bill and Park prospects dates back to the 1970's when Cominco conducted regional silt sampling programs through the Toodoggone area. Cominco staked the Bill claims to cover the drainages of 10 samples exceeding 50 ppb Au. Contour soil sampling in 1980 identified the T-Bill prospect, a widespread Au-As soil geochemical anomaly (Sharp, 1981). In 1981 and 1982, Cominco collected rock and soil geochemical samples.

In 1980, Du Pont of Canada Exploration Limited collected field-sieved bulk samples for heavy mineral concentrate analysis that identified anomalous samples from streams draining what is now the Park prospect. Mapping identified a number of gossans on the claims (Eccles, 1981). The next year, mapping and soil sampling identified a small gold anomaly (>100 ppb Au) coincident with the westernmost gossan (Drown 1982). In 1982, Du Pont continued work on the Park, including blast trenching, soil sampling and rock sampling. Bedrock sampling in the blast trenches yielded lower Au, As, and Cu values than the overlying soils and the claims were allowed to lapse (Copland, 1982).

Also in 1982, Du Pont optioned the Bill property from Cominco and conducted mag-VLF and IP surveys, detailed soil sampling of the core of the soil anomaly and blast trenching. The geophysical surveys highlighted NNW-trending linear magnetic lows and VLF conductors, as well as an IP chargeability high that is unrelated to soil geochemical anomalies. Trenching did not reach fresh bedrock and chip samples returned lower values than the soils immediately above (Copland and Drown, 1983).

In 1983, Du Pont extended the mag/VLF survey and drilled six holes in the >500 ppb Au portion of the T-Bill soil anomaly; four were directed to the east across the northerly-trending VLF conductors. Core was sampled in 2-metre intervals. All holes intersected quartz-arsenopyrite veining with the best intervals assaying 35.0 g/tonne Au over 2.0 metres (83-2) and 11.0 g/tonne Au over 4.0 metres (83-6). With this program, Du Pont's option was vested and they formed a 50/50 joint venture on the Bill with Cominco (Forbes and Drown, 1984).

It appeared from the 1983 drilling that the east-west holes were subparallel to the bulk of veining, so the follow-

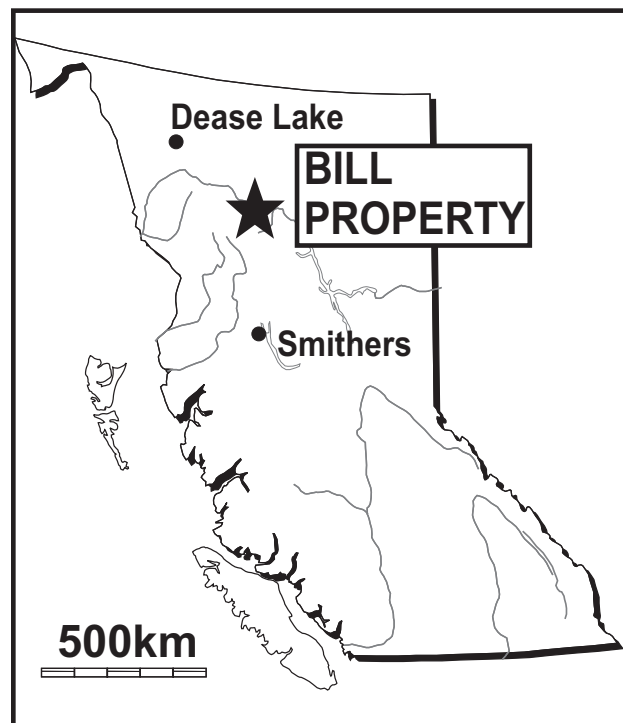


Figure 1. Bill Property Location.

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ing year Du Pont and Cominco carried out a new VLF-EM survey on north-south lines and drilled seven of nine holes to the north or south. Each of their holes cut intervals with >1 g/tonne Au, with the best sections assaying 16.5 g/tonne over 2.0 metres (84-2), 24.7 g/tonne over 1.5 metres (84-5) and 24.8 g/tonne over 2.0 metres (84-8). In addition, soil sampling extended the main T-Bill Au-As soil geochemical anomaly 600 metres to the northwest in the West Bowl and revealed a new 400 x 900 metre Au-As soil anomaly in the North Cirque (Kowalchuk, 1984). A structural study by Paterson (1985) indicated that ESE-trending quartz-carbonate-arsenopyrite veining was related to but post-dated doming and subsequent carbonate alteration of a highly deformed intermediate to mafic volcanic package. No further work was carried out by Du Pont, its successor companies, or Cominco on the Bill property and their claims were allowed to lapse in 2001.

The claims covering the Park prospect were re-staked in 1987 by Comox Resources who then optioned them to Skylark Resources Ltd. Skylark established a detailed 250 x 400 metre grid for prospecting, soil geochemical and VLF-EM surveys (McAtee and Burns, 1988).

AGC Americas Gold Corp. staked the Park gossan in 1995 and carried out soil sampling over a 900 x 1000 metre grid. This survey showed the Au-Cu soil geochemical anomaly to be much larger than previously known, covering an area of 500 x 900 metres and open to the east and west (Krause, 1996). No further fieldwork was carried out on the Park property, but in 1997, AGC Americas and

Antares Mining and Exploration Corporation participated in a joint GSC-industry airborne magnetic survey over the entire Toodoggone area, including the Park prospect (Hawkins, 1998).

### 2001 EXPLORATION PROGRAM

Rimfire Minerals Corporation optioned the Bill property in May 2001, attracted by its large, poorly explained soil and silt geochemical anomalies, by the extent and high Au grades of the T-Bill mesothermal veining and by a large magnetic low centred immediately southeast of the T-Bill prospect. An initial program of prospecting, silt and soil geochemistry and core re-examination and sampling was carried out in July.

The 1983 core and holes 84-6 to 84-9 were inaccessible, due to collapse of their core racks. The first five 1984 holes could be recovered, but were in poor condition from animal disturbance. They were examined and 14 previously unsampled sections split for analysis.

### REGIONAL GEOLOGY

The Bill property lies near the eastern edge of the Intermontane Belt in a fault mosaic of: Devonian to Permian Asitka Group carbonates and volcano-sedimentary rocks; the Carboniferous to Lower Triassic Cache Creek oceanic assemblage, including the Kutcho Formation; Triassic Stuhini volcano-sedimentary rocks; Lower Jurassic Toodoggone (subaerial) and undifferentiated Hazelton vol-

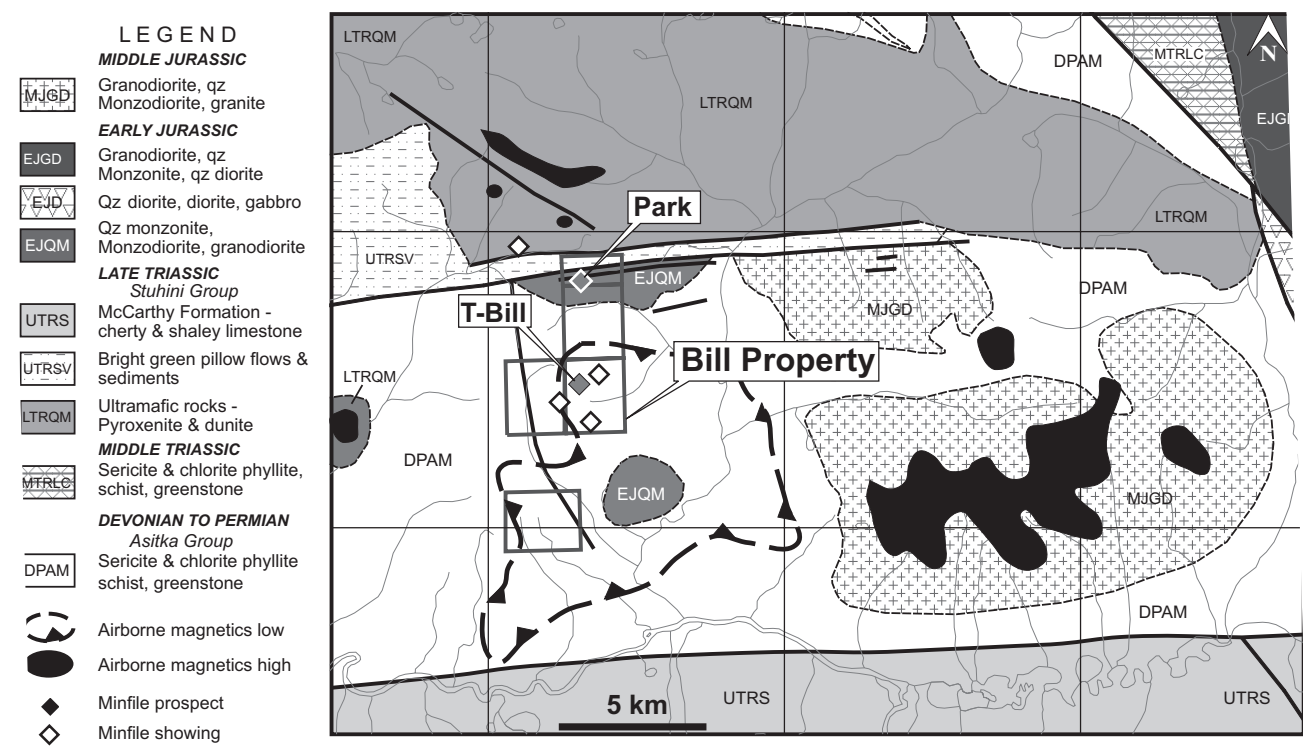


Figure 2 - Regional Geology in the vicinity of the Bill property with airborne magnetic anomalies and BC Minfile occurrence locations indicated.

canic rocks and Laberge Group volcanic and epiclastic rocks (Figure 2).

The stratified rocks are intruded by a variety of Late Triassic and Early to Middle Jurassic stocks and batholiths of felsic to ultramafic composition. Most of the Early Jurassic quartz monzonites, granodiorites and quartz diorites are characterized by a distinctive magnetic high; in particular, this applies to the intrusive immediately northeast of the Bill property. The quartz monzonite stock exposed on the southern part of the Bill property is the exception to this rule; it coincides with a distinctive magnetic low that is almost ten kilometres across.

The Pitman Fault is a major E-W fault that is about 30 kilometres north of the Bill property. Alldrick (2000), who traced the Pitman Fault for 300 kilometres, states that there is 3 kilometres of left-lateral movement along it with minimal vertical offset, and that movement occurred during Eocene to Oligocene time. Three major E-W faults have been mapped at the northern and southern boundaries of the Bill property, one along the Stikine and Chukachida Rivers four kilometres south of the Gos claim and the other two passing through the BT 3 claim, north of the Park occurrence. A fourth could reasonably be inferred along the valley between the T-Bill and the Park prospects, dropping undeformed Upper Triassic Stuhini Group volcanics down to the north against deformed Paleozoic Asitka Group rocks to the south.

## PROPERTY GEOLOGY

Most of the Bill property is underlain by phyllites and schists of the Devonian-Permian Asitka Group (Figure 3). These have been penetratively deformed; primary textures and protoliths are not generally obvious. Schists in the vicinity of the T-Bill prospect consist of a sequence of chlorite schists and quartz-chlorite-feldspar schists; it has undergone extensive carbonatization and sericitization and hosts the quartz-arsenopyrite veining at the T-Bill prospect (Paterson, 1985). Paterson recognized two phases of Triassic(?) penetrative deformation and a Mesozoic or Tertiary kinking. The kink folding accompanied a northeasterly-elongated doming of the foliation, centred on the T-Bill prospect.

Northeast of the property, the Asitka Group is dominated by dark grey chert with lesser tuffaceous sediments and andesitic volcanics (Drown, 1982). Further west, green, aphyric to feldspar-phyric volcanics are assigned to the Upper Triassic Stuhini Group. In the immediate vicinity of the Park prospect, these are represented by siliceous tuffs. The contact between the Asitka and Stuhini Group rocks has not been mapped.

An unfoliated quartz monzonite to granodiorite stock intrudes Asitka Group schists on the GOS claim and immediately southeast of the BT claim. The stock is generally medium-grained and equigranular, but has local pegmatitic and aplitic phases; it is quite variable in composition. A pronounced magnetic low associated with this stock suggests that it may be about ten kilometres in diameter at depth, and centred two kilometres southeast of the BT claim. How-

ever, part of this magnetic low could be related to magnetite-destructive alteration like that at the T-Bill prospect.

Another felsic stock intrudes Asitka Group cherts northeast of the Bill property. It is fine- to medium-grained, with phases ranging from rhyolite to granodiorite (Drown, 1982). A medium-grained diorite body mapped immediately to the west may constitute a separate phase of this stock. A crowded feldspar porphyry intrusive lies a little further west, along the north edge of the Park gossan; its extent is unknown, but it too is thought to be another phase of this stock. The entire stock, like almost all Jurassic intrusions in the Toadogone area, is characterized by a broad magnetic high, but no magnetic susceptibility work has been done to separate the effects of the stock from those of its enclosing pyrrhotite-bearing hornfels. No dating has been carried out on any of the intrusives and their ages are a conjectural.

## ALTERATION AND MINERALIZATION

Two main styles of alteration and gold-bearing mineralization occur on the Bill property; mesothermal arsenopyrite-bearing veins and disseminations (T-Bill prospect); and intrusive-related veining and silicification (Park prospect).

### T-BILL PROSPECT

Asitka Group chlorite schists have been extensively altered to a muscovite-carbonate-quartz assemblage in a northeasterly-trending area of 1,200 x 2,300 metres. On a large scale, this alteration appears mainly controlled by foliation (S1) and by steeply-dipping NE-SW structures. It is largely confined to the core of the structural dome. In detail, the muscovite-carbonate-quartz alteration follows joints, fractures and foliation planes. It appears to pre-date deposition of gold from an evolving hydrothermal fluid. Cominco dated the alteration at 136 $\pm$ 5 Ma (Early Cretaceous), using K-Ar methods on muscovite collected at 110 metres depth in hole 84-1.

The three styles of gold mineralization recognized on the T-Bill Prospect are spread over an area of 1,800 x 2,400 metres that roughly coincides with the muscovite-carbonate-quartz alteration. The styles are:

- Disseminated and vein pyrite-arsenopyrite in carbonatized rock adjacent to mineralized veins (e.g. Showing D): Up to 20% sulphides in quartz-carbonate-muscovite schist is accompanied by <1 g/tonne Au;
- Brecciated quartz veins or carbonatized rock associated with movement on faults or joints (e.g. Showings A, F). These breccias are related to post-carbonatization, pre-mineralization faulting. Quartz-arsenopyrite-pyrite-carbonate $\pm$ -chalcopyrite comprise the breccia matrix; gold values are moderate.
- Quartz-carbonate-arsenopyrite-pyrite veins: These are responsible for all high-grade surface and core assays. They are planar tension veins, 0.2 to 30 centimetres wide, and occur in swarms. They commonly cross-cut foliation and are present in both chlorite schist and muscovite-carbonate-quartz alteration. In the chlorite schist the

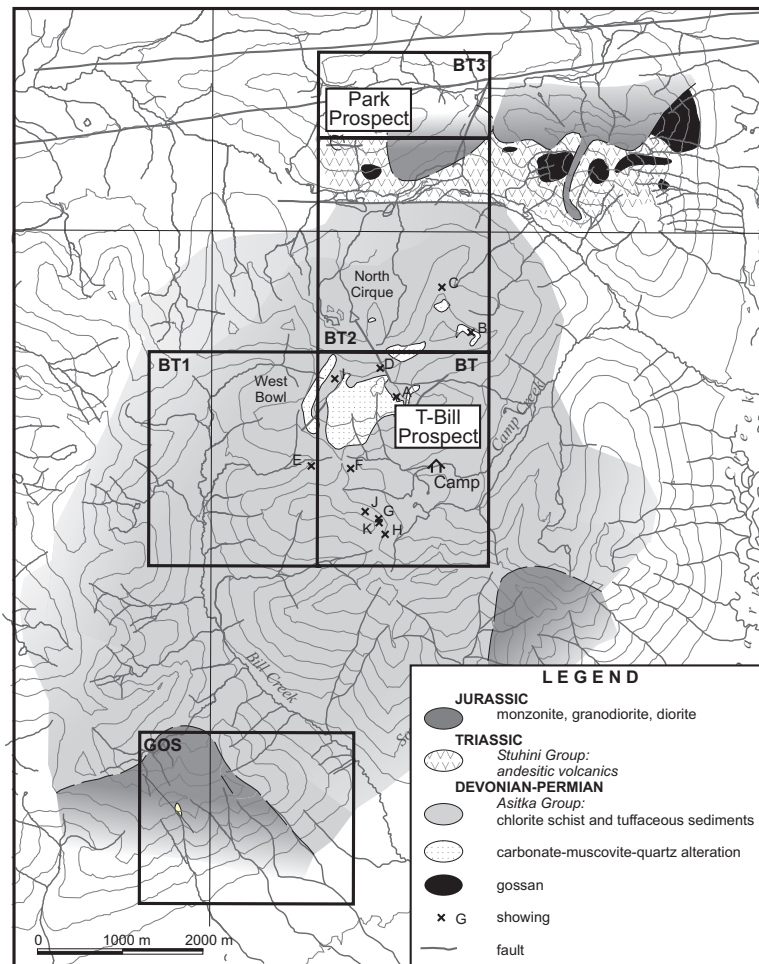


Figure 3 - Property scale geology showing T-Bill and Park prospects, showings and carbonate-muscovite-quartz alteration zones.

**TABLE 1**  
**INTERSECTIONS GREATER THAN 1 G/TONNE AU FROM THE 1983-1984 DRILL PROGRAMS**

Hole	From (m)	To (m)	Length (m)	Au (g/tonne)	Ag (ppm)	As (ppm)	Cu (ppm)	Pb (ppm)	Sb (ppm)	Zn (ppm)
83-1	102.0	104.0	2	12.5	N/A	300	N/A	N/A	N/A	N/A
83-2	52.0	54.0	2	35	N/A	11500	N/A	N/A	N/A	N/A
	94.0	96.0	2	11.9	N/A	4000	N/A	N/A	N/A	N/A
83-6	60.0	62.0	2	13.8	N/A	5500	N/A	N/A	N/A	N/A
	116.0	120.0	4	11	N/A	2300	N/A	N/A	N/A	N/A
	126.0	128.0	2	12	N/A	7400	N/A	N/A	N/A	N/A
84-2	183.2	186.7	3.5	10.3	0.1	633	21	3	1	37
	212.4	214.4	2	15.6	0.2	850	38	1	1	66
84-4	172.5	173.0	0.5	25.6	6.2	28300	12	178	74	144
84-5	48.5	51.5	3	12.7	0.4	2500	64	4	1	44
84-7	111.8	113.3	1.5	15.5	0.3	>5000	18	1	1	40
84-8	31.9	33.9	2	24.8	0.1	3000	24	4	1	70

veins have narrow bleached or carbonate-pyrite alteration envelopes. Although some of these veins lie outside the pervasive carbonate-muscovite alteration, most are within the alteration zone. Based on a study of vein orientations relative to foliation in drill core, Cominco calculated that most of these veins strike 100-120° and dip 60-90° to the north. Foliation-parallel shear locally offsets veins. Visible gold is present in higher-grade veins, and grades in some exceed 100 g/tonne Au.

Most mineralization in the T-Bill prospect is characterized by elevated Au and As and background levels of Ag, Cu, Pb, Sb and Zn. The Au:Ag ratio is 1:1 or higher and the As:Sb ratio is commonly >100:1. However, mineralization in showings on the periphery of the T-Bill prospect, Showing C (at the northern boundary) and Showings H, J and K (at the southern boundary) indicate the possibility of zonation from the Au-As core outwards to mineralization with much higher Ag (Showings C and K), Ba (Showing J), Pb (Showing C), Sb (Showings C and K) and Zn (Showings C, H and K) contents.

### 1983-84 CORE RELOGGING AND SAMPLING

About a third of the 1983-84 drill core was re-examined in 2001, with an emphasis on holes 84-3, -4 and -5. A few more sections were split for analysis, to cover previously unsampled mineralized zones and to clarify sampling problems. Including the new samples, Table 1 summarizes significant intersections (>1 g/tonne Au over 2 metres) from this early drilling.

Table 2 summarizes intersections that are >50 metres wide and have Au values exceeding 0.5 g/tonne. Some examples are simply an artefact of a few gold-rich intervals within a broad zone. However, some drill holes contain significant widths of low-grade gold values due to multiple vein swarms and gold-bearing alteration (Figure 4). Despite the incomplete assaying for the 1984 holes, which lowers the average gold grade reported below, these broad

low-grade intersections indicate that there is potential for a bulk-mineable target at the T-Bill prospect.

### PARK PROSPECT

A multi-phase stock that extends east from the north end of the Bill property is responsible for several geochemically anomalous gossans near its contacts. Of these, only the Park prospect was examined in 2001, but previous workers ascribed the others to bleaching and pyritization of chert adjacent to the intrusive.

The main Park gossan is an intense goethite-jarosite gossan developed along the contact between a crowded feldspar porphyry intrusive and siliceous tuff. A few hundred metres from the contact, the siliceous tuff is hornfelsed and variably chloritic; within a few tens of metres of the contact, it is intensely silicified and the weathered surface has boxwork developed after sulphides. Locally, the silicified rock has a frothy texture, with drusy quartz lining some of the abundant voids. Float from the strongest zone of silicification returned up to 2960 ppb Au. A weaker gossan extends a few tens of metres into the porphyry, with little silicification or sulphides. Blocks of ferricrete indicate the abundance of sulphides in the unweathered intensely silicified zones.

A subtle gossan is apparent through the trees and scrub about 500 metres southeast of the main Park gossan. Although outcrop is limited, this gossan also appears related to hornfelsing and pyritization. Only 5 rock samples were collected, but two altered and pyritic grab samples, taken 300 metres apart, returned 1405 and 3590 ppb Au respectively. Similar looking but untested hornfelsing and pyritization is common, leaving open the possibility for extensive low-grade Au mineralization in this area.

Mineralization sampled in each gossan is accompanied by elevated Cu and Mo (max. 731 ppm Cu, 93 ppm Mo) and variable As levels. Both gossans are accompanied

**TABLE 2**  
**SUMMARY OF BROAD, LOWER-GRADE INTERSECTIONS (AU>0.5 G/TONNE AND WIDTH > 50 METRES)**

Hole	From (m)	To (m)	Length (m)	Au (g/tonne)	Ag (ppm)	As (ppm)	Cu (ppm)	Pb (ppm)	Sb (ppm)	Zn (ppm)
83-1	60.00	176.00	116.00	0.58	N/A	93	N/A	N/A	N/A	N/A
83-2	50.00	198.73 <sup>5</sup>	148.73 <sup>5</sup>	1.17	N/A	2381	N/A	N/A	N/A	N/A
83-6	60.00	224.00	164.00 <sup>1,5</sup>	0.73	N/A	1383	N/A	N/A	N/A	N/A
84-2	57.80	218.20 <sup>5</sup>	166.40	0.62	0.1	809	12	1	1	25
84-3	29.00	113.50	84.50 <sup>2</sup>	0.56	0.5	1544	35	15	1	43
84-5	48.50	135.50	87.00 <sup>3</sup>	0.61	0.5	682	60	5	4	34
84-7	65.80	129.20	63.40 <sup>4</sup>	1.02	0.1	1272	9	1	0	16
84-8	9.70	85.00	75.30	1.07	0.2	1043	12	15	0	122

<sup>1</sup> Only 92.7 metres have been sampled; the remaining 73.7 metres were assigned zero grade.

<sup>2</sup> Only 60.3 metres have been sampled; the remaining 26.7 metres were assigned zero grade.

<sup>3</sup> Only 21.0 metres have been sampled; the remaining 42.4 metres were assigned zero grade.

<sup>4</sup> Only 31.5 metres have been sampled; the remaining 43.8 metres were assigned zero grade.

<sup>5</sup> End of hole (bottomed in mineralization)

# Bill Property - T-Bill Prospect

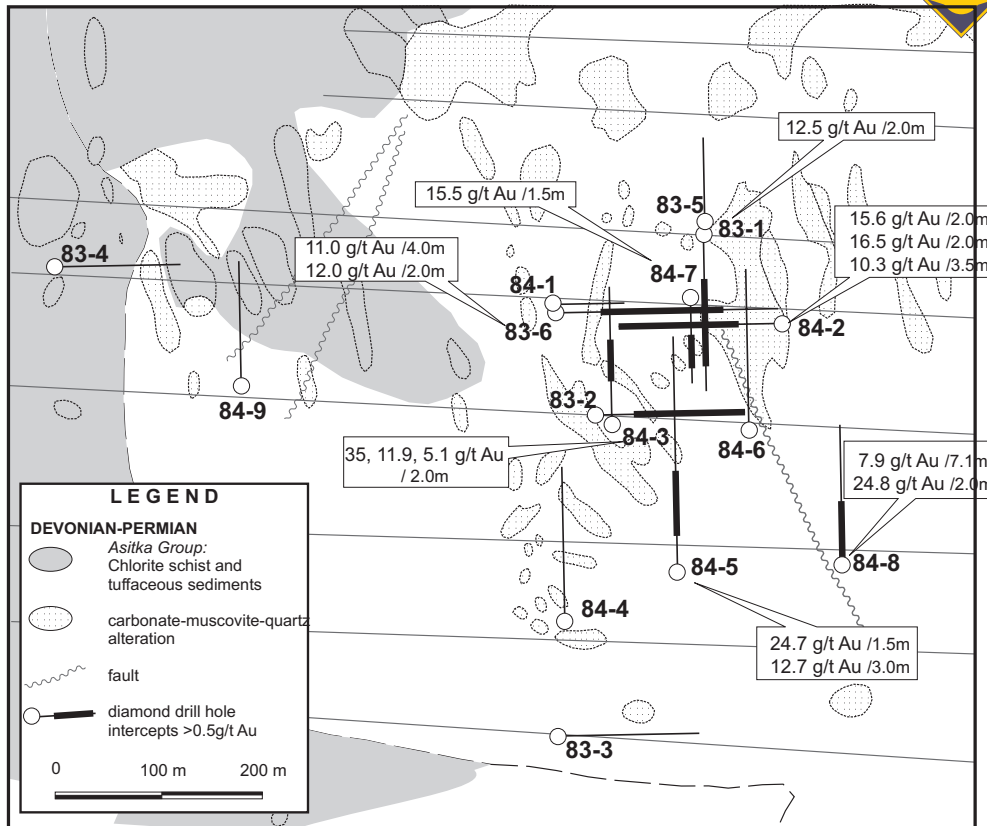


Figure 4. T-Bill prospect diamond drilling plan showing significant intersections and broad, lower-grade intersections.

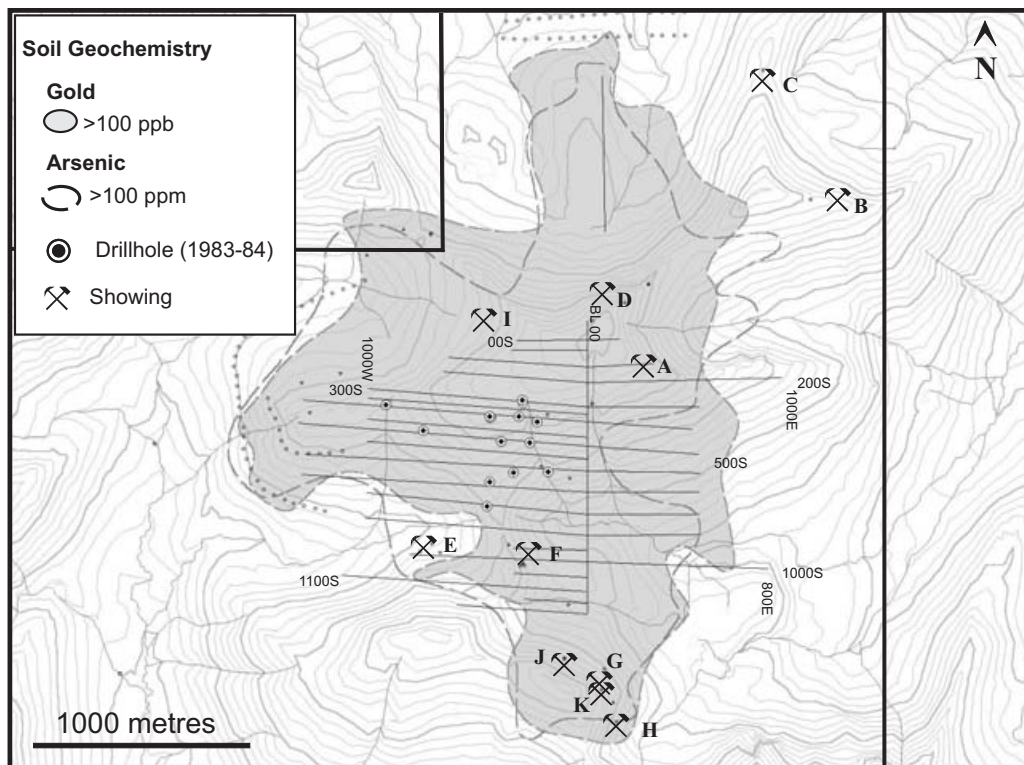


Figure 5. T-Bill soil gold and arsenic soil geochemistry with drillholes and surface gold showings located.

by Au+Cu+/-As soil geochemical anomalies which remain incompletely explained by rock sampling to date.

## SOIL GEOCHEMISTRY

More than 1750 soil samples have been collected from the Bill property (Figure 5). As would be expected from the character of the mineralization seen on the property, the soils show strong correlations between Au-As (characteristic of the T-Bill prospect) and Au-Cu (especially prominent at the Park and Gos prospects). There is an excellent correlation in soils between Pb and Zn, neither of which is associated with precious metals, and a good correlation between them and Cu-Mo. As and Sb are not correlated.

A strong Au-As soil geochemical anomaly, defined by >100 ppb Au and >200 ppm As, covers an area of 2 x 3 km over the T-Bill prospect. The majority of this anomaly lies above tree-line on gentle to moderate grassy slopes; solifluction lobes are common. Rock outcrop is sparse throughout most of the area of the soil anomaly, although float is present in frost boils and talus patches. In 2001, soil sampling was carried out at the northern and western tips of the T-Bill anomaly, because previous sampling had not closed off the anomaly. Results extend the T-Bill geochemical anomaly 500 metres to the west and 200 metres to the north. The northern, eastern and western boundaries of the soil anomaly appear to be a function of till cover rather than metal-deficient bedrock.

The Park soil anomaly is an Au-Cu+/-As geochemical anomaly covering a 900 x 500 metre area that is tree covered with very little outcrop (figure 6). This open-ended

anomaly is defined by coincident copper (>100 ppm) and gold (>100 ppb) in soil geochemistry from an area underlain by hornfelsed, silicified and pyritized volcanics. The anomaly remains largely unexplained, however limited prospecting in 2001 successfully identified gold mineralization from a subtle gossan 500 metres east of any previously known mineralization.

## DISCUSSION

Two distinct, but possibly related, styles of gold mineralization, mesothermal and intrusion-related, characterize the Bill property. Most previous exploration has been focused on the mesothermal mineralization of the T-Bill prospect, where a package of Devonian to Permian metavolcanics has been altered to carbonate-muscovite-quartz schist over an area of 1,200 x 2,300 metres. This alteration is confined to the core of a northeasterly-trending structural dome and is controlled both by foliation and by steep cross-cutting structures. Gold-rich quartz-arsenopyrite veins are broadly co-spatial with the carbonate-muscovite alteration, although they extend into bordering unaltered chlorite schist where veins have only centimetre-scale alteration envelopes. Individual veins generally cut across foliation and are rarely wider than 30 centimetres, but vein swarms are common. The best drill intersections include 2.0 metres @ 35.0 g/tonne Au (83-2), 4.0 metres @ 11.0 g/tonne Au (83-6) and 2.0 metres @ 24.8 g/tonne Au (84-8). The T-Bill prospect is marked by a strong 2 x 3 kilometre Au-As soil geochemical anomaly along a grassy slope; its limits reflect masking by till and talus cover rather

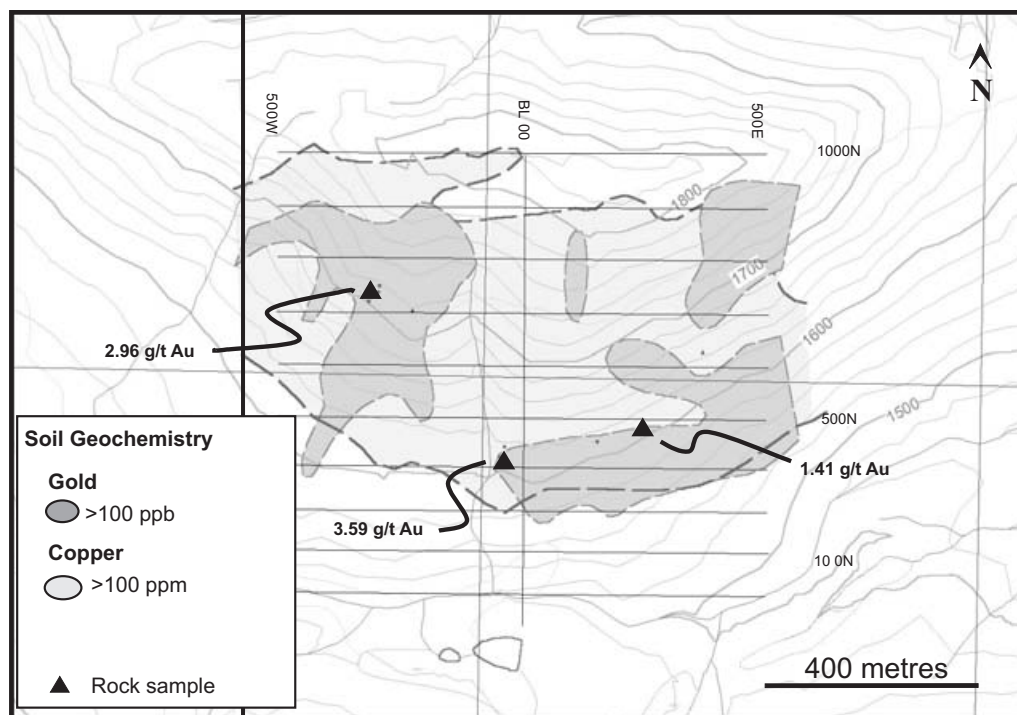


Figure 6 - Park prospect gold and copper soil geochemistry.

than changes in alteration and mineralization in the bedrock.

The 1983 and 1984 diamond drilling programs on the T-Bill prospect cut dozens of gold-bearing intervals but failed to define controls governing the location and intensity of the quartz-arsenopyrite veining. Understanding the ore controls is made more difficult by the lack of surface exposure, however on a very broad scale, there appears to be metal zonation outward from Au-As in the heart of the prospect to higher Ag, Ba, Pb, Sb and Zn toward its periphery. Showings C, H, J and K, each of which has elevated levels of one or more of these elements, are located to the north and south of the carbonate-altered schists and may mark the limits of the hydrothermal system in these directions. No equivalent "peripheral" veining has been found to the east or west, implying that the system could extend in these directions under till and talus cover.

To date exploration on the T-Bill prospect has been oriented toward identifying high-grade veins or vein swarms amenable to underground mining. While this should remain the highest priority, drilling has indicated potential for broad zones of lower-grade mineralization. As an example, hole 84-2 averaged 0.62 g/tonne Au across 166 metres, despite assuming zero grade for unsampled sections, and hole 83-2 averaged 1.17 g/tonne Au across 149 metres; both holes bottomed in mineralization.

Although visible gold was noted in core, no metallics (screen) assaying was carried out on it prior to the current program. Four of the 2001 rock and core samples exceeded 5000 ppb Au on initial analysis and were subjected to metallics assaying. Three of the four samples showed coarse gold to be a significant factor, with the grade increasing by 22 to 113% with metallics assaying. It is very likely that some of the better intersections previously reported by Du Pont and Cominco were substantially under-reported by not recognizing the presence of coarse gold.

The intrusion-related gold mineralization at the Park prospect has received less exploration and is not as well understood as the mesothermal T-Bill veining. At the Park prospect, a 500 x 900 metre open-ended Au-Cu<sup>±</sup>-soil geochemical anomaly overlies hornfelsed, silicified and pyritized volcanics. Limited prospecting in 2001 in this anomaly yielded up to 3590 ppb Au in grab samples of fairly mundane-appearing rocks, indicating potential for extensive low-grade mineralization.

The T-Bill and Park prospects represent kilometre-scale gold-mineralizing systems within a few kilometres of each other. The T-Bill prospect contains high-grade quartz vein structures localized within an area of lower grade alteration and mineralization measuring 1200 metres by 2300 metres. The Park prospect shows similar widespread gold mineralization and has yet to be tested by drilling. The large magnetic low, and coincident alteration, anomalous soil geochemistry and high-grade gold values in rock sampling and diamond drilling programs indicate the presence of a large, gold-bearing hydrothermal system at the Bill Property.

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