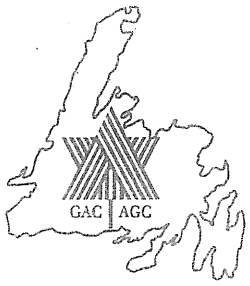


GEOLOGICAL ASSOCIATION OF CANADA
NEWFOUNDLAND SECTION

"New Showings in Old Rocks"

Fall Field Trip Guidebook

Northeast Avalon Zone
October 13 - 15, 2000

Leaders: Cyril O'Driscoll, Geological Survey Branch
Tim Froude, Cornerstone Resources
Ramsey Way, Matty Mitchell Room
John Hinchey, MUN

New Showings in Old Rocks

C. F. O'Driscoll, T. Froude, R. Way and J. G. Hinchey

The introduction and descriptions for Day 1 for the eastern Avalon Peninsula have been adapted from O'Brien et al. (1998).

INTRODUCTION

Regional Setting of the Avalon Zone

The Avalon Peninsula lies at the eastern edge of the Appalachian Orogen on the Island of Newfoundland. The peninsula is situated within the larger Avalon Zone, the easternmost of the four principal tectonostratigraphic divisions of the Newfoundland Appalachians (Williams, 1979; Figure 1). The Avalon Zone extends offshore to the eastern edge of the continental margin, and has a width nearly twice that of the orogen as a whole. Much of this eastern (or "Avalonian") margin of the Appalachians is formed by late Neoproterozoic volcano-plutonic arcs and marine to terrestrial sedimentary basins of peri-Gondwanan paleogeographic affinity (O'Brien *et al.*, 1996) that range in age between approximately 760 and 540 Ma. In southeastern Newfoundland, these are capped unconformably by a Lower Paleozoic shale-dominated cover sequence with an Acado-Baltic faunal assemblage (*see* Boyce, 1988), distinct from that found in similar-aged platformal rocks on the western (North American) Appalachian margin.

The same late Neoproterozoic and earliest Paleozoic rocks continue southwestward from Newfoundland through Maritime Canada, New England and into the Carolinas and Georgia, in a continuous Appalachian tectonostratigraphic belt that is positioned outboard of early to mid-Paleozoic Iapetan (e.g. Appalachian-cycle) arc and continental margin successions (Figure 2). Analogous rocks comprise the southeastern margin of the Caledonides of Wales and England, inliers in the European Variscides (Cadomian belt), and extensive terranes within the Pan-African orogenic system. The Late Neoproterozoic Avalonian rocks record the development of a larger peri-Gondwanan orogenic system that is similar in scale and – in a general way – tectonic setting to the modern Pacific Rim magmatic arcs, i.e., the Andean belt of South America. Parts of this larger Avalonian-Cadomian-Pan African belt, including those rocks of the Newfoundland Avalon Zone, were reworked within or incorporated into the Appalachian Orogen during varied stages (e.g. Penobscottian, Salinic, Acadian, Alleghenian) of Paleozoic orogenesis.

The defining Proterozoic character of the Avalonian belt, both within and outside the Appalachian system, is linked to widespread magmatic activity, the peak of which occurred between about 645 and 545 Ma. At this time, extensive magmatic arcs developed in a variety of arc and back-arc or analogous continental exten-sional settings. Construction of these volcano-plutonic arcs coincided with, and in many cases was succeeded by, the accumulation of thick and diverse marine, deltaic and terrestrial siliciclastic sediments in basins of variable dimension, setting, complexity and age. These sediment successions are most completely preserved in Newfoundland, particularly on the Avalon and Bonavista peninsulas.

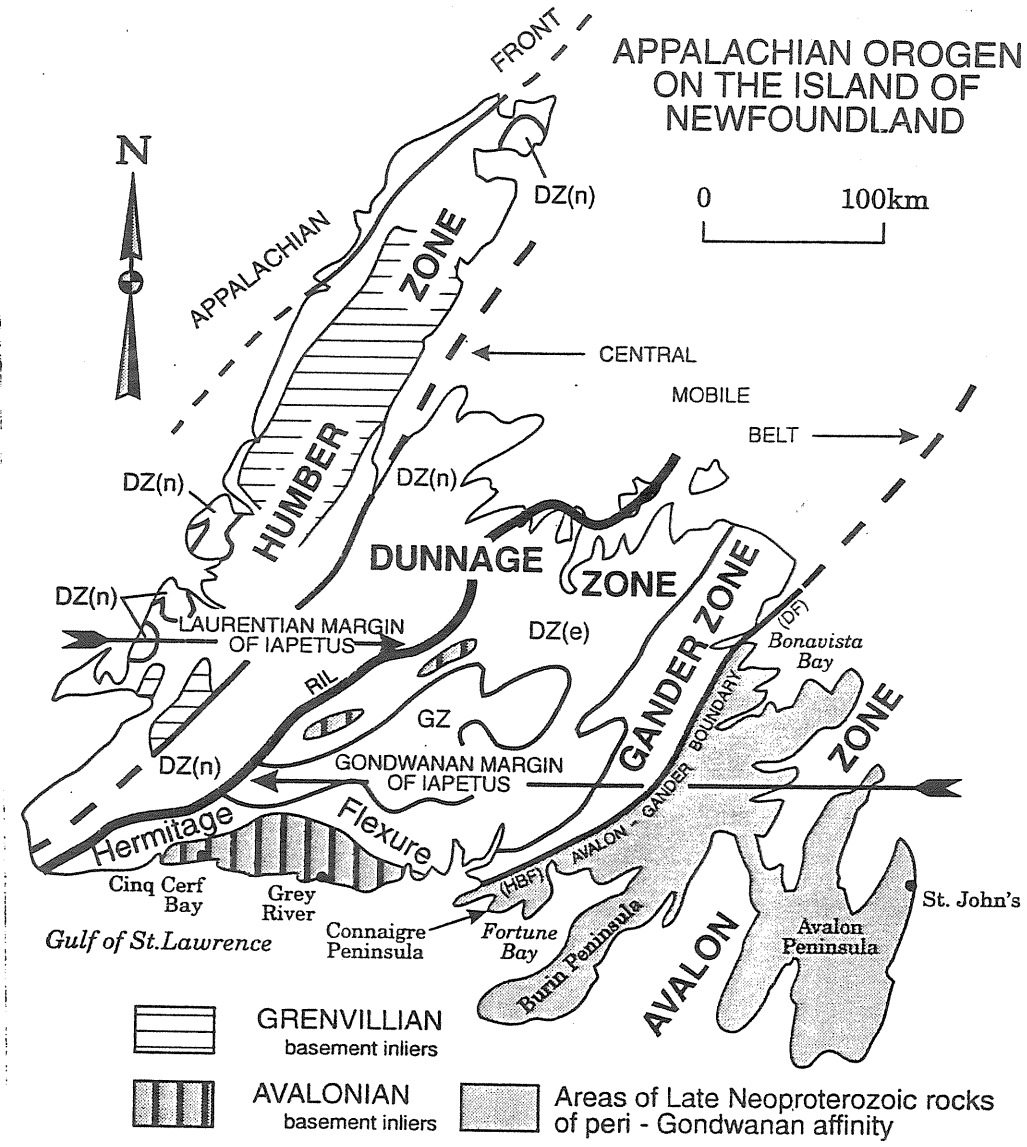


Figure 1. *Tectonostratigraphic subdivision of the Newfoundland Appalachians showing distribution of Avalonian rocks. DZ(e)= Dunnage Zone: Exploits subzone; DZ(n)= Dunnage Zone: Notre Dame subzone; GZ= Gander Zone; HBF= Hermitage Bay Fault; DF= Dover Fault; RIL= Red Indian Line (from O'Brien et. al. 1996)*

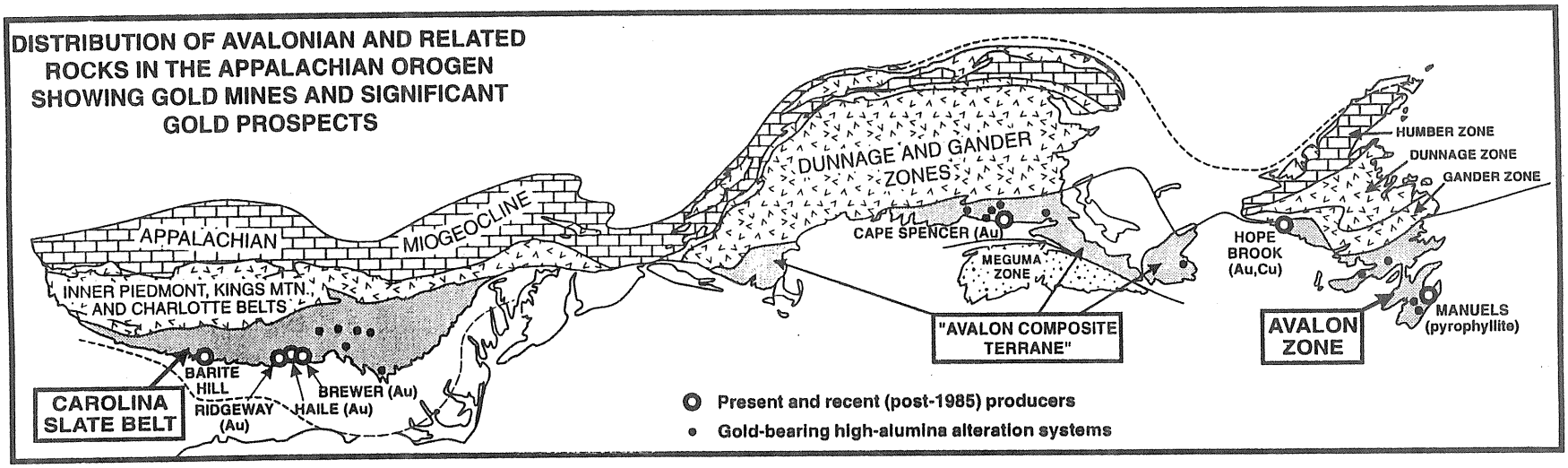


Figure 2. *Distribution of Avalonian and related rocks in the Appalachian Orogen showing gold mines and significant gold prospects(modified from Williams and Hatcher, 1983).*

Many of the late Neoproterozoic magmas generated at this time rose to very high levels in the crust and were emplaced onto the surface as subaerial, caldera-vented volcanic rocks. In a number of instances, these magma chambers were the driving force behind large-scale hydrothermal convective systems active at high levels in the crust. The resultant hydrothermal alteration was, in some cases, accompanied by the deposition of gold, with or without silver, copper and in some instances zinc and arsenic, in a variety of volcanic, hypabyssal and plutonic settings. The acumulation of latest Neoproterozoic marine, deltaic and terrestrial sediments – the latter associated with subaerial mafic and felsic flows – are also metallogenically significant, both from the point of view of sedimentary exhalative Pb-Zn mineralization and volcanic redbed-style copper mineralization, amongst other possibilities.

Geology of the Avalon Peninsula: A Thumbnail Sketch

The eastern parts of the Avalon Peninsula is cored by a broad, north-south elongated periclinal dome (Holyrood Horst) of late Neoproterozoic, primarily subaerial volcanic and coeval plutonic rocks that have historically been assigned to the Harbour Main Group and the Holyrood Intrusive Suite (King, 1988a, 1990; O'Brien and O'Driscoll, 1996; O'Brien *et al.*, 1997, 1998; *Figure 3*). These low-grade rocks, which characteristically lack penetrative deformation, yield a variety of late Neoproterozoic U/Pb zircon ages (Krogh *et al.*, 1988), most of which fall in the bracket 640 to 580 Ma. This volcano-plutonic core contains outliers of marine siliciclastic rocks and is flanked by a younger, shoaling-upward succession of marine, deltaic and fluviatile siliciclastic rocks (Conception, St. John's and Signal Hill groups, respectively; e.g., King, 1988) concentrically disposed around the older succession.

Locally, the base of the marine succession is unconformable on the earlier volcano-plutonic rocks. An estimate of minimum total composite thickness of the stratified succession would be in the range of 7 to 10 km (e.g., King, 1988a). Tuff beds in the upper Conception Group are dated at 565 Ma; the age of the base of the flanking marine succession is largely unconstrained (Dunning, *in* King, 1988b).

The Conception Group in the southern Avalon Peninsula is locally intruded by a suite of gabbros and granites, which includes the Whalesback Gabbro and related rocks. A thick bimodal volcanic series (Bull Arm Formation) occupies a stratigraphic position above marine siliciclastic rocks in the western Avalon Peninsula and along the Isthmus of Avalon. These volcanic rocks pass up into fluvial and molasse-facies clastic rocks, part of the Musgravetown Group; correlatives of these late bimodal volcanic rocks may lie within the Holyrood Horst. A shale-rich cover of Early Cambrian to earliest Ordovician age lies with pronounced angular discordance on various levels of the folded and faulted Proterozoic succession (e.g., Hutchinson, 1962).

Early Silurian mafic sills and related intrusions are emplaced into this Cambrian cover in the southwestern part of the Avalon Peninsula (Greenough *et al.*, 1993). Diabase of Mesozoic age has intruded the Proterozoic succession, and coincides with a 110-km-long magnetic lineament that trends in a north-easterly direction across the southeastern Avalon Peninsula (Papezik and Hodych, 1980). A regional magnetic high of similar orientation parallels the south shore of Conception Bay, locally
coinciding with exposure of post-tectonic diabase, possibly of similar age.

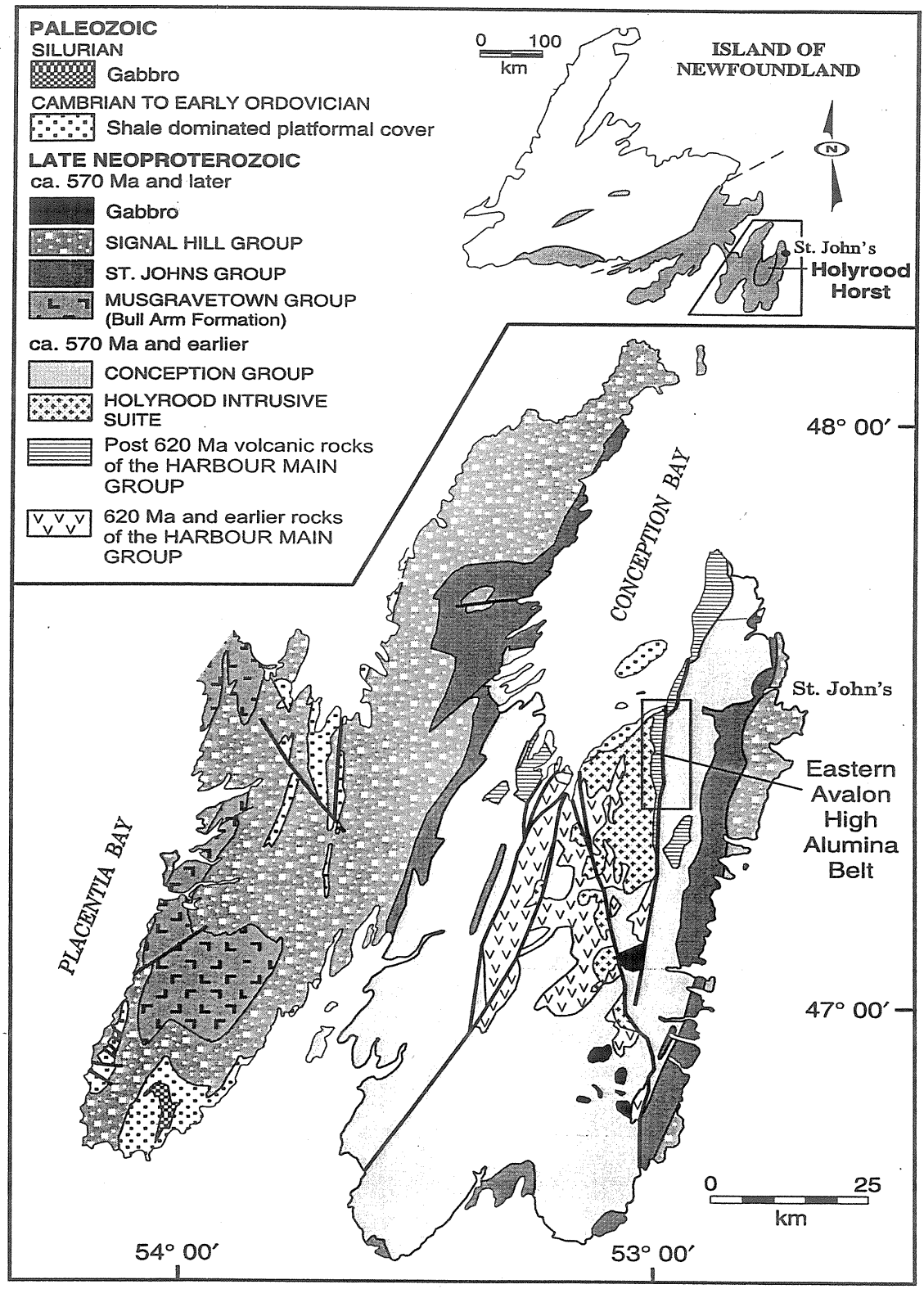


Figure 3. *Simplified geological map of the Avalon Peninsula (modified from King, 1998)*

STYLES AND SETTING OF HYDROTHERMAL ALTERATION ON THE EAST-CENTRAL AVALON PENINSULA

Late Neoproterozoic plutonism and volcanism, as recorded in the east-central Avalon Peninsula, was locally associated with widespread hydrothermal activity, and the development of significant areas of argillic, advanced argillic and phyllic alteration (*see* O'Brien and O'Driscoll, 1996b; O'Brien *et al.*, 1997a, 1997b, 1998 and references therein). Alteration occurred at high crustal levels, within the epithermal and porphyry domains. On a regional scale, the volcanic-hosted alteration and related precious and base-metal mineralization is typically preserved near the margins of late Neoproterozoic intrusions and, in many instances, near the boundary with overlying late Neoproterozoic sedimentary basins (Figure 1-1). Mineralization and alteration is, in places, associated with zones of relatively high strain, although in most instances, much or all of the alteration is pre-tectonic.

The largest continuous zone of hydrothermal alteration on this part of the Avalon Peninsula is the 'eastern Avalon high-alumina belt' of Hayes and O'Driscoll (1990) (Figure 1-2). This extensive area of epithermal-style alteration is sited along the eastern side of the Holyrood Horst, adjacent to the Holyrood Intrusive Suite. Alteration is developed primarily in subaerial pyroclastic volcanic rocks, and to a lesser degree in comagmatic plutons. Alteration is exposed along a strike-length of more than 15 km; the zone has a maximum width of about 1 km. Its northern extension is covered by a thin, gently dipping to flat-lying early Paleozoic platformal sedimentary succession. This zone, best known for its deposits of pyrophyllite, including the Oval Pit Mine, is also host toepithermal gold mineralization related to high- and low-sulphidation style hydrothermal alteration.

The volcanic succession that hosts much of the alteration is characterized by subaerial, rhyolitic to dacitic volcanic rocks. These include caldera-facies thicknesses of welded and variously flattened, pumice-rich ash-flow tuffs, which are stratigraphically associated with dome-facies flows and breccias of broadly similar composition. The hydrothermal system produced extensive zones of argillic, advanced argillic and massive silicic alteration, locally affecting or subsequently overprinted by hydrothermal breccias. The observed mineralogy (in particular the assemblage pyrophyllite, diaspore, barite) is most consistent with an advanced argillic alteration system related to a magmatically derived high-sulphidation system. In the northern part of the belt, however, similar volcanic rocks host a different style of hydrothermal alteration, in the form of gold-bearing veins related to low-sulphidation (adularia-sericite) alteration.

Hydrothermal alteration in this area is primarily pre-tectonic with respect to the regional deformation and most likely has followed the original 'plumbing' system of the host Late Neoproterozoic magmatism. Syn-volcanic structural and lithologic controls are similarly linked to primary volcanic architecture. The advanced argillic alteration zone, the associated pyrophyllite deposits, and the gold mineralization in the eastern Avalon high-alumina belt most probably constitute parts of a large, tilted hydrothermal system spatially and genetically related to one or more phases of the Holyrood Intrusive Suite. The potential for significant gold mineralization within this system remains high.

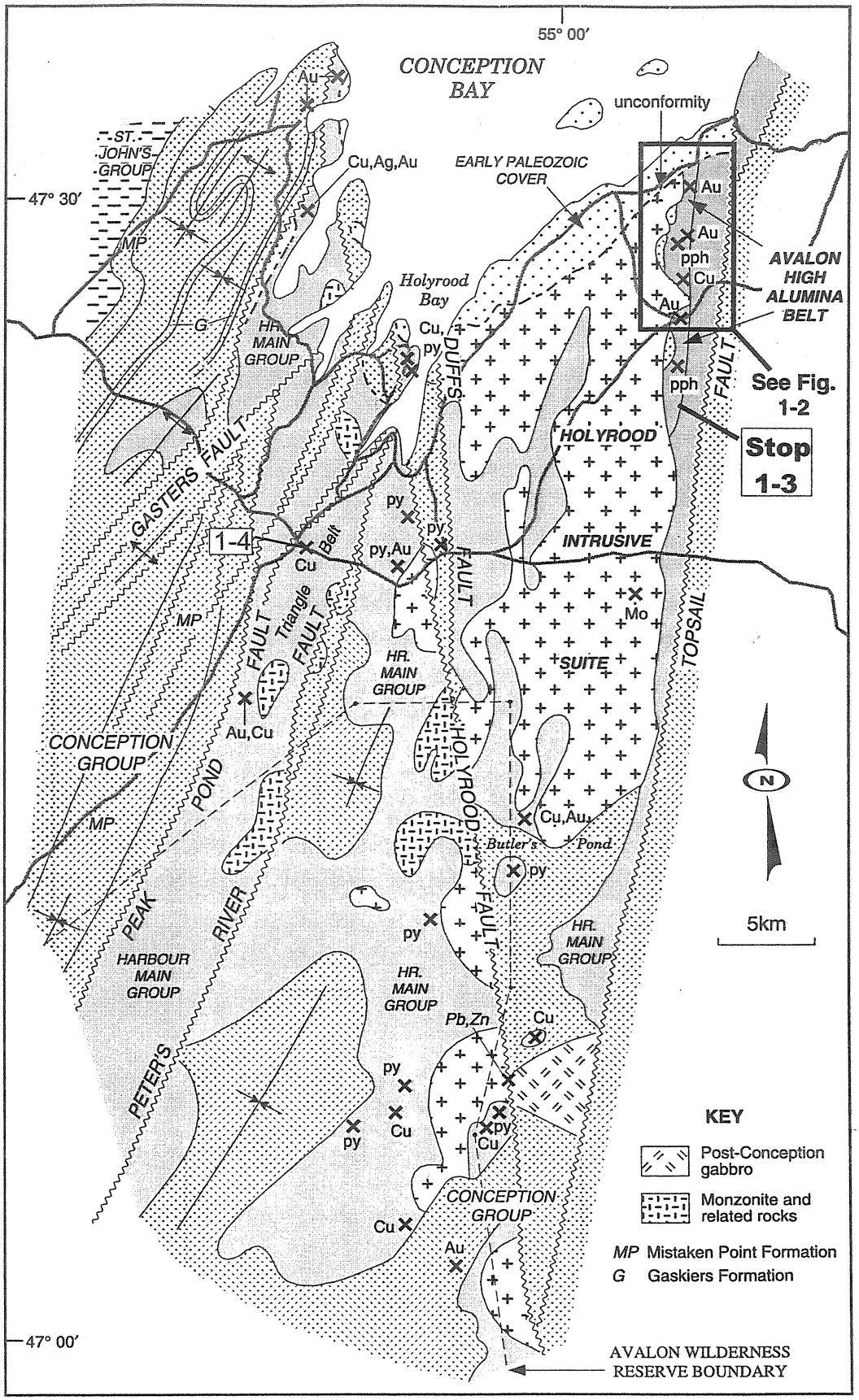


Figure 1-1. *Simplified geology of the Holyrood Horst*

The volcanic rocks in this belt are intruded by polyphase, mainly high-level plutonic rocks. These display evidence of extensive magmatic degassing, and are affected by hydrothermal alteration. There is a range in composition and texture on a regional scale, from gabbro through granite to quartz-feldspar porphyry, with ample evidence of magma mixing. Plutons include I-type hornblende-biotite intrusions of calc-alkaline chemical affinity. Field and existing geochronological evidence indicate that these are coeval with various parts of the intruded volcanic pile. The intrusive suite includes, as presently outlined, pre- and/or syn-alteration and post-alteration phases. Altered plutonic rocks are exposed in a number of areas south and along strike of the eastern Avalon high-alumina belt. Silica-altered intrusions locally carry disseminated pyrite, chalcocite, chalcopyrite, bornite and molybdenite, and locally contain hydrothermal magnetite veins.

Volcanic-hosted hydrothermal alteration in the Avalon Peninsula, like elsewhere in the larger Avalonian belt, occurs primarily at or near the boundary with Proterozoic sedimentary rocks (depositional boundaries and/or basin margin faults), or at or near the boundary with felsic to intermediate elements of coeval plutonic suites. Zones of relatively high strain are at least spatially associated with alteration on the Avalon Peninsula, although in most cases alteration has pre-dated the latest strain. There is significant potential for further discoveries within the eastern Avalon high-alumina belt, and elsewhere in the Holyrood Horst.

The low-sulphidation system represented in the north of the eastern Avalon high-alumina belt may be broadly coeval with, and distal to, the high-sulphidation system typified by the Oval Pit Mine and related advanced argillic alteration in the eastern Avalon high-alumina belt. Low- and high-sulfidation deposits are two members of the tripartite epithermal–porphyry clan, which also includes porphyry (gold–copper) deposits. If any one type of deposit is present in a magmatic system, the potential for others is high. Intrusion-related gold occurrences such as those at Triangle Pond and at Butlers Pond (12.2g/tAu; 6% Cu) (*see*: O'Brien and O'Driscoll, 1996b and O'Brien *et al.*, 1997, 1998 and references therein), located on the west and eastern flanks of the Holyrood Horst, are strong evidence that this third member of the epithermal–porphyry gold clan is preserved in the Avalon Peninsula. The occurrence of silicic alteration with disseminated Cu, Mo and Fe sulphides, coupled with the local development of hydrothermal magnetite veins and copper mineralization within plutons of the Holyrood Intrusive Suite (both in the eastern Avalon high-alumina belt and farther south, for more than 30 km), clearly points to potential for porphyry-style alteration and mineralization. The geological setting of extensive (calc-alkaline) subaerial volcanism, the existence of composite comagmatic high-level plutonism, the observed widespread advanced argillic alteration, and the presence of hydrothermal hematite and, locally, magnetite and K-feldspar, further underscore the potential for porphyry-style Au–Cu mineralization on the Avalon Peninsula.

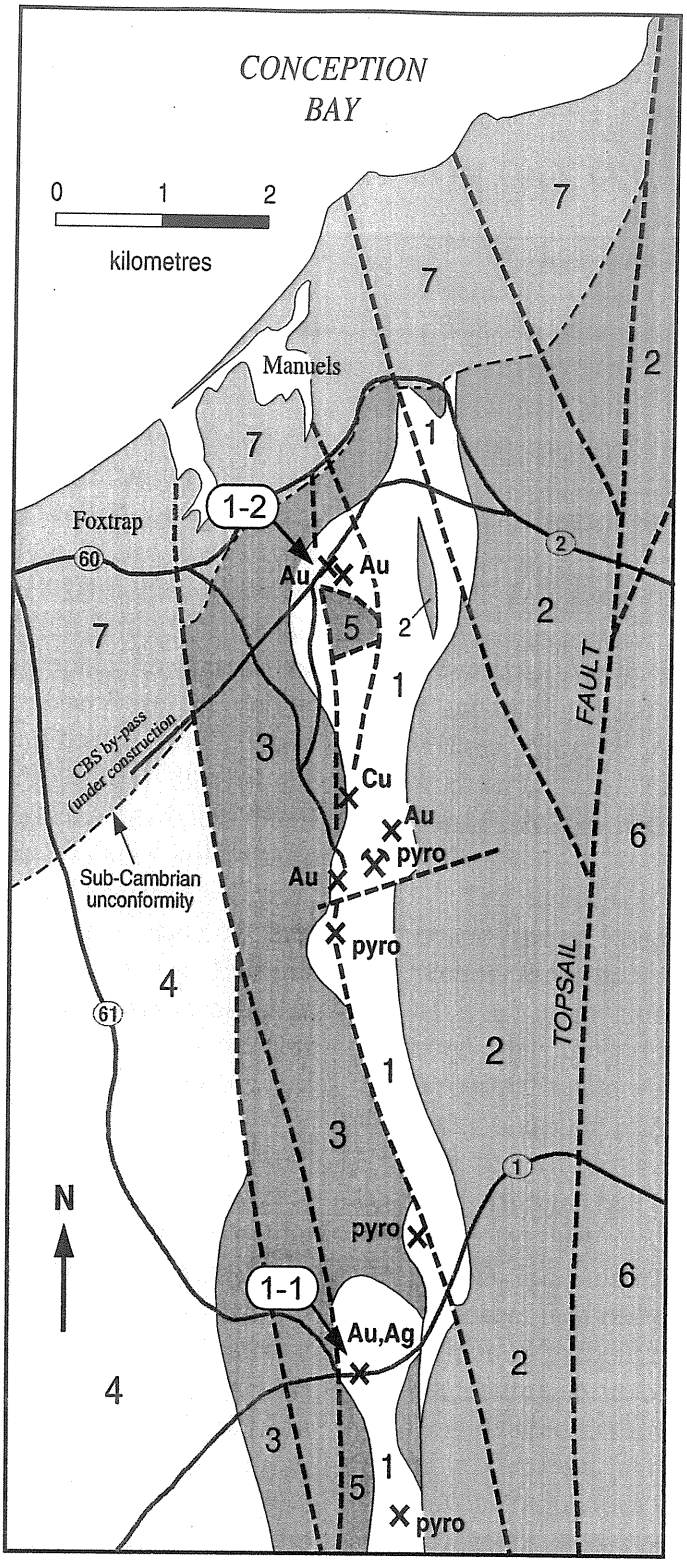


Figure 1-2. *Location of field trip stops 1-1 to 1-2 in the eastern Avalon High-Alumina Belt; (map updated from Hayes and O'Driscoll 1989; scale approximately 1:50 000). Legend: 1= eastern Avalon high-alumina belt and related rocks of the Harbour Main Group; 2= unseparated mafic and felsic flows and sediments of the Harbour Main Group; 3= unseparated monzonite, gabbro, granite and porphyry phases of the Holyrood Intrusive Suite, in many instances with hydrothermal alteration; 4= mainly weakly altered (chlorite- epidote) quartz-rich biotite granite (Holyrood Intrusive Suite); 5= sediments of uncertain stratigraphic affiliation; 6= Conception Group marine sediments; 7= Cambrian cover sequence of mainly shaly rocks.*

TRIP ITINERARY FOR DAY ONE

Three vehicles will leave Natural Resources Building at 11:30 am, Friday, October 13 and drive to Alexander Murray Building to meet with remaining participants.

The field trip departs the Alexander Murray Building at approximately 12:00 noon en route to the intersection of the Trans Canada Highway (Route 1) and the Foxtrap Access Road (Route 61). Geologically, we are travelling downward through much of the late Neoproterozoic stratigraphic section of the eastern Avalon Peninsula: from the deltaic sandstones and shales of the St. John's Group (which underlie much of the city of St. John's), down through the Mistaken Point Formation and other marine siliciclastic sedimentary rocks of the Conception Group, across the Topsail Hill fault system, into volcanic and plutonic rocks of the Harbour Main Group and Holyrood Intrusive Suite, at the eastern edge of the Holyrood Horst. Our first stop is a roadcut on the Foxtrap Access Ramp.

The Day 1 itinerary includes 5 stops that will give a 'birds eye' view of some of the rock types within this part of the Avalon Zone and various styles of alteration and associated mineralization. **Stops 1-1** to **1-3** are located in the *eastern Avalon high-alumina belt* (AHAB Zone of Hayes and O'Driscoll, 1990), an extensive area of hydrothermal alteration, greater than 15km long and up to 1 km wide, located along the eastern flank of the Holyrood Horst. **Stop 1-4** is located west of the Holyrood Intrusive Suite, within Cu-, Cu-Au-, and Cu-Ag-Au bearing subaerial mafic flows (and associated intrusive rocks) that locally form some of the youngest parts of the Neoproterozoic volcanic succession of the eastern Avalon Peninsula.

We then head west across the Avalon Peninsula to the Doe Hills area and look at potassium-altered rhyolites of the Bull Arm Formation (**Stop 1-5**). We will then proceed on to the Hotel Clarenville for rest and sustenance (liquid and solid).

Descriptions of Stops

***STOP 1-1*: Roadcut Prospect**

Location: *North side of Route 1 (Trans-Canada Highway) on ramp onto the Foxtrap Access. Stop at outcrop on north side of highway.* ***CAUTION: HIGH SPEED TRAFFIC ON RAMP!***

The outcrop on the north side of the west-bound lane on Route 1 exposes a 100-m-wide section through a locally auriferous (up to 11.2 g/t Au) zone of advanced argillic alteration developed in the same late Neoproterozoic volcanic succession as in today's earlier stops. The prospect is sited near the western edge of the eastern Avalon high-Alumina belt, approximately 4 km along strike to the south from the Oval Pit pyrophyllite mine and the Mine By-Pass prospect. Hydrothermal alteration (silica–sericite ± pyrophyllite ± chlorite ± pyrite ± magnetite) is developed in a succession of flow-banded rhyolite, pumice-rich lapilli tuff or tuff-breccia, and lithophysae-bearing ash flow material, near the contact with overlying tuffaceous sedimentary rocks, and within several hundred metres of the boundary of the host volcanic rocks with monzonite-diorite-granite complex and the edge of the Holyrood Intrusive Suite. The latter are exposed nearby, immediately south of Route 1.

Much of the outcrop consists of zones of

silica alteration, containing in excess of 90 percent (by volume) of silica-rich material, with remnant sericite and/or pyrophyllite; small pink patches seen in the western part of the outcrop are relict (silica-altered) lithophysae. Silica-rich (silica-flooded?) material contains blocks of sericite ± pyrophyllite ± silica alteration, which is developed parallel to fine eutaxitic- and flow-banding in felsic rocks. Late subhorizontal extensional quartz veins crosscutting sericite-silica altered rocks exposed at the western edge of the outcrop, are related to late vertical movements along the western edge of the high-alumina belt.

The larger silicic alteration zone contains areas of 'pebbly' breccia, composed of dark grey sericite-pyrophyllite-pyrite fragments in a silica matrix, as well as zones of more angular to subrounded breccia with silicic-altered rhyolitic material in a chlorite-rich matrix. Both are present within a significant, ca. 10m-wide zone of gold mineralization in the central part of the outcrop. A chip sample taken across this zone averaged 3 g/t over 10 m (P. Saunders, personal communication). Anomalous gold values occur in the pebbly breccias, but highest gold values (up to 11.2 g/t) are obtained from silica-rich breccia with chlorite–pyrite (plus minor K-feldspar and muscovite) matrix and from felsic hydrothermal breccia with banded rhyolite clasts (O'Brien and O'Driscoll, 1996a, 1997: O'Brien *et al.*, 1997, 1998). Pyrite occurs as disseminations, clots and thin veinlets within the matrix of the breccias. The auriferous breccias yield assays up to 210 g/t Ag and 2 g/t As.

STOP 1-2: **Steep Nap Gold Prospect: Low sulphidation style, auriferous quartz - K-feldspar - hematite veins and breccias**

Location: *Steep Nap Road: Drive north along Fox Trap Access to new CBS By-pass road. Turn east (right), and proceed to Minerals Road. Drive south (right) to Anchorage Road (on the left). Turn on to Anchorage Road continue to Steep Nap Road Access (Before you reach the underpass). Turn right . Stop at long exposure on the south side of the road.* ***Please do not hammer that part of the outcrop with the main banded Au-bearing vein bundle;*** *samples of this texturally distinctive material can be collected from amongst the loose blocks underfoot.*

The blasted outcrop on the south side of the road forms part of the Steep Nap Prospect. Discovered in 1995, the prospect consists of gold-bearing hydrothermal quartz-hematite-K-feldspar veins in pyroclastic and hydrothermal breccias within Harbour Main Group pyroclastic rocks. The veins in this exposure have many of the characteristics of low sulfidation (adularia-sericite) epithermal gold mineralization. This outcrop is a superb example of one of three main types of late Neoproterozoic epithermal mineralization/ alteration in the eastern Avalon high-alumina belt (e.g., high-sulphidation-low-sulphidation-porphyry "clan").

We are located in the northern part of the eastern Avalon high-alumina belt, about 3 km to the north of the Oval Pit pyrophyllite mine. The largest veins in this outcrop carry up to 3.3 g/t Au (O'Brien and O'Driscoll, 1996a, 1997; O'Brien et al., 1998). This 60 m long outcrop of felsic pyroclastic rocks contains at least 100 veins, ranging in size from 1 mm up to 1.7 m; most are less than 2 cm wide. Several types of breccia are also exposed. The main auriferous material forms a 1.7 m wide composite vein composed of crustiform bands of K-feldspar–quartz–chalcedony and minor hematite. Very little sulfide mineralization is

present in any of the veins. The largest auriferous veins have been traced, with consistent thickness, intermittently along strike for at more than 300 m.

The earliest veins are crustiform-banded, and consist of grey recrystallized chalcedony and white quartz, with or without minor chlorite and hematite. A second group of veins consist of crustiform and locally colloform bands of K-feldspar, grey recrystallized chalcedony, white quartz and hematite. The latest veins are characterized by weakly banded quartz along the margin, bounded by crystalline comb quartz nearer the centre, surrounding a hematite core. In many instances, especially in the larger veins, internal brecciation of the vein material by hematite has occurred. Hematite fracturing of the surrounding outcrop occurs locally.

The earliest hydrothermal breccias are gold-bearing and have a matrix of grey recrystallized chalcedony and minor K-feldspar, that forms cockade textures cored by sericite-chlorite-altered clasts. This breccia is crosscut by the main adularia-quartz-hematite vein, and by smaller veins cored by comb-quartz and hematite. Other, later breccias have either black, chlorite-rich and/or brown, hematite-rich matrix. These breccias contain fragments of banded vein material, and are thus either late syn-, and/or post-veining. The two matrix types are typically mixed. The late breccias with vein material fragments return anomalous gold values.

Sericite, chlorite, and hematite are the main wall-rock alteration phases; there is also evidence of some potassic and silica alteration. Most (although not necessarily all) of the more intense sericite alteration is post-veining, and related to brittle deformation. Less intense but more pervasive sericite alteration is present in the northern half of the outcrop. Chlorite alteration is mainly confined to thin halos around pre-veining fractures and veinlets. A more extensive area of chloritic alteration (ca. 2 m wide) is developed adjacent to (west of) the widest vein. Hematite alteration occurs sporadically throughout the outcrop, both as early remobilization halos and later patches and halos around late veinlets and fractures.

STOP 1-3: Foxtrap Property: Polymetallic (Pb - Zn - Cu - Ag - Au)

Location: *Pastureland Road: Return to Foxtrap Access Road and proceed to TCH . Turn right on dirt road* ***before*** *going up ramp towards St. John's. Drive south to area of stripping and trenching along side of road.*

This property is a recently discovered polymetallic occurrence situated in the southern part of the eastern Avalon high-alumina belt. Recent grab samples have given assay results as follows: 8.0% Zn, 5.2% Pb, 0.80% Cu, 1.42 oz/t Ag and 2.13 g/t Au. Because of its polymetallic nature, it is thought that this may be deposited in a submarine to subaerial environment during the main alteration episode that took place along the belt. These types of deposits are at the VMS - epithermal transition and in part are typical of VMS deposits but also resemble subaerial epithermal deposits. Subaqueous epithermal deposits have been documented around the world and include a continuum of deposit types that may contain auriferous polymetallic sulphides, pyritic gold-rich stockworks, and stratiform Au - Ag barite deposits (Schroeter, 2000).

The following page is reproduced from a promotional brochure on the property.

Foxtrap Property
Pb-Zn-Cu-Ag-Au

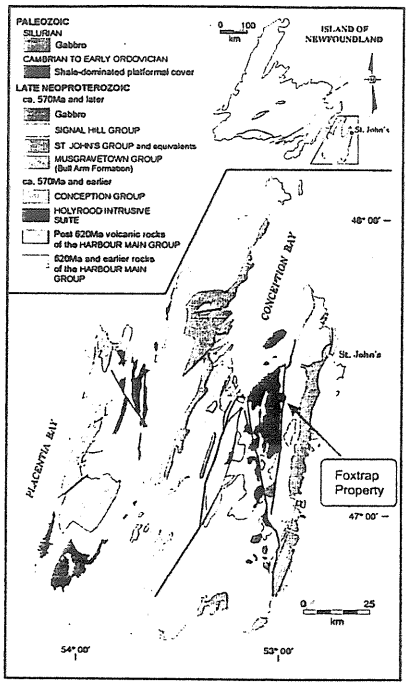
The Foxtrap Prospect is a polymetallic (Zn, Pb, Cu, Ag, Au) sulphide occurrence situated in a narrow belt of mafic and felsic volcanic and sedimentary rocks of Precambrian age, within the Avalon Zone of eastern Newfoundland.

The mineralization occurs in a steeply dipping shear zone, and is hosted by dark green-gray coloured, chlorite-rich rock of possible mafic volcanic origin, which is in contact to the west with a matrix-rich intermediate volcanic fragmental rock. The shear zone has been exposed over an approximate 40 metre width, and for 25 metres along strike (refer to sketch). It is open along strike and to the east. The Zn-Pb-Cu mineralization appears to pre-date the shear zone, and was incorporated into it. The mineralization is interpeted to represent part of a VMS alteration zone that was micaceous or clay rich and therefore instrumental in shear zone development.

The chlorite schist contains variable amounts of very fine-grained disseminated pyrite (from traces to almost 10%). Some base metals are associated with the pyrite.

Most of the base metal sulphides occur as lenses or large knockers composed of a mixture of very fine-grained sphalerite-galena-minor pyrite/chalcopyrite either in silica gangue, or as vague veinlets cutting very strongly altered rock. Knockers may be up to 2 metres wide.

Three trenches have been completed over this prospect. Significant polymetallic mineralization was exposed in each trench.



For more information contact:

Tom Gosine
Telephone: (709) 368-1751
Fax: (709) 368-7701
E-Mail: tgosine@calvin.stemnet.nf.ca

Highlights of Trenches:
(Data from vendors and Fort Knox Gold Inc.)

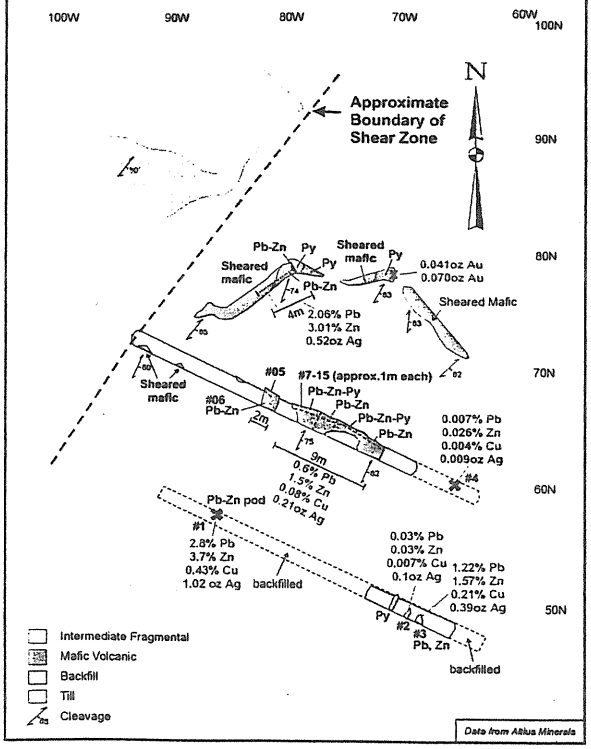
- 4 metres—3.01% Zn, 2.06% Pb, 0.52 opt Ag
- 12 metres—with one metre sections assaying up to 3.50% Zn, 2.53% Pb, 0.19% Cu, 0.38 opt Ag.
- 1 metre—3.70% Zn, 2.80% Pb, 0.43% Cu, 1.02 opt Ag. Grab)

  Grab Samples of semi-massive sulphides from several of these lenses assayed:

- 5.70% Zn, 2.47% Pb, 0.93% Cu, 1.48 opt Ag, 180 ppb Au
- 5.10% Zn, 3.60% Pb, 1.13% Cu, 1.43 opt Ag, 146 ppb Au

  Barium is also anomalous (> 2200 ppm) with this mineralized zone.

Map of Foxtrap Property



STOP 1-4: Triangle Belt

Location: *Stop 1-4 is a roadcut adjacent to the west-bound lane of Route 1, several hundred metres east of Triangle Pond.*

A number of small copper (chalcocite, bornite, covellite ± chalcopyrite) showings, hosted by basalt flows, tuffs and breccia are present in this, the central block of the Harbour Main Group. The basalt-hosted copper occurrences on a regional scale are spatially associated with altered intrusive rocks (here and elsewhere in the Triangle Belt; see O'Brien and O'Driscoll, 1996; O'Brien *et al.*, 1997b). Their origin is uncertain. In some instances, mineralization is not accompanied by any extensive hydrothermal alteration, and bears similarity to volcanic-redbed copper mineralization (as noted by Kirkham, 1995). Elsewhere in the same belt, mineralization is associated with extensive auriferous silica-rich hydrothermal alteration, that is intimately associated with intrusive rocks of mainly monzonitic composition (Rennie, 1989; Beischer, 1991; O'Brien and O'Driscoll, 1996). Here vesicular to massive basaltic rocks and associated diabase, with hematite-chlorite-epidote alteration are intruded by fine to medium grained intermediate intrusive rocks. Calcite and quartz veins and vein breccias associated with chlorite and/or chloritoid and hematite occur in several parts of the outcrop. Veinlets contain weakly elevated gold concentrations. Nearby intrusions are extensively hematitized.

STOP 1-5: ***Bull Arm Formation - potassium altered rhyolites, Doe Hills***

Location: *Large road-cut on the Isthmus of Avalon approximately 6 km past Fair Haven turn off. Previously known as the S-turn before road was adjusted.*

The following description is taken from O'Driscoll *et al.*,1988. The Bull Arm formation forms the base of the Musgravetown Group and overlies the marine sediments of the Connecting Point Group. The contact hes been interpreted as conformable in this area (McCartney, 1967). The same contact, 100 km to the north in Bonaviste Bay, is a well-exposed angular unconformity. The formation is overlain by terrestrial red to green clastic rocks which form the remainder of the Musgravetown Group. In general, the Bull Arm Formation consists of basaltic and rhyolitic lavas, pyroclastics and volcanic sediments with a variable aggregate thickness of 2500 m.

Day 2 of this field trip will be spent looking at rocks of the Bull Arm and overlying formations in Bonavista Bay. There, they contain volcanic-redbed copper mineralization, close to the underlying contact with the Connecting Point Group.

Hughes and Malpas (1971) described the Doe Hills where this stop is located, as containing rhyolitic rocks of exceptional appearance, mineralogy, and chemical composition. They underlie a zone approximately 200 m wide situated at the crest of an anticline (**Figure xx**). The roadcut at this stop offers a section across the anticline with the east limb and the contact with overlying pyroclastic rocks and the interbedded sediments exposed. The rhyolites are conspicuously reddened although some varieties are pale green. They are variably flow banded and autobrecciated. The flow banding can be traced over several metres in places, but more commonly becomes distorted and turbulent over a short distance. This breakdown is the first sign of autobrecciation in which angular rhyolite blocks are caught up in a matrix of the same composition (Malpas, 1971).

The rocks are well jointed and in places contain abundant barite as joint fillings and as a thin film along joint surfaces. Generally there is little or no alteration in the wall rock along the barite veins. Another type of veinlet found in the area consists of quartz ± specularite ± pyrite. In contrast to the barite veins, the quartz-rich veins have diffuse boundaries and the wall rock has undergone some alteration close to the vein.

Barite is widely distributed throughout the Isthmus of Avalon (**Figure xx**). A vein is exposed on the east side of Collier Bay, Trinity Bay, which has been mined intermittently in the past. Reserves are estimated to be less than 27,000 tonnes (Dean and Watson, 1981).

Acording to Hughes and Malpas (1971) plagioclase phenocrysts are ubiquitous in all acidic flows in the general area except in the Doe Hills anticline. Here, the rhyolites contain apparent phenocrysts of turbid, untwinned orthoclase, in some cases intergrown with checker-albite. Some grains of turbid orthoclase preserve plagioclase multiple twinning, implying that the orthoclase has formed by the replacement of plagioclase and does not represent original alkali-feldspar phenocrysts. Thin section study reveals that the groundmass alteration is mainly by epidote replacement.

The chemical composition and mineralogy of the rhyolites in the doe Hills area is that of potash-keratophyres (Malpas, 1971). K2O values range up to 10% in red lavas and the CaO content is up to 12% in pale green volcanic rocks that are rich in zoisite. Hughes and Malpas (1971) and Malpas (1971) conclude that the anomalous composition of the rhyolites could only be derived secondarily. Since the metasomatised rocks are concentrated in an anticlinal crest with evidence of increasing degrees of replacement of plagioclase by orthoclase from the limbs to the crest, and because of the normal chemistryof other rhyolites outside the Doe Hills anticline, Hughes and Malpas (1971) and Malpas (1971) suggest that the metasomatism originated at the time of Acadian deformation. They also suggest that the genesis of these rocks may be similar to those at Yellowstone Park where groundwaters are actively replacing plagioclase by orthoclase at 200°C.

Because of the potassium alteration in these rocks which may have caused by epithermal fluids, this area contains potential for precious metal deposits.

DAY 1 - END OF TRIP - proceed to Hotel Clarenville

DAY TWO

Day 2 will be spent looking at various properties belonging to Cornerstone Resources Inc. These properties contain showings in the lower part of the Musgravetown Group. It is believed that these deposits are volcanic-redbed type. We will assemble in the parking lot at 8:00 am and proceed westward along the TCH to the Thorburn Lake area where the West Princess Property is located. Details of the itinerary will be provided at this time.The following pages contain information on the various properties, as well as a report on the West Princess.

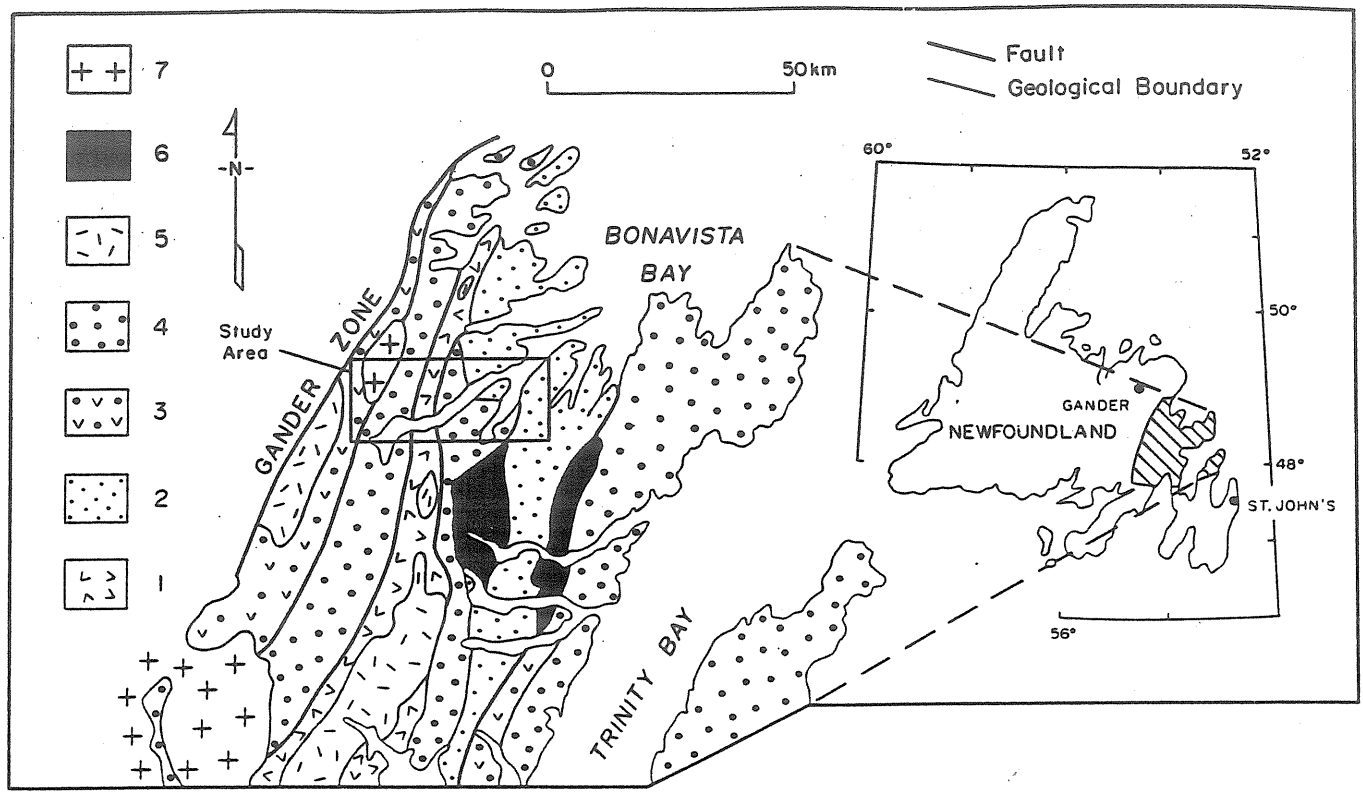


Figure 1. *Generalized geological map of the northwestern Avalon Zone showing the location of the study area (rectangle). 1: Love Cove Group, 2: Connecting Point Group, 3: Musgravetown Group—mainly volcanic rocks, 4: Musgravetown Group—mainly terrestrial sedimentary rocks, 5: Precambrian granite, 6: Cambrian sedimentary rocks, 7: Devonian granite.*

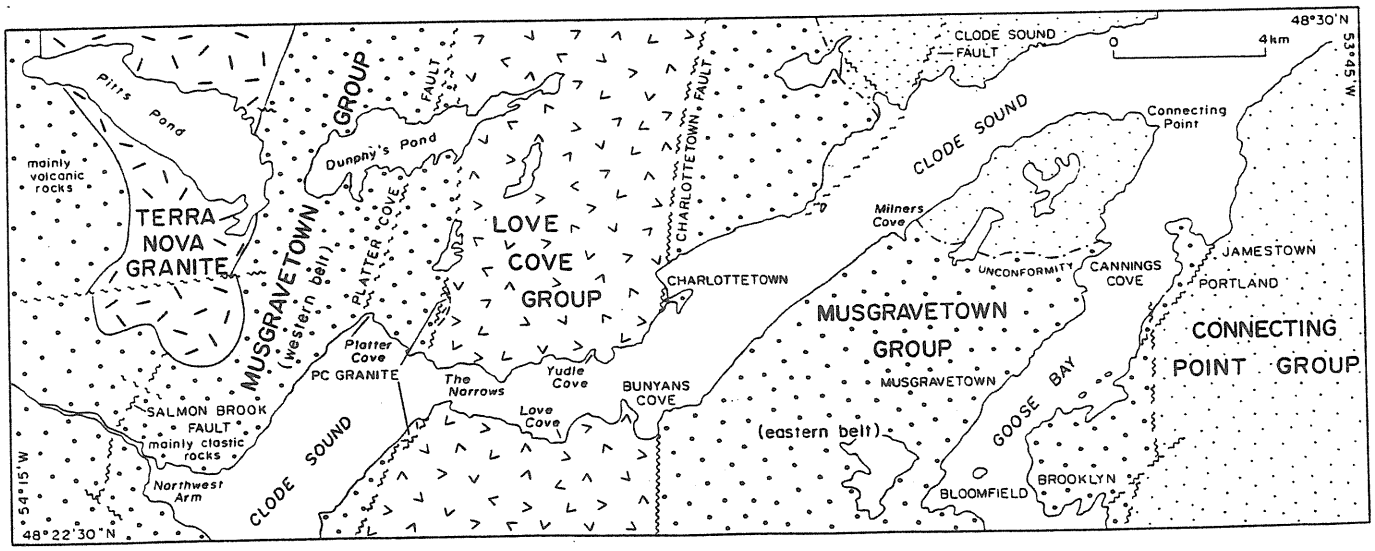


Figure 2. *Major geologic divisions of the study area.*

Preliminary Report on Geological Mapping of the West Princess Property, Eastern Newfoundland

(Prepared by Derek H. C. Wilton Ph.D, P.Geo and Ramsey Way, B.Sc)

The West Princess Property is wholly owned by Cornerstone Resources Inc. It hosts copper mineralization in Neo-Proterozoic Rocks of the prospective Musgravetown Group. The property is located south of Clode Sound near the community of Port Blandford (N.T.S. 2D/08). Exploration by Cornerstone has uncovered 6 separate zones of copper mineralization over a 7 km strike length in the east-central portion of the property, and several other showings,widely scattered over the remainder of the property.

Geological Relationships
Geologically the grid area can be subdivided into six rock types.

Love Cove Group: Furthermost east are polydeformed chlorite and sericite schist(Unit 1), according to O'Brien's (1993) recent mapping of the area.

Musgravetown Group (units 2 - 5)

Bull Arm Formation: The second unit is hematized, amygdaloidal basalt, which crops out to the west of the grid. This unit, which was deposited subaerially, also contains lesser flow top breccias, along with mafic tuffs and agglomerates.

The third unit is the most spectacularly exposed of all and underlies the Mountain View ridge. This unit consists of a large rhyolite dome and associated ash flow tuff apron which crops out to the east and north of the dome. The rhyolite and ash flow tuffs have complex contact relationships with the subaerial basalt flows and tuffs; in part, the felsic and mafic volcanics appear to be consanguineous, but along the western Watershute Steadies, the mafic unit appears to be a roof pendant on the rhyolite. Some hematized, subaerial, amygdaloidal basalt, flow breccia and tuff are present to the east of the rhyolite dome. At the Lori Showing on the TransCanada Highway (TCH), the Unit 5 sandstones are intruded by felsic dykes presumably related to the rhyolite.

Rocky Harbour Formation: The fourth unit crops out to the east of the rhyolite dome and hematized amygdaloidal basalt and consists of mainly basaltic (locally pyritiferous) and gabbroic rocks (variably magnetic) interbedded with green siltstone and tuffs, and white to pinkish siltstones. These mafic igneous rocks are completely different from the Unit 2 lithologies in that they are reduced, and don't have the same degrees of porosity. Conformable and tops up contacts between tuffs and overlying siltstones are locally visible in outcrops to the east. Bedding dips at approximately 42° to the SE. There are also a number of dacitic to rhyolitic dykes cutting the Unit 4 rocks. Outcrops range from pervasively altered, fine- to medium-grained gabbro to porphyritic diabase. Our mapping suggests that there are substantial amounts of gabbroic rock in the area. Sedimentary rocks exposed in Pit No. 1 are most similar to these sedimentary rocks, but contain red-beds interbedded within the green sedimentary units, typical of rocks of the Rocky Harbour Formation.

Crown Hill Formation: Unit 5 makes up the western edge of the grid and consist of well-bedded, undeformed red sandstone with red shale and red conglomerate interbeds. The unit dips shallowly to the west.

Georges Brook Pluton: Unit 6 consists of locally foliated, fine-grained, pink to red biotite granite exposed on the east of the grid on line 8+00 to 12+00 North.

Mineralization

Mountain View Showing: Chalcocite (± bornite and chalcopyrite) occur in quartz vein boulders at the Mountain View Showing. The boulders are part of the talus slope surrounding the northwestern cliff face of the Mountain View ridge. The quartz veins are up to 2 m thick and locally have rhyolite host rock margins. Thinner and much less mineralized quartz veins cut the rhyolite outcrops that constitute the side and top of the ridge, but the very thick and well mineralized veins are only present as boulders. There is no doubt, due their sizes, shapes and lithologies, that the boulders are of local derivation as weathering debris from the ridge. In selvages to the quartz veins, the host rhyolite is bleached and typically exhibits epidote alteration with the quartz. The best assays for all samples analysed were from this showing. Sample RW99-050 assayed at 1.95% Cu and 1.7 oz/t Ag, and selective sample W-20A-95A assayed at 18% Cu and 11.6 oz/ton Ag.

Copper Creek: This showing consists of amygdaloidal basalt cut by epidote-carbonate-prehnite veins. There are two components to the copper mineralization here; (1) minor native copper-filled amygdules in the outcrop, and (2) spectacular native veins and disseminations in mafic volcanic float, note there is intense epidote alteration associated with the disseminations. The best assay from this showing was grab sample CC#3 that contained 0.60% Cu and 2.1 g/t Ag.

Pit No. 1 Showing: Chalcocite (± bornite) is present both within quartz veins cutting oxidized and reduced sandstones and siltstones, and also as fine disseminations in more permeable green siltstones at the Pit No. 1 showing. The quartz veins have produced epidote alteration selvages most especially in the green siltstones. The best assay from this showing was 0.097% Cu (sample W20-070).

Lori Showing: This showing consists of quartz-carbonate veinlets with minor chalcocite cutting red sandstones and siltstones of Unit 1. There is minor fluorite associated with some carbonate veins which may be related to the intrusive felsic dykes; it is not indicative of porphyry-style mineralization as there is no strong alteration associated with the felsics. The best assay from this showing was 0.071% Cu (sample W20-075).

Little White Hills Showing: This showing consists of hematized, amygdaloidal basalts with scattered native copper-filled amygdules. Epidote (± carbonate) alteration is present as amygdules and veins. The best assay for this showing was 0.009% Cu (RWP99-014) .

Island Pond Showing: This essentially consist of pyritiferous siltstone. Sample RWP99-028 contained low concentrations of Au and base metals.

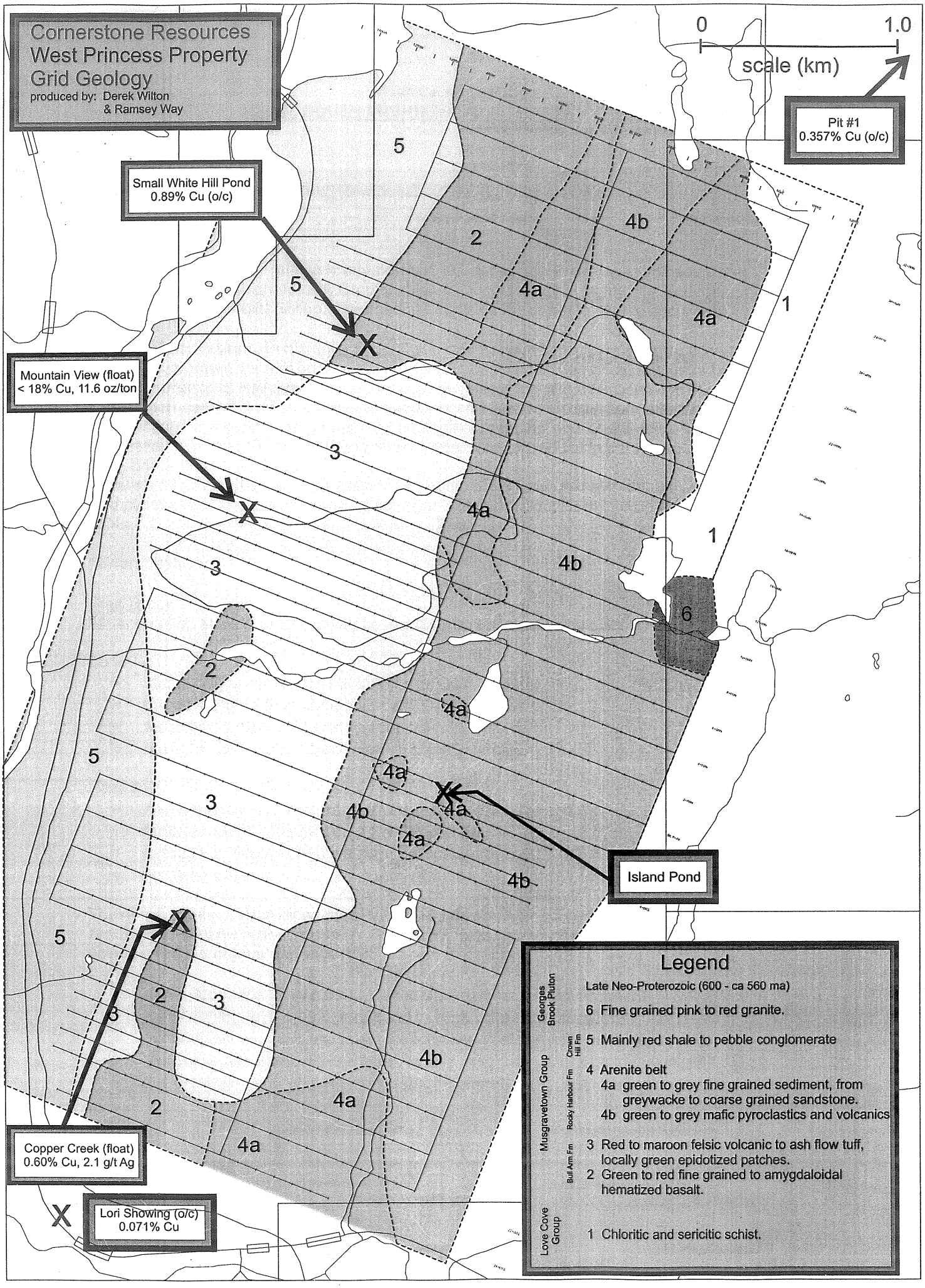
Summary:
Cornerstone Resources is thoroughly exploring the property in search of a Volcanic Redbed Copper deposit. Airborne magnetic and radiometric geophysical surveys, soil sampling, trenching and geological mapping entails some of the exploration which is planned, completed or ongoing for the year 2000.

References Cited

Hussey, E.M., 1979. The stratigraphy, structure and petrochemistry of the Clode Sound map area, northwestern Avalon Zone, Newfoundland. Unpub. MSc. thesis, Memorial University, St. John's, 312p..

Hutchings, C., 1999. Report on the West Princess Property. Unpub. Rept. for Cornerstone Resources Inc.

O'Brien, S.J., 1993. A preliminary account of geological investigations in the Clode Sound - Goose Bay region, Bonavista Bay, Newfoundland (NTS 2C/5NW and 2D/8NE). Newfoundland Department of Mines and Energy, Report 93-1, pp. 293-309.


Cornerstone Resources
West Princess Property
Grid Geology
produced by: Derek Wilton
& Ramsey Way
0
1.0
scale (km)
Pit #1
0.357% Cu (o/c)
Small White Hill Pond
0.89% Cu (o/c)
Mountain View (float)
< 18% Cu, 11.6 oz/ton
Island Pond
Copper Creek (float)
0.60% Cu, 2.1 g/t Ag
Lori Showing (o/c)
0.071% Cu
Legend
Late Neo-Proterozoic (600 - ca 560 ma)
Georges Brook Pluton
6 Fine grained pink to red granite.
Musgravetown Group
Crown Hill Fm
5 Mainly red shale to pebble conglomerate
Rocky Harbour Fm
4 Arenite belt
4a green to grey fine grained sediment, from greywacke to coarse grained sandstone.
4b green to grey mafic pyroclastics and volcanics
Bull Arm Fm
3 Red to maroon felsic volcanic to ash flow tuff, locally green epidotized patches.
2 Green to red fine grained to amygdaloidal hematized basalt.
Love Cove Group
1 Chloritic and sericitic schist.

PRINCESS GROUP:
PRINCESS, SOUTH PRINCESS, PRINCESS RIDGE & AVIATION

Location: Bonavista Peninsula, Newfoundland (NTS 2C/05 & 2D/08)

Number of Claims: 595

Geology: Underlain by relatively undeformed, subaerial, late Proterozoic volcanics and sediments of the Musgravetown Group, which lie unconformably on marine, sedimentary rocks of the Connecting Point Group. Intermediate intrusive rocks are known to occur locally.

Exploration: Exploration history pre-1997 was minimal with only a single Pb/Cu occurrence noted on the government mineral occurrence map on the coast near Bloomfield and an old shaft sunk on a Zn occurrence at Holloway Cove – no modern exploration has ever been carried out until now. Exploration carried out to date by Cornerstone and Phelps Dodge from 1997 to 1999 included prospecting, line cutting, soil sampling, geological mapping and geophysical surveys including magnetics, VLF and IP. Most of the detailed work was carried out in a 5 X 2 km corridor between Stag Brook and Milner's Cove.
This work was successful in identifying numerous, previously unknown chalcocite, chalcopyrite and pyrite occurrences in a variety of settings. The most significant to date include Stag Brook, Milners Cove, Cannings Cove and Holloway Cove.

Mineralization:

Stag Brook
Mineralization at Stag Brook occurs as two distinct, yet possibly related styles.

Zone I
- structurally controlled pyrite/quartz (Au) vein system.
- traced for more than a kilometer and is of unknown width.
- weak gold (<500 ppb) and low copper (<60 ppm Cu)
- hosted within fractured and weakly chloritic basalt.

Zone II
- disseminated and fracture controlled chalcocite + Ag and Au
- grabs to 12.1% Cu, 3.02 oz Ag, 1194 ppb Au
- average of 7 representative samples spaced over 60 X 40 m 0.83% Cu and 7.1 g/t Ag
- no pyrite observed.

These two styles in such close proximity (< 100 m) strongly suggest zoning, similar to metal zoning in a volcanic redbed deposit. Stag Brook also shares other features common with volcanic redbed copper deposits (VRC).

- rocks deposited in an oxidized, subaerial, extensional environment
- metal zoning (pyrite halo peripheral to chalcocite mineralization)
- mineralization occurs as disseminations and in structurally controlled veins.
- chalcocite dominant with variable Ag
- low grade chlorite, epidote, quartz/calcite alteration

PRINCESS GROUP:
PRINCESS, SOUTH PRINCESS, PRINCESS RIDGE & AVIATION

Mineralization:

Milner's Cove
- vein and fracture controlled chalcocite (Ag/Au)
- polyphase fracturing, silicification +/- hematization
- some mineralization does occur within clasts in conglomerate
- some of the mineralization associated with mafic flow
- 50 meter thick section including conglomerates and volcanics
- grab sample 5.6% Cu, 1.12 oz Ag, 282 ppb Au

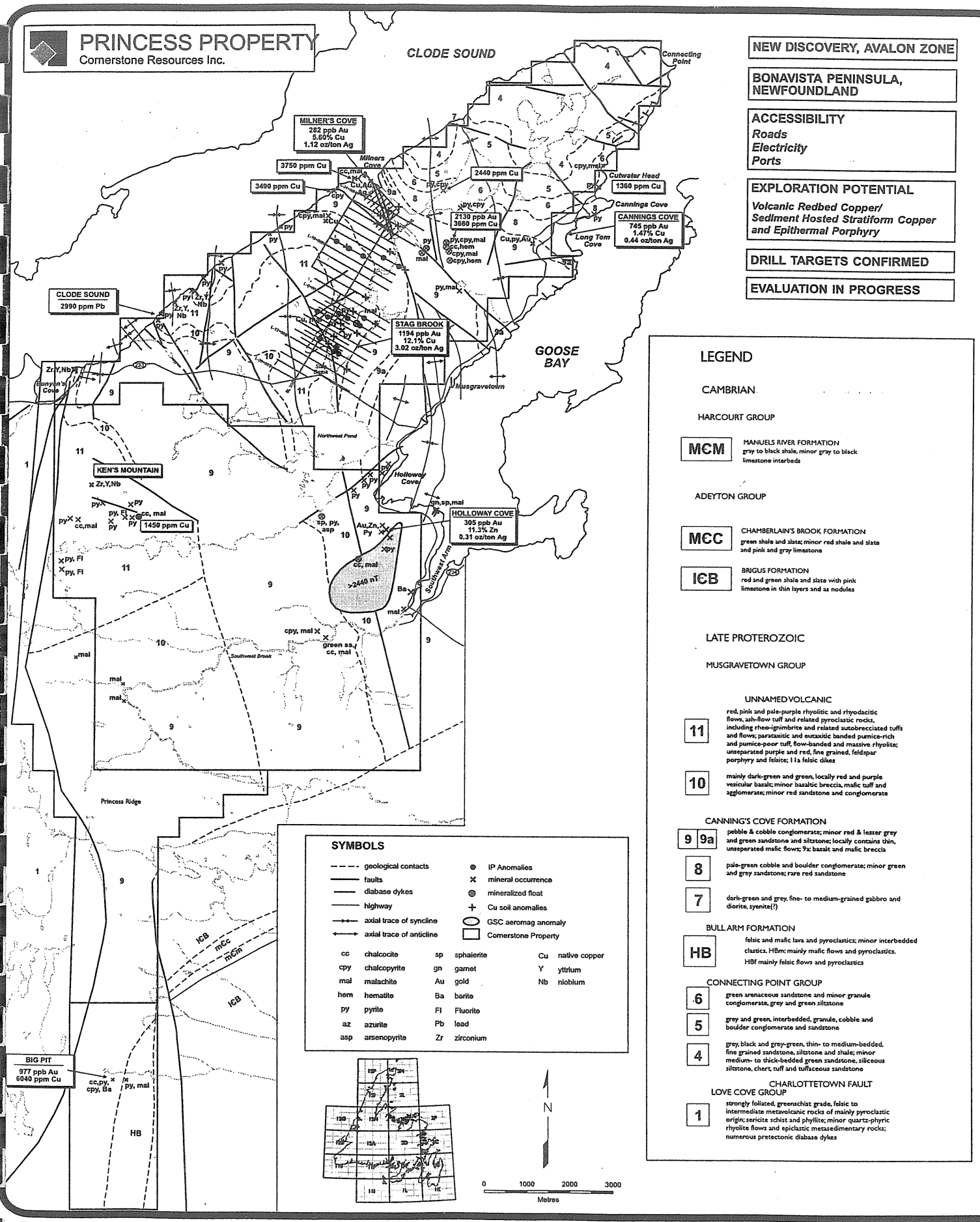
Milner's Cove Road
- cluster of mineralized conglomerate boulders
- fracture and vein hosted cpy/py/Au mineralization
- some clasts of a siliceous porphyry carry disseminated malachite (possibly after copper sulphide)
- highest gold values to date, 2130 ppb Au with 0.36% Cu

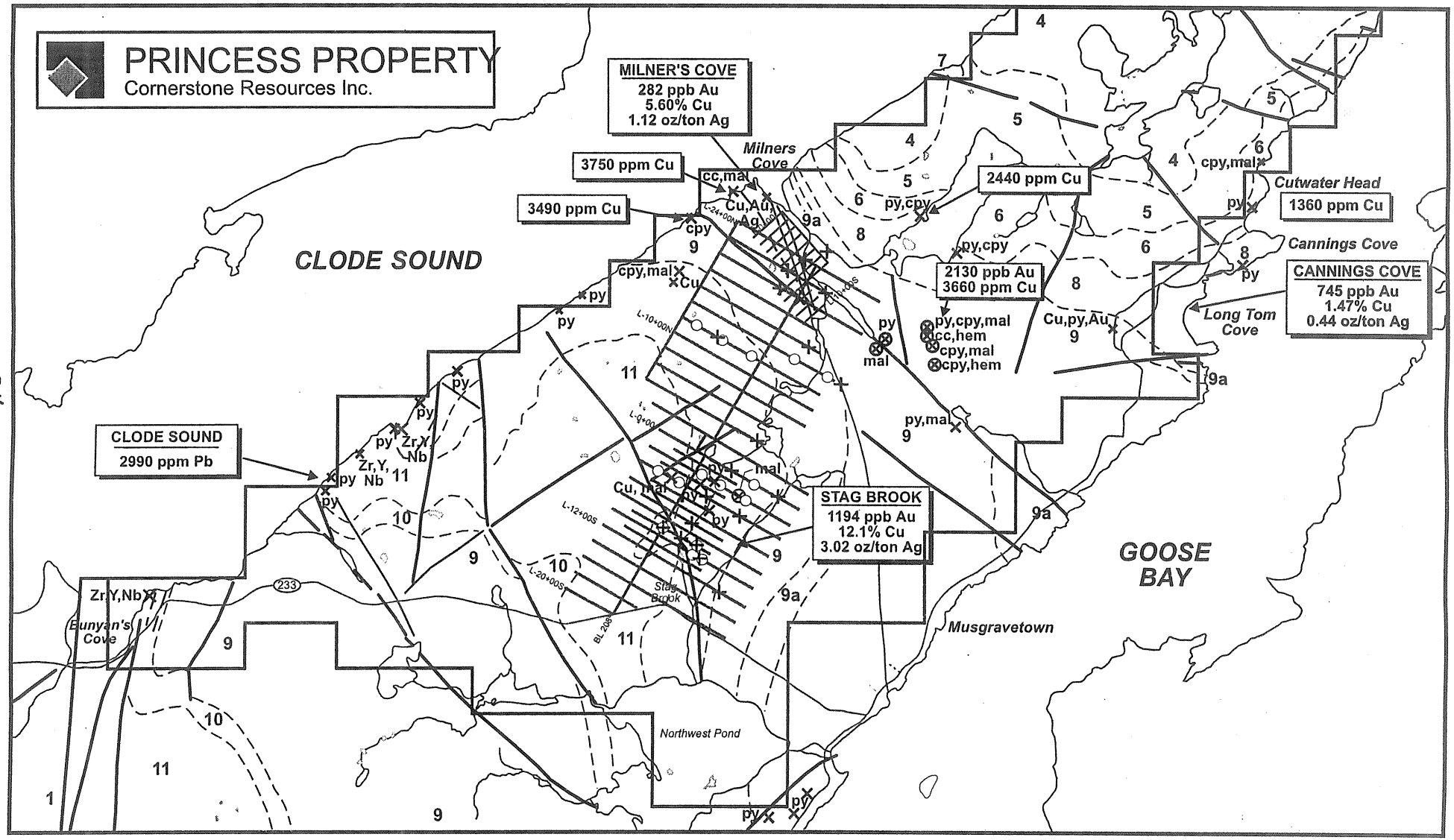
Canning's Cove
- vein hosted chalcopyrite Ag/Au mineralization
- hosted within grayish pebble conglomerate
- mineralization traced intermittently over 3 kilometers
- 1.47% Cu, 0.44 oz Ag, 745 ppb Au

Holloway Cove
- vein hosted sphalerite and pyrite
- mineralization exposed in a small cut in a mafic dike or sill
- mineralization spatially related to a major structure and a magnetic high
- 11.3% Zn, 0.31 oz Ag, 305 ppb Au

2000 WORK PROGRAM:

- airborne magnetics, radiometrics
- 1.7 kilometers of trenching coincident soil and IP anomalies
- ground follow up of airborne anomalies
- continue to seek joint venture partners


PRINCESS PROPERTY
Cornerstone Resources Inc.
CLODE SOUND
GOOSE BAY
Connecting Point
Cutwater Head
Cannings Cove
Long Tom Cove
Miners Cove
Holloway Cove
Southwest Arm
Southwest Brook
Northwest Pond
Musgravetown
Bunyan's Cove
Princess Ridge
MILNER'S COVE
282 ppb Au
5.60% Cu
1.12 oz/ton Ag
3750 ppm Cu
3490 ppm Cu
2440 ppm Cu
1360 ppm Cu
2130 ppb Au
3660 ppm Cu
CANNINGS COVE
745 ppb Au
1.47% Cu
0.44 oz/ton Ag
CLODE SOUND
2990 ppm Pb
STAG BROOK
1194 ppb Au
12.1% Cu
3.02 oz/ton Ag
KEN'S MOUNTAIN
1450 ppm Cu
HOLLOWAY COVE
305 ppb Au
11.3% Zn
0.31 oz/ton Ag
>2440 nT
BIG PIT
977 ppb Au
6040 ppm Cu
NEW DISCOVERY, AVALON ZONE
BONAVISTA PENINSULA, NEWFOUNDLAND
ACCESSIBILITY
Roads
Electricity
Ports
EXPLORATION POTENTIAL
Volcanic Redbed Copper/ Sediment Hosted Stratiform Copper and Epithermal Porphyry
DRILL TARGETS CONFIRMED
EVALUATION IN PROGRESS
LEGEND
CAMBRIAN
HARCOURT GROUP
MCM MANUELS RIVER FORMATION gray to black shale, minor gray to black limestone interbeds
ADEYTON GROUP
MCC CHAMBERLAIN'S BROOK FORMATION green shale and slate; minor red shale and slate and pink and gray limestone
ICB BRIGUS FORMATION red and green shale and slate with pink limestone in thin layers and as nodules
LATE PROTEROZOIC
MUSGRAVETOWN GROUP
UNNAMED VOLCANIC
11 red, pink and pale-purple rhyolitic and rhyodacitic flows, ash-flow tuff and related pyroclastic rocks, including rheo-ignimbrite and related autobrecciated tuffs and flows; parataxitic and eutaxitic banded pumice-rich and pumice-poor tuff, flow-banded and massive rhyolite; unseparated purple and red, fine grained, feldspar porphyry and felsite; I la felsic dikes
10 mainly dark-green and green, locally red and purple vesicular basalt; minor basaltic breccia, mafic tuff and agglomerate; minor red sandstone and conglomerate
CANNING'S COVE FORMATION
9 9a pebble & cobble conglomerate; minor red & lesser grey and green sandstone and siltstone; locally contains thin, unseperated mafic flows; 9a: basalt and mafic breccia
8 pale-green cobble and boulder conglomerate; minor green and grey sandstone; rare red sandstone
7 dark-green and grey, fine- to medium-grained gabbro and diorite, syenite(?)
BULL ARM FORMATION
HB felsic and mafic lava and pyroclastics; minor interbedded clastics. HBm: mainly mafic flows and pyroclastics. HBf mainly felsic flows and pyroclastics
CONNECTING POINT GROUP
6 green arenaceous sandstone and minor granule conglomerate, grey and green siltstone
5 grey and green, interbedded, granule, cobble and boulder conglomerate and sandstone
4 grey, black and grey-green, thin- to medium-bedded, fine grained sandstone, siltstone and shale; minor medium- to thick-bedded green sandstone, siliceous siltstone, chert, tuff and tuffaceous sandstone
CHARLOTTETOWN FAULT
LOVE COVE GROUP
1 strongly foliated, greenschist grade, felsic to intermediate metavolcanic rocks of mainly pyroclastic origin; sericite schist and phyllite; minor quartz-phyric rhyolite flows and epiclastic metasedimentary rocks; numerous pretectonic diabase dykes
SYMBOLS
geological contacts
faults
diabase dykes
highway
axial trace of syncline
axial trace of anticline
IP Anomalies
mineral occurrence
mineralized float
Cu soil anomalies
GSC aeromag anomaly
Cornerstone Property
cc chalcocite
cpy chalcopyrite
mal malachite
hem hematite
py pyrite
az azurite
asp arsenopyrite
sp sphalerite
gn garnet
Au gold
Ba barite
Fl Fluorite
Pb lead
Zr zirconium
Cu native copper
Y yttrium
Nb niobium
N
0 1000 2000 3000
Metres


PRINCESS PROPERTY
Cornerstone Resources Inc.
MILNER'S COVE
282 ppb Au
5.60% Cu
1.12 oz/ton Ag
Milners Cove
3750 ppm Cu
3490 ppm Cu
2440 ppm Cu
2130 ppb Au
3660 ppm Cu
py,cpy,mal
cc,hem
cpy,mal
cpy,hem
Cutwater Head
1360 ppm Cu
Cannings Cove
CANNINGS COVE
745 ppb Au
1.47% Cu
0.44 oz/ton Ag
Long Tom Cove
CLODE SOUND
CLODE SOUND
2990 ppm Pb
STAG BROOK
1194 ppb Au
12.1% Cu
3.02 oz/ton Ag
Stag Brook
GOOSE BAY
Musgravetown
Bunyan's Cove
Northwest Pond
233
L-24+00N
L-10+00N
L-0+00
L-12+00S
L-20+00S
BL 20S
Zr,Y,Nb
Cu,Au,Ag
cpy,mal
py,cpy
Cu,py,Au
py,mal
Cu,mal
24

RED CLIFF

Location: Eastern Newfoundland (NTS 2C/11)

Number of Claims: 304

Geology: Underlain by thick sequence of relatively undeformed, locally folded, subaerial, late Proterozoic sediments of the upper Musgravetown Group.

Exploration: No previous exploration is known from this area. Government lake sediment survey indicates several anomalies on the property. Exploration to date by Cornerstone has been limited to reconnaissance prospecting and rock sampling.

To date two main areas of sediment hosted stratiform copper/silver mineralization has been outlined on the property. Red Cliff and Blue Point zones are found within identical host rocks and geological environments more than 10 kilometers apart.

Mineralization:

Red Cliff

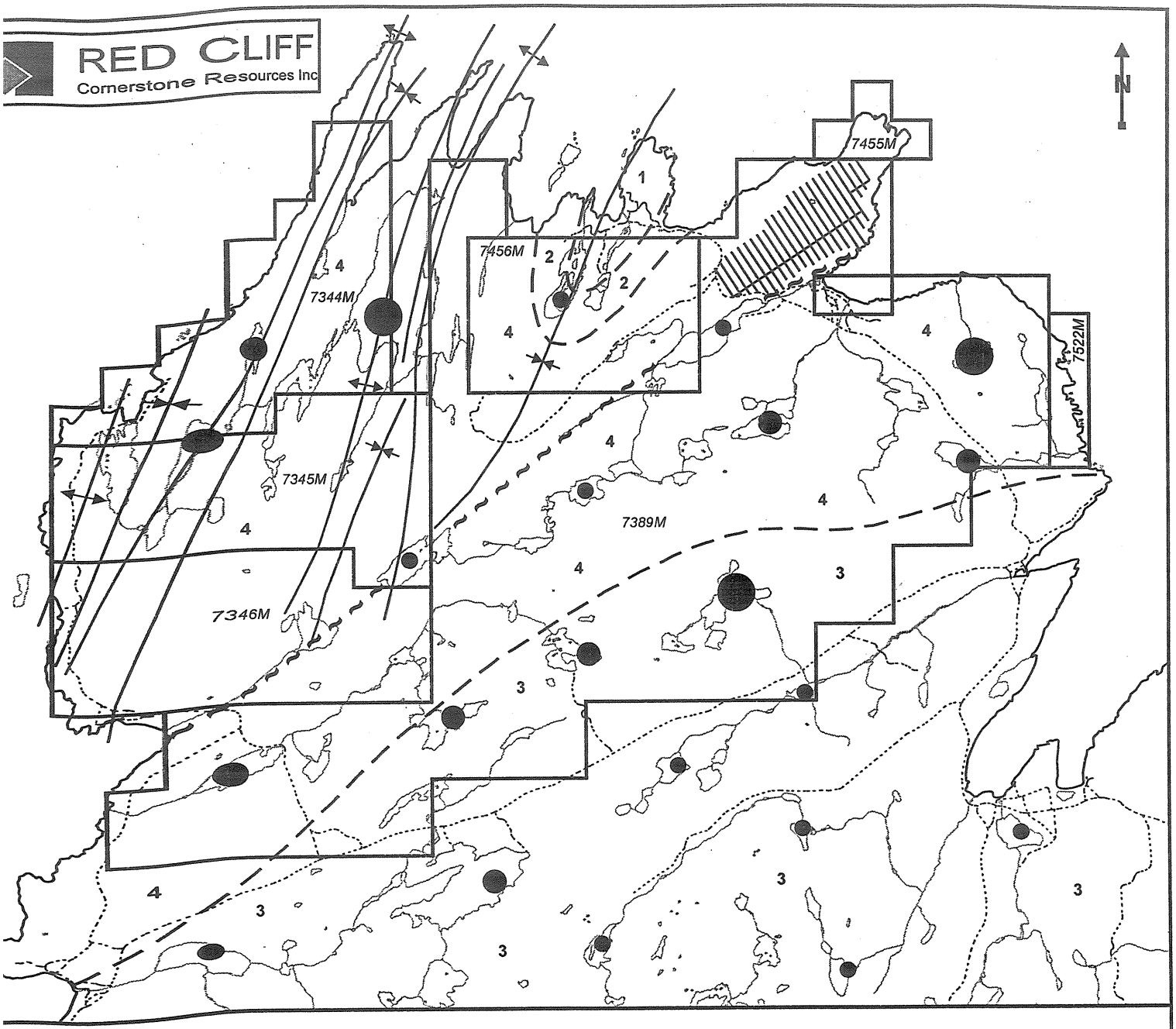
- sediment hosted stratiform copper/silver mineralization occurs as disseminated, replacement, and fracture controlled chalcocite and native copper
- the mineralization is hosted by a >20 meter thick greybed unit sandwiched between thick redbed sequences
- to date, only random grab sampling has been carried out on the zone and has returned up to 0.89% Cu and 2.1 ppm Ag

Blue Point

- sediment hosted stratiform copper/silver mineralization occurs as disseminated and fracture controlled chalcocite
- the zone at Blue Point is 40 –50 meters thick and is hosted by a greybed similar to the Red Cliff showing
- the zone is gently dipping to the northwest and trending southwest towards Red Cliff
- preliminary sampling from the north end of the exposure has returned 0.35% Cu and 3.7 ppm Ag
- preliminary sampling from the central portion has returned 1.2% Cu and 0.29 oz Ag

2000 Work Program:

- line cutting – 22 kilometer grid over Blue Point
- geological mapping and soil sampling Blue Point Grid
- channel sampling at Blue Point and Red Cliff
- reconnaissance geology and geochemistry over remainder of property



OWER ORDOVICIAN TO CAMBRIAN

DEYTON GROUP

1 Bonavista Formation: red and green shale and slate; minor pink limestone in thin beds and as nodules.

2 Random Formation: white quartzite with interbedded gray shale, siltstone and sandstone; minor red sandstone in easterly areas.

ADRYNIAN

IUSGRAVETOWN GROUP

3 Undivided Musgravetown Group: mainly red sandstone and conglomerate north of Clode Sound; south of Clode Sound includes felsic and mafic lava and pyroclastics and gray and red clastic rocks.

4 Crown Hill Formation: red pebble conglomerate and sandstone; minor argillite.

Geological contact

Fault

Fold (syncline, plunge direction)

Fold (anticline)

Copper (ppm) Distribution in Lake Sediments

40 - 80

20 - 40

10 - 20

0 2000

Metres

Geology adapted from NDME Mineral Occurrence Map 84-21

Breccia-Hosted Gold on the Northern Burin Peninsula

The Lodestar Prospect

Location

The Lodestar Prospect is located in the Goobies-Come by Chance area and is associated with the Powder Horn Intrusive Suite (PHIS). This suite is exposed as an elliptical body and is located at the intersection between the isthmus of the Avalon Peninsula and the northern part of the Burin Peninsula. Access to the prospect is via the Burin Peninsula Highway (210) from which a gravel woods road turns east approximately 3 km west of the Trans Canada Highway intersection. The Lodestar prospect is located 1 km in this woods road.

Regional Geology

In terms of the regional geology, the PHIS is located in the Avalon Zone (Figure 3-1) The area is divided up into two contrasting geological units which are separated by an extension of the Paradise Sound Fault.

On the southeast side of this fault, the area is underlain by the late Neoproterozoic sedimentary rocks of the Connecting Point Group, which in turn are overlain by mixed volcanic and sedimentary rocks of the Musgravetown group. These in turn are fault bounded against Lower Cambrian Shales. To the northwest of the fault lies a belt of chlorite-sericite schists derived from volcanic, sedimentary, and intrusive rocks. These rocks are now considered to be part of the ca. 575 Ma Marystown Group.

Intrusive rocks in the area consist of granite, quartz-feldspar porphyry, and diorite of the Sall the Maid Intrusive Suite, and diorite, gabbro, and felsic dykes of the Powder Horn Intrusive Suite.

The Connecting Point Group (Hayes, 1948) is exposed in the southern and eastern sides of the map area (Figure 3-2). This unit includes green, grey, and brown regularly bedded and laminated sandstone, siltstone, and shale and is separated from the other units by faulting . The central portion of the map area (Figure 3-2) is partially underlain by the Musgravetown Group (Hayes, 1948) which consists of green/grey, graded and cross bedded sandstone, conglomerate, and shale. This unit contains some detrital magnetite. A small amount of Random Formation overlies the Musgravetown Group in the north-central part of the map area, where it consists of white/brown quartzite, quartz sandstone, and siltstones. Red/green/purple shales and slates of the Adeyton Group overly the Random Formation.

The Sall the Maid granite crops out on the western edge of the map area and extends as discontinuous intrusive bodies southward along the trace of the Paradise Sound Fault to the North Harbour area. This unit consists of pink/orange fine-grained granites, QFP's and diorite, which are assumed to be Devonian in age.

Local Property Geology and Mineralization

The PHIS is a multi-phase intrusive suite, containing both pre- and post-brecciation (mineralization) phases. Pre-mineralization rocks consist of medium-grained gabbro/diorite, minor felsic material, and hornfelsed sedimentary units of the

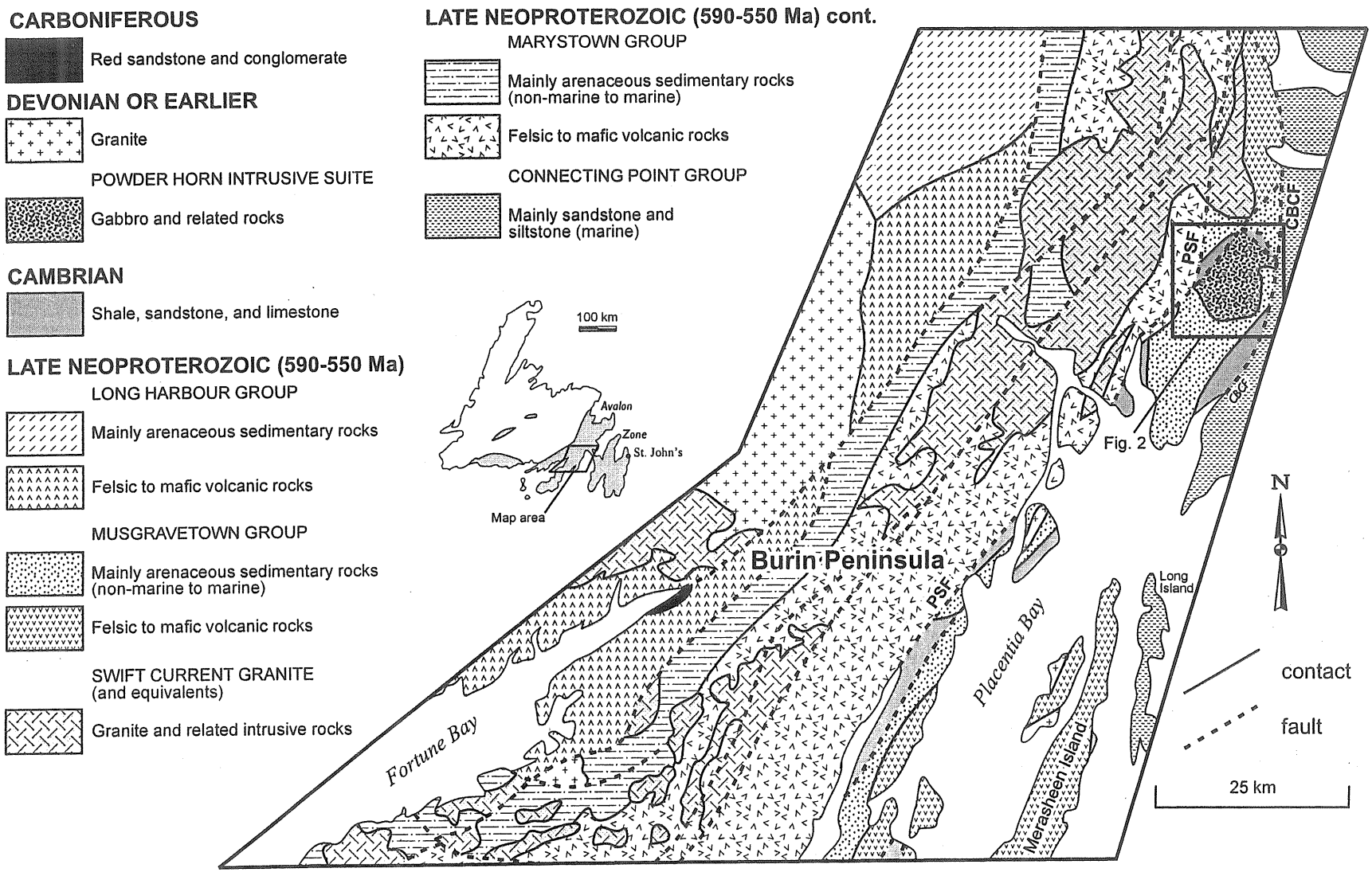
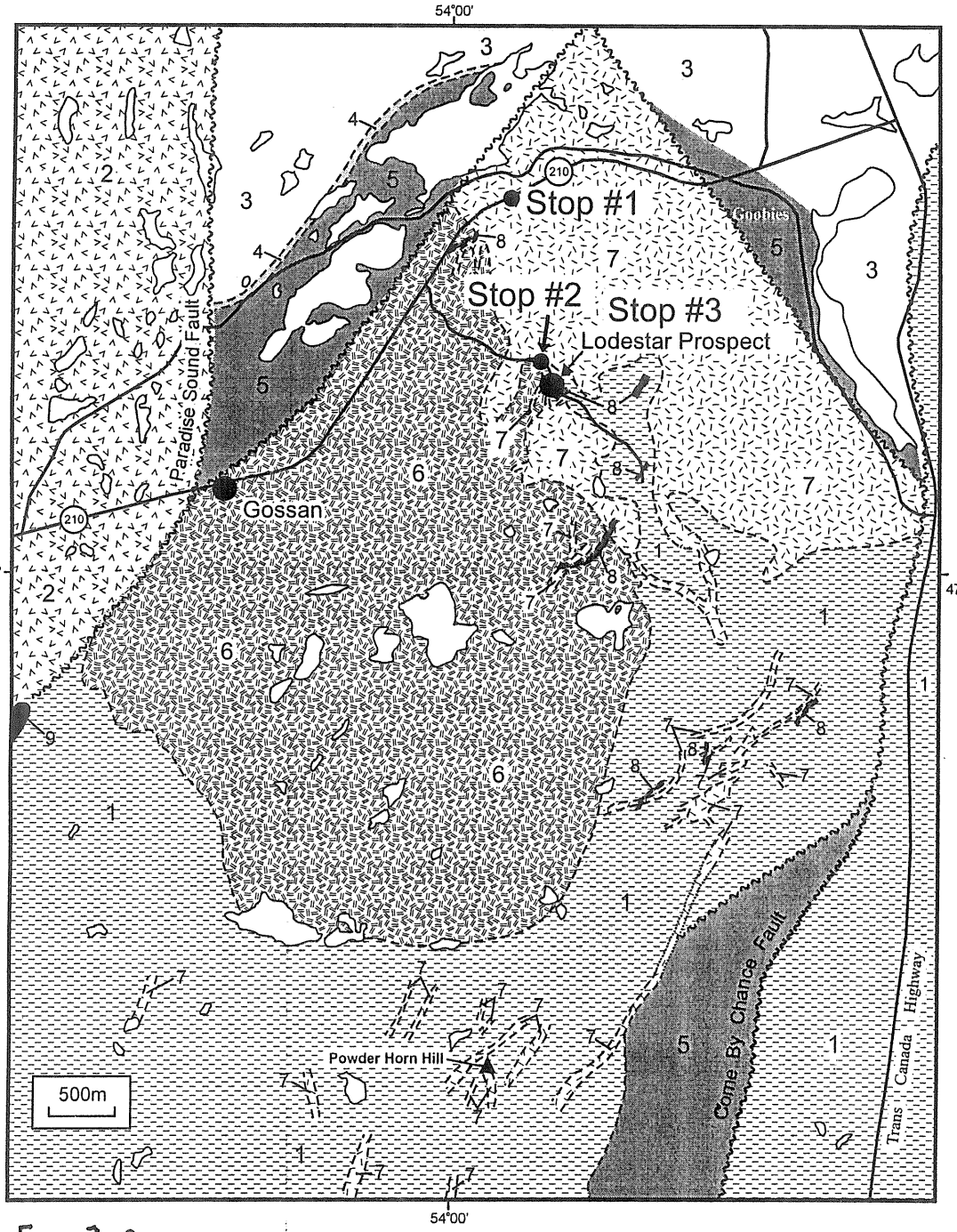

CARBONIFEROUS
Red sandstone and conglomerate
DEVONIAN OR EARLIER
Granite
POWDER HORN INTRUSIVE SUITE
Gabbro and related rocks
CAMBRIAN
Shale, sandstone, and limestone
LATE NEOPROTEROZOIC (590-550 Ma)
LONG HARBOUR GROUP
Mainly arenaceous sedimentary rocks
Felsic to mafic volcanic rocks
MUSGRAVETOWN GROUP
Mainly arenaceous sedimentary rocks (non-marine to marine)
Felsic to mafic volcanic rocks
SWIFT CURRENT GRANITE (and equivalents)
Granite and related intrusive rocks
LATE NEOPROTEROZOIC (590-550 Ma) cont.
MARYSTOWN GROUP
Mainly arenaceous sedimentary rocks (non-marine to marine)
Felsic to mafic volcanic rocks
CONNECTING POINT GROUP
Mainly sandstone and siltstone (marine)
100 km
Avalon
Zone
St. John's
Map area
Burin Peninsula
PSF
CBCF
CG
Fig. 2
Fortune Bay
Placentia Bay
Merasheen Island
Long Island
N
contact
fault
25 km

Fig. 3-1



Geology of the Powder Horn Intrusive Suite

CAMBRIAN

- 5 — Purple and green slate and shale; pink limestone beds and nodules (Adeyton Group)
- 4 — White crossbedded quartzite and interbedded green micaceous siltstone and sandstone (Random Formation)

Neoproterozoic (600-610 MA)

- 9 — Beige, pink and orange, fine-grained granite and quartz to quartz-feldspar porphyry (Sall the Maid Granite)

POWDER HORN INTRUSIVE SUITE

- 8 — Pink to orange, fine-grained granite, aplite and quartz to quartz-feldspar porphyry
- 7 — Dark green, fine-grained diorite to gabbro with a pilotaxitic texture. Porphyritic (plagioclase and/or amphibole) in places
- 6 — Medium- to coarse-grained, black to dark green and white gabbro to diorite

PRECAMBRIAN

- 3 — Green and grey, graded and crossbedded sandstone, black siltstone and green conglomerate. Purple and red sandstone and shale near top (Upper Musgravetown Group)
- 2 — Chlorite and sericite schist derived from mafic and silicic, crystal-lithic tuffs (Marystown Group)
- 1 — Green, grey and black, well bedded siltstone, sandstone and slate. Green polymictic conglomerate (Connecting Point Group)

Fig. 3-2

Connecting Point Group. Post-mineralization phases include fine-grained gabbro/diorite, felsic phases, and diabase dykes.

The Lodestar Prospect consists of sulphide-oxide mineralized breccias with a magmatic-hydrothermal origin. The prospect contains significant gold mineralization, and associated copper, zinc and arsenic, within polylithic breccias associated with the PHIS. The best grades obtained by exploration companies from chip-channel sampling of the mineralized breccia was of 4.98 g/t Au and 14.8 g/t Ag over a 15.9 m width, with one assay of ~ 2.0 % Zn. Earlier assays returned values of 6.13 g/t Au and 4.91 g/t Au over 3m. Recent samples collected by the owner indicate 5.6 g/t Au over 8.5 m and 12.6 g/t Au over 1m. The highest grade assays returned from the property (58.5 g/t Au with 260 g/t Ag) came from grab samples of massive arsenopyrite (25% As) (J. Hinchey unpublished data).

The main mineralized breccia, which occurs at the intrusive contact between late Neoproterozoic marine siliclastic rocks (Connecting Point Group) and a pre-tectonic, late Neoproterozoic gabbro-diorite-granite complex (PHIS), is exposed over approximately 25 m and contains gold mineralization in association with copper, arsenic and zinc. The breccia is clast-supported and the mineralization dominantly occurs as the matrix to the breccia, whereas un-mineralized sections of the breccia contain actinolite/chlorite within the matrix. The breccia clasts consist of the host sedimentary material, pre-breccia gabbro/diorite, quartz-feldspar porphyry, diabase, and minor granite. The sedimentary and gabbro/diorite clasts were locally derived from the wall rock and are generally unstrained and unaltered, other than concentric banding around some of the sedimentary clasts. However, the high-level quartz-feldspar porphyry clasts have not been observed in outcrop at the area of the showing and are therefore assumed to be exotic clasts derived from an unexposed epizonal intrusion at depth which was sampled by the breccia process. In places, these exotic clasts are heavily mineralized with disseminated arsenopyrite which typically rims the outer 1-3 mm of the QFP clasts. These QFP clasts are also locally finely comminuted, thereby producing a rock-flour matrix in portions of the breccia which is possibly indicative of transport from depth.

U-Pb zircon age dating has recently been conducted on rocks from the PHIS in order to bracket the ages of the brecciation and mineralization processes associated with the Lodestar Prospect. Two phases were dated at 603 +/- 2 Ma for the pre-mineralization gabbro/qtz-diorite, and 605 +/- 5 Ma for a post-mineralization felsic dyke intrusion (O'Brien *et al.*, 2000). These geochronological data confirm a late Neoproterozoic age for both the magmatism and mineralization at the Lodestar prospect. Therefore the brecciation and mineralization are assumed to be coeval with emplacement and crystallization of the PHIS. Along with other characteristics of the Lodestar prospect such as the style of mineralization, presence of exotic QFP clasts, and the presence of some hydrothermal magnetite in the matrix, the coeval ages of emplacement and breccia crystallization define a magmatic-hydrothermal origin for the breccia.

The presence of mineralized exotic QFP clasts in the breccia indicate that the brecciation and mineralization may have been related to a Cu-Au porphyry system at depth. If so, the Lodestar prospect could represent a transitional environment between a deep seated and a shallow epithermal system.

Since the age bracket for the brecciation and mineralization associated with the Lodestar prospect (600-610 Ma) is significantly older than the 590-570 Ma ages of Avalon Zone high-sulphidation systems

associated with volcanic-epiclastic successions, such as Hope Brook and Hickey's Pond (O'Brien *et al.*, 1998), the Lodestar Prospect represents a previously unknown age of precious metal mineralization on the western margin of the Avalon Peninsula. These new age data should draw attention to the belt of sediments (Connecting Point Group) which hosts the Lodestar prospect. These rocks are thought to have accumulated in an extensional arc-adjacent basin ca. 620-610 Ma. (O'Brien *et al.*, 2000). There were a number of plugs, sills and dykes emplaced within this sedimentary belt in several parts of northeastern Bonavista Bay. Mafic intrusions in the Connecting Point Group have also been described in the Placentia Bay and Avalon Isthmus area (O'Driscoll and Muggridge, 1979). These intrusion's therefore, should represent areas of potential magmatic-hydrothermal gold mineralization similar to the Lodestar prospect. Thus the Lodestar prospect is very significant since it indicates the potential for additional porphyry-style mineralization within the PHIS as well as elsewhere on the Burin Peninsula. The age and style of mineralization of the Lodestar Prospect also highlight the unrecognized potential of the under-explored 620-600 Ma volcanic arc-marine basin successions in the Western Avalon Belt, extending from northern Bonavista Bay, southwards to and including the Placentia Bay area (O'Brien *et al.*2000).

Stop Descriptions

STOP 3-1: **Rock quarry pit**

This gravel pit is located on the east side of the Burin Peninsula Highway approximately 3 km from the intersection with the Trans Canada Highway. The purpose of this stop is to introduce the major phases of the Powder Horn Intrusive Suite. Within the pit, the medium to coarse-grained, pre-breccia and pre-mineralization gabbro/diorite are exposed in contact with the fine-grained, post-breccia and post-mineralization gabbro. The nature of this contact is intrusive with the finer-grained gabbro intruding and being chilled against the coarser-grained gabbro. A felsic dyke is also exposed which cuts across both phases of gabbro.

2) **STOP 3-2: Hornfelsed sediments:**

At this stop, the exposed outcrop is of the host sedimentary rocks (Connecting Point Group) intruded and migmatized by the pre-breccia gabbro. The hornfelsed sediments are slightly magnetic and are hornfelsed/metamorphosed to amphibolite grade.

3) **STOP 3-3: Magmatic-Hydrothermal mineralized breccia: Lodestar Prospect**

This stop focuses on the Lodestar Prospect itself. As previously mentioned, this prospect consists of a clast-supported, magmatic-hydrothermal breccia containing significant gold associated with copper, zinc and arsenic mineralization. Details of the breccia and mineralization are given above and will be pointed out at the prospect.

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