

***Preliminary Geochemical Analysis of
Various Gold Occurrences Within the
Volcano-sedimentary Rocks of the
Annidale Belt,
Southern New Brunswick***

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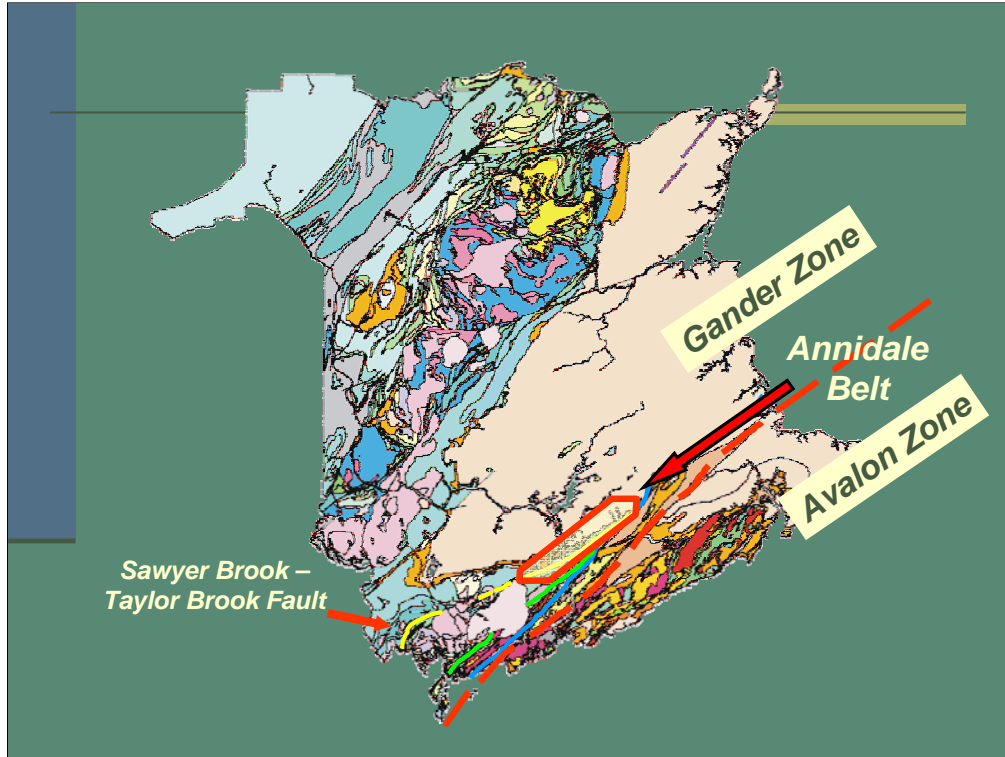


This presentation summarizes a recent field project that focused on various gold occurrences within the Annidale Belt in south-central New Brunswick.

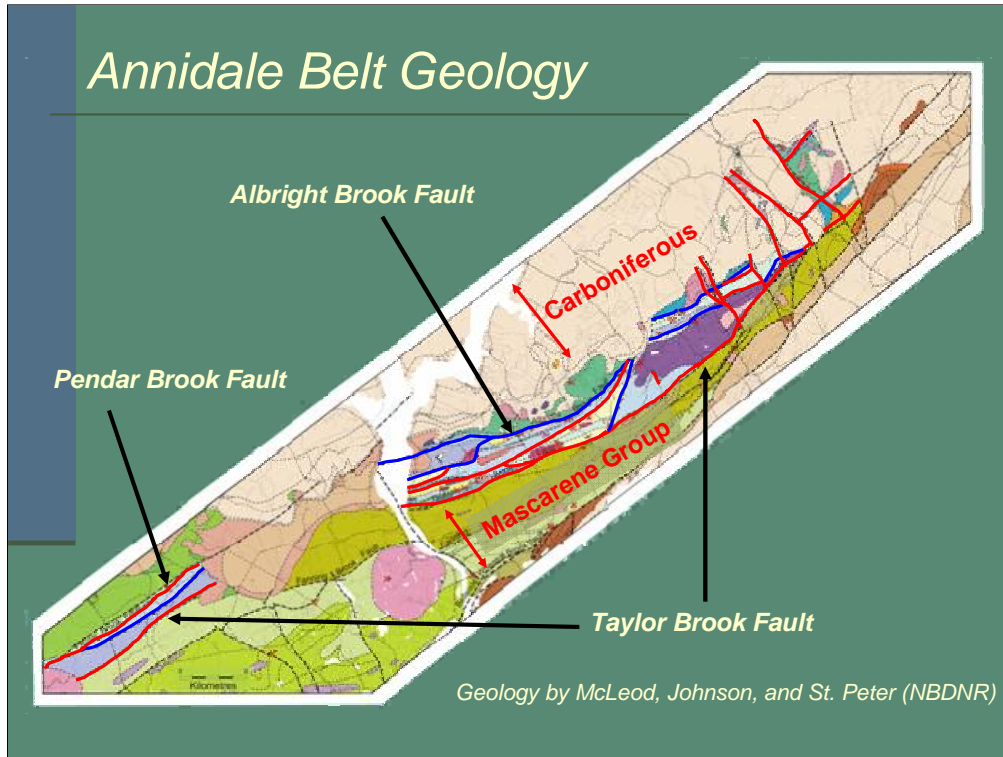
Introduction

- *Cambro-Ordovician belt of rocks in south-central NB of Gander affinity*
- *Host to ~26 gold and/or base metal occurrences*
- *Project Objectives:*
 - *Geochemically characterize the major occurrences*
 - *Establish source of the mineralizing fluids and genetic links*
 - *Genetic model*

The Annidale Belt comprises a Cambro-Ordovician volcano-sedimentary belt of rocks that underlie south-central New Brunswick. Based on lithology and geochemistry, rocks in this belt are interpreted to constitute part of the Gander Zone in New Brunswick. These rocks are very mineral-rich as can be attested to by the fact that they are host to approximately 26 gold and/or base metal occurrences. The focus of a current study will be to geochemically characterize and document the major gold occurrences within the belt and attempt to establish a genetic model at the deposit scale and possibly the belt as a whole. The following is a brief introduction to the Annidale Group rocks highlighting a few of the more extensively explored gold occurrences hosted by the belt.

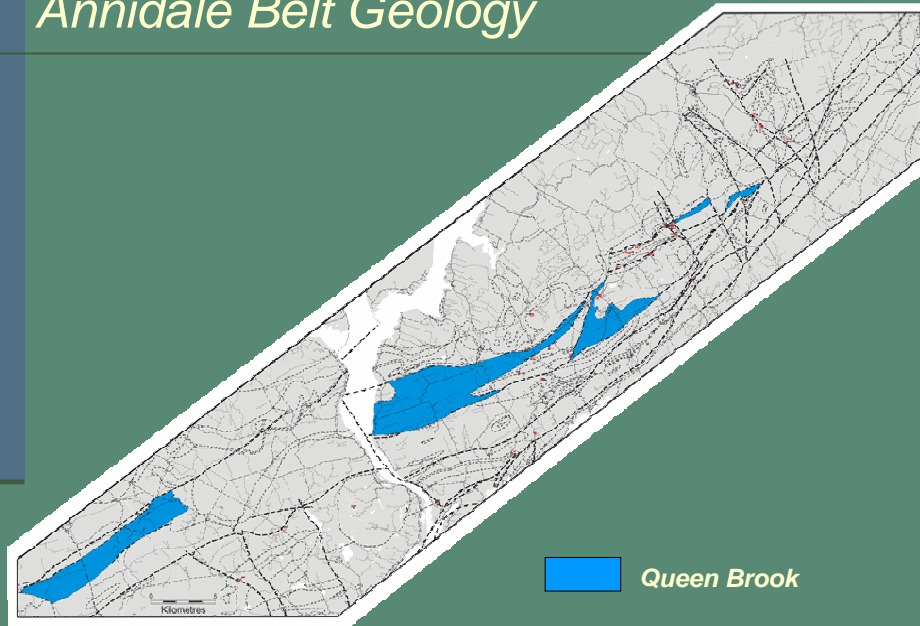


The Annidale Belt, shown here outlined in red, comprises an approximately 70 km long northeast-trending belt of rocks in south-central New Brunswick that lie just to the north of the interpreted Gander-Avalon cryptic suture. The suture is shown here as the red dotted line. The yellow, green and blue lines indicate some other major faults in the area, the most important being the Sawyer Brook-Taylor Brook Fault which marks the surface boundary between the Gander Zone to the north and the Avalon Zone to the south. The majority of these rocks have a within-plate geochemical signature with the exception of a small sliver of rocks along the southeastern margin of the Group near Annidale that have an arc-like signature (McLeod et al., 1994). The tectonic setting proposed for the deposition of these rocks is a rift setting in a back-arc basin with the arc-like rocks indicating possible closure of a small ocean basin. The fact that the Annidale Belt lies just to the north of this major tectonic boundary indicates that faulting likely played an important role with respect to mineralization, possibly in conjunction with the emplacement of intrusions and/or back-arc basin activity.



The Annidale Belt is unconformably overlain by the Carboniferous cover sequence to the north and northeast and is separated from the Silurian Mascarene Group to the south by the Taylor Brook Fault. To the southwest of the map area, the Annidale Group rocks are separated from the Fredericton cover sequence to the north by the Pendar Brook Fault and are intruded by the felsic intrusions of the Late Silurian to Early Devonian Saint George Batholith. There are also a number of major northeast- and northwest-trending faults, shown here in red and blue, which are internal to the belt and primarily define formational contacts. For the most part, they consist of steeply dipping normal faults, represented by the red lines. There are a number of thrust faults that occur as well, shown here in blue, such as the Albright Brook Fault.

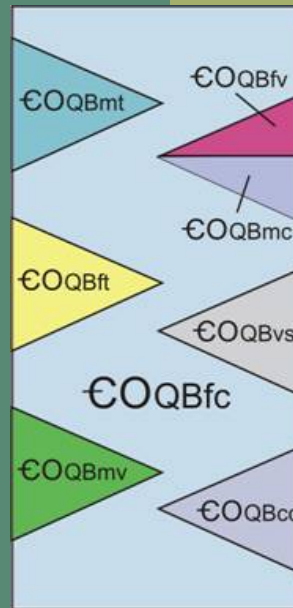
Annidale Belt Geology



Geology by McLeod, Johnson, and St. Peter (NBDNR)

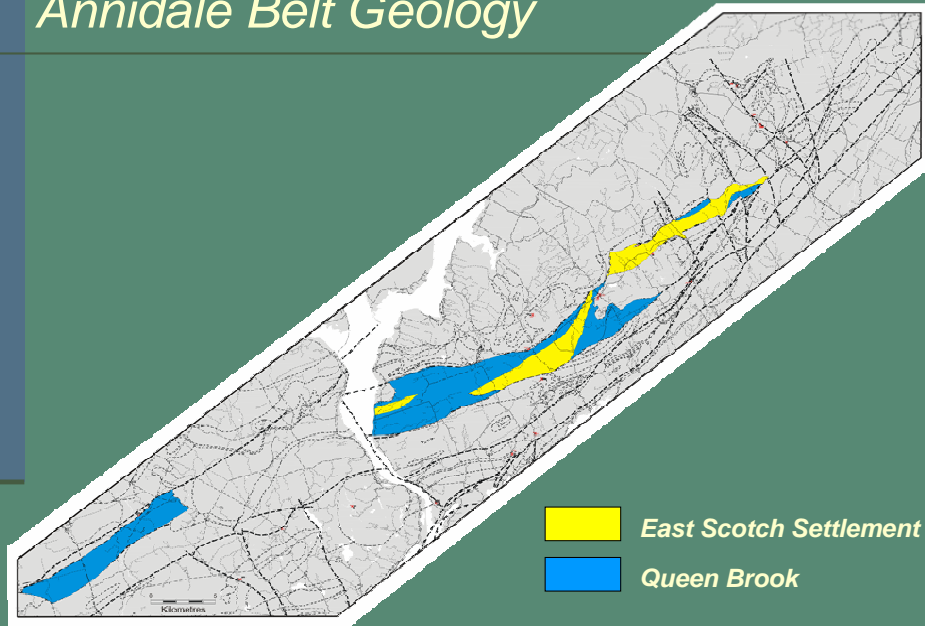
The Annidale Group consists of four formations. The lowermost unit and most extensive is the Queen Brook Formation, shown here in blue.

Queen Brook Formation



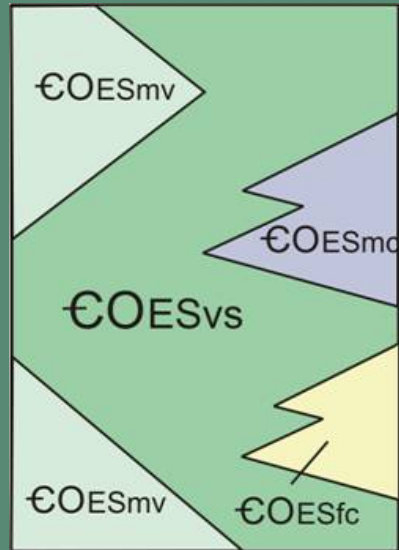
The bulk of the Queen Brook Formation consists of purple and green siltstones deposited in a deep water environment, interbedded with minor mafic, felsic volcanic units, and coarser clastic and volcanoclastic units. The volcanic units are interpreted to have been emplaced in or near an expanding back-arc basin that may have developed some oceanic crust. The top photo shows the green-grey siltstones that are so typical of the formation. The bottom photo shows a conglomeratic unit. The tectonic affinity of this unit was the subject of much debate over the years but geochemical studies have shown that the Queen Brook rocks most resemble the Annidale Group when compared to the other local units.

Annidale Belt Geology

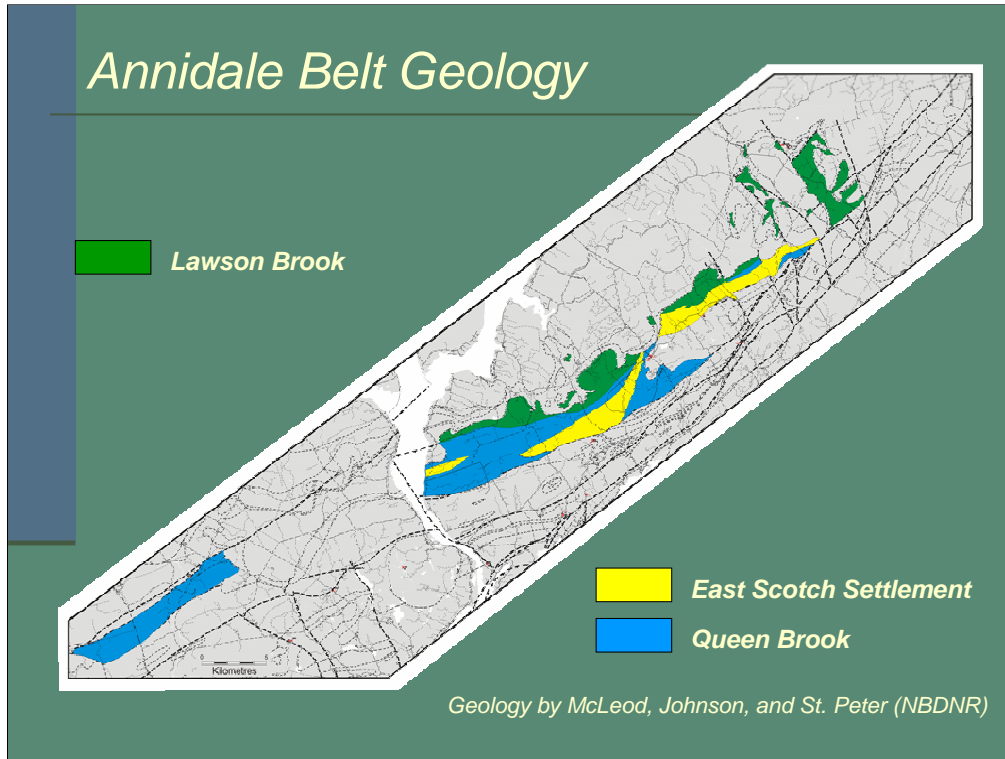


The next unit in the sequence is the East Scotch Settlement Formation, represented here by yellow.

East Scotch Settlement



The East Scotch Settlement Formation consists mainly of volcaniclastic and clastic rocks interbedded with mafic volcanic units such as pillow lava, mafic flows and breccia, interbedded with fine clastic units. Overall, the unit youngs to the south. Black carbonaceous shale and locally pyritiferous shale occurs throughout the Formation. It has been demonstrated that the mafic volcanic rocks in this unit were formed in a rifting environment proximal to an ocean basin and that the rocks of the Queen Brook Formation bear the most resemblance to the rocks of the East Scotch Settlement Formation.

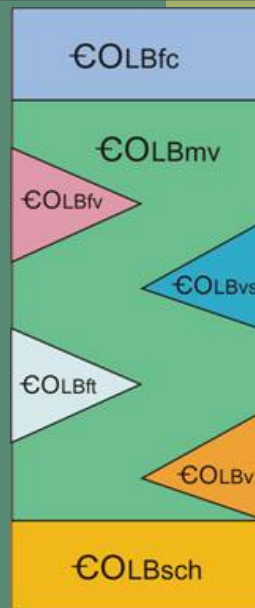


The next formation in the sequence is the Lawson Brook Formation, shown here in green. It occurs mostly as inliers within the Carboniferous cover sequence.

Lawson Brook



497±10 Ma
(U-Pb zircon, McLeod et al., 1992)

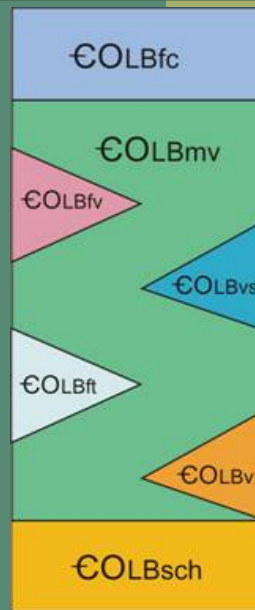


The Lawson Brook Formation consists mainly of a variety of volcanic rocks such as pillow basalts as seen here in the top photo, tuffs, and gabbros, interbedded with felsic volcanic rocks and minor volcaniclastic units. A muscovite-biotite-bearing felsic schistose unit that occurs as an inlier within the Carboniferous cover sequence, shown here in the bottom photo, has been tentatively placed near the base of this formation based on a Late Cambrian U-Pb zircon age of 497±10 Ma (McLeod et al., 1992).

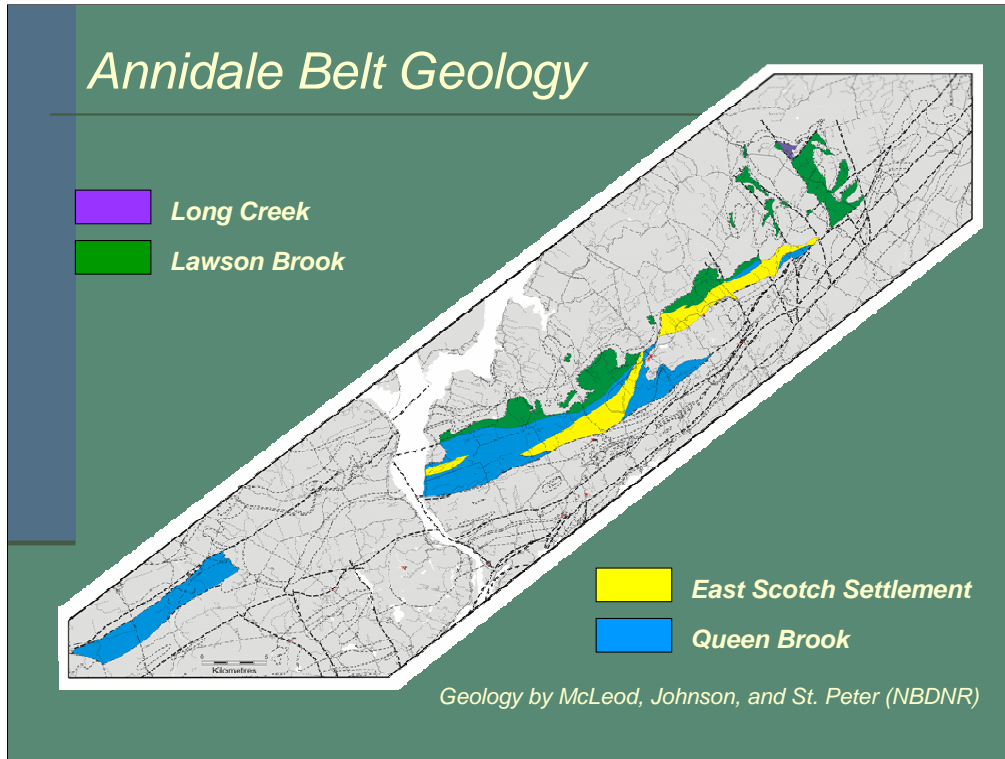
Lawson Brook



493±2 Ma
(U-Pb zircon, McLeod et al., 1992)

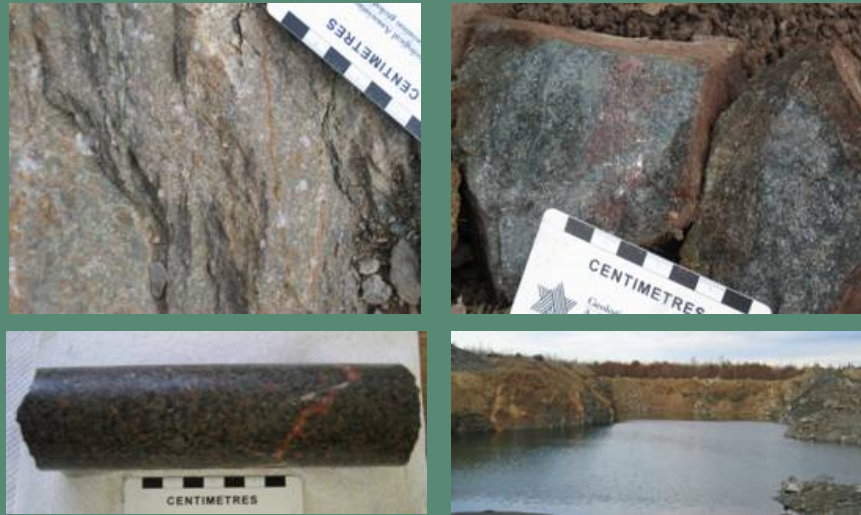


Some of the felsic volcanics within the Lawson Brook occur as extensive rhyolitic domes that are masked by the Carboniferous cover sequence to the north. They are commonly cross-cut by stockwork quartz veining and are usually pyritic. Investigations revealed that these domes are geochemically as well as geochronologically similar to those that host the Kuroko-type massive sulphide deposit at Harborside in Maine. A U-Pb zircon date obtained on a rhyolite dome near the Shannon area yielded a Late Cambrian age of 493±2 Ma (McLeod et al., 1992).



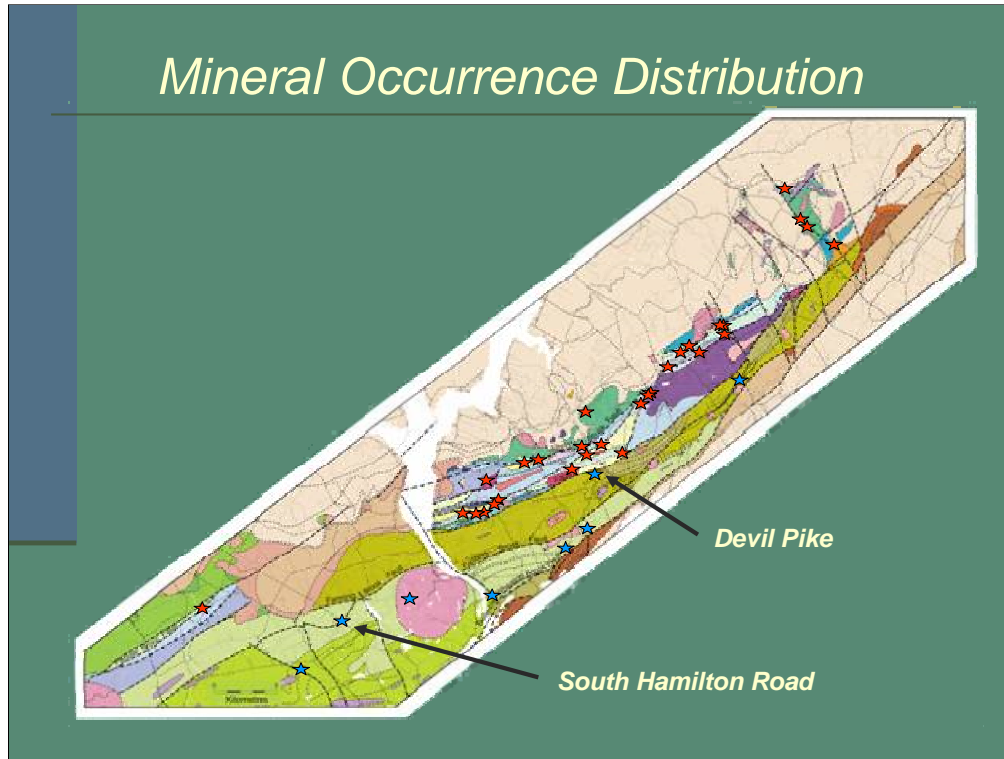
Finally, a small inlier of what is referred to as the Long Creek Formation occurs in the northeastern corner of the belt, shown here as the little patch of purple.

Cambrian-Ordovician and Silurian Intrusions



The Annidale Group sequence is also intruded by a number of Cambro-Ordovician intrusions that range from porphyritic rhyolites to coarse-grained mafic intrusions, a few of which are shown here in the two photos on the left and the top photo on the right. The sequence is intruded in the northeast part of the map area by the Stewarton Complex that is assumed to be of Silurian age. It consists of a mafic to felsic suite of rocks, which are pictured here in this aggregate quarry.

Mineral Occurrence Distribution



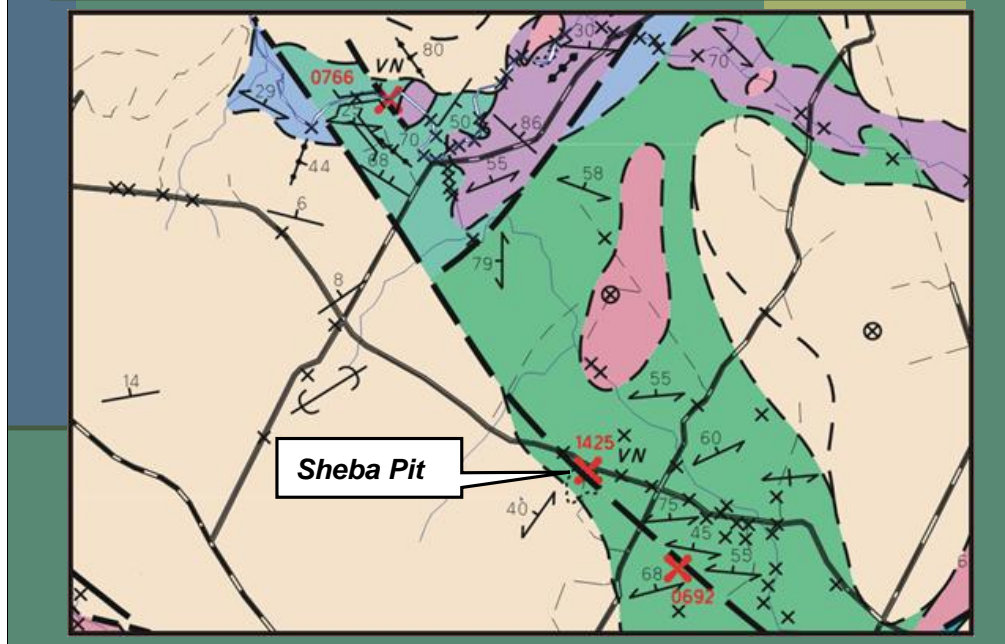
This map shows the distribution of the various gold (\pm base metal) occurrences within the Annidale Belt, which are represented by the red stars. Those within the Silurian Mascarene Group rocks are shown here as the blue stars. Worthy of mention within the Mascarene rocks are the Devil Pike and South Hamilton Road occurrences, where significant gold mineralization has been discovered. The Devil Pike property comprises three mineralized zones that were delineated during past drill programs conducted by Fosters Resources during the early to mid 1990's. Grades of up to 200 g/t Au have been reported from grab samples collected from quartz veins exposed in trenches. At the South Hamilton Road occurrence, which lies within the boundaries of CFB Gagetown, grab samples collected from outcrop exposures yielded up to 5 g/t Au (McLeod, 2000). Overall, the majority of the occurrences lie within the East Scotch Settlement Formation. During this field project, many of these occurrences were visited and sampled, and available drill core was examined. The following slides highlight a few of the higher grade occurrences that were subjected to the most exploration activity in the past. We begin with those in the northeast corner moving toward the southwest.

Sheba Pit - Au, As



One of several occurrences in the far northeastern corner is the Sheba Pit occurrence.

Sheba Pit - Au, As



This occurrence is hosted by mafic volcanics and gabbroic intrusions of the Lawson Brook Formation, and occurs along a major northwesterly trending fault zone.

Sheba Pit - Au, As



*Grab samples up to
22.5 g/t Au*



The Sheba Pit occurrence was discovered by prospector Emilio Doiron in 2001 (bottom photo on right) in an abandoned aggregate quarry. Initial grab samples of large angular altered and arsenopyrite-bearing gabbroic boulders that lined the wall of the pit assayed up to 22.5 g/t Au. The boulders were apparently derived from altered and veined material such as that shown in the two lower photos.

Sheba Pit - Au, As

*NW-trending shear zone
within gabbro*



*Quartz-carbonate
cemented breccia*

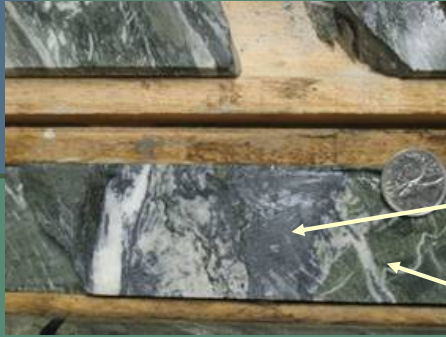
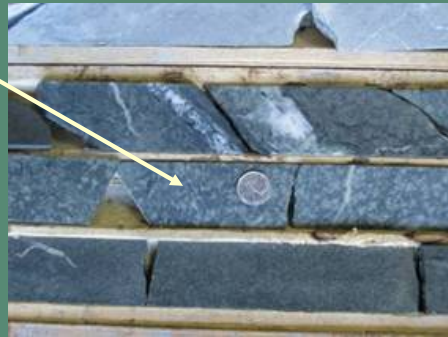


*Euhedral arsenopyrite
needles disseminated
throughout altered
gabbro; quartz-carbonate
veining throughout*

The mineralization was observed to be contained within a NW-trending shear zone that transects an ophitic gabbro intrusion along the southeast wall of the pit. The shear zone is characterized by quartz-carbonate cemented breccia, disseminated acicular arsenopyrite, and quartz-carbonate veining throughout the bleached gabbro.

Sheba Pit - Au, As

*Leucoxene alteration near
Au-bearing veins*



*Massive arsenopyrite-quartz-
carbonate vein; slightly Au-
mineralized*

Fuchsite alteration

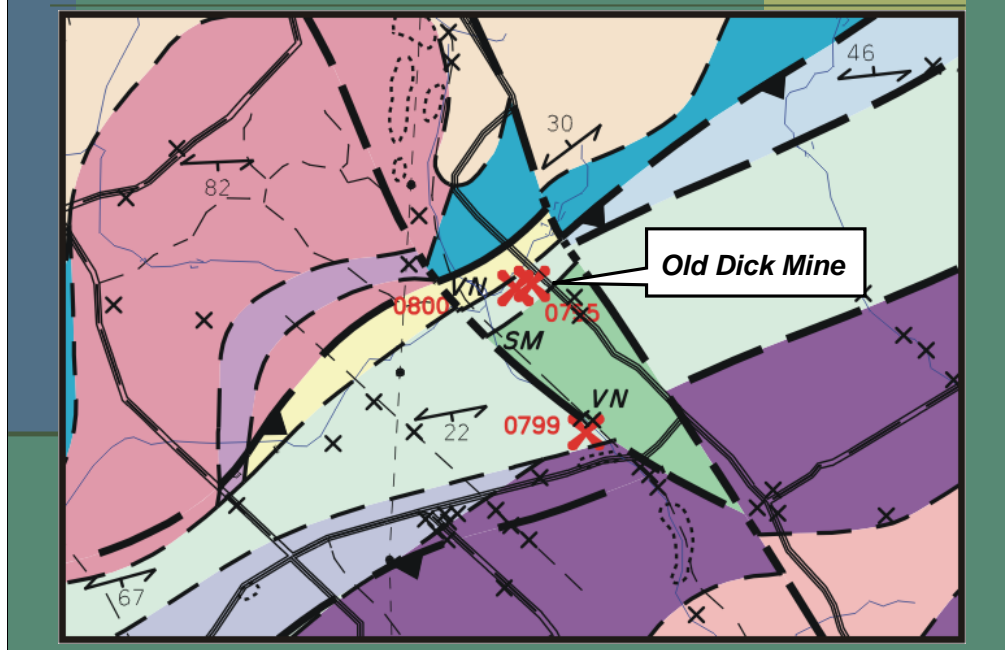
Pathfinder Resources Ltd. optioned the property from Southfield Resources and conducted an exploration program during the fall of 2001 and the summer of 2002, which consisted of a soil survey, Magnetometer and Induced Polarization geophysics, and a 14-hole drill program. Within the mineralized sections of the core, leucoxene alteration was evident within the gabbro near the gold-bearing veins. Massive arsenopyrite-quartz-carbonate veins, that had fuchsite alteration haloes, were also intersected during the drilling. Overall, drilling was unsuccessful at duplicating the grades found at the surface so the property was returned to the original claim holders. However, room remains for much more exploration in the area.

Old Dick Mine - Cu, Ag, Zn, Pb



Approximately 9 km to the southwest of the Sheba Pit occurrence is the site of the Old Dick Copper Mine.

Old Dick Mine - Cu, Ag, Zn, Pb



In 1916, ~40 tons of ore grading 9% Cu and 1.13 oz/t Ag were extracted from this occurrence and sold to the US (Wilson, 1927).

Old Dick Mine - Cu, Ag, Zn, Pb



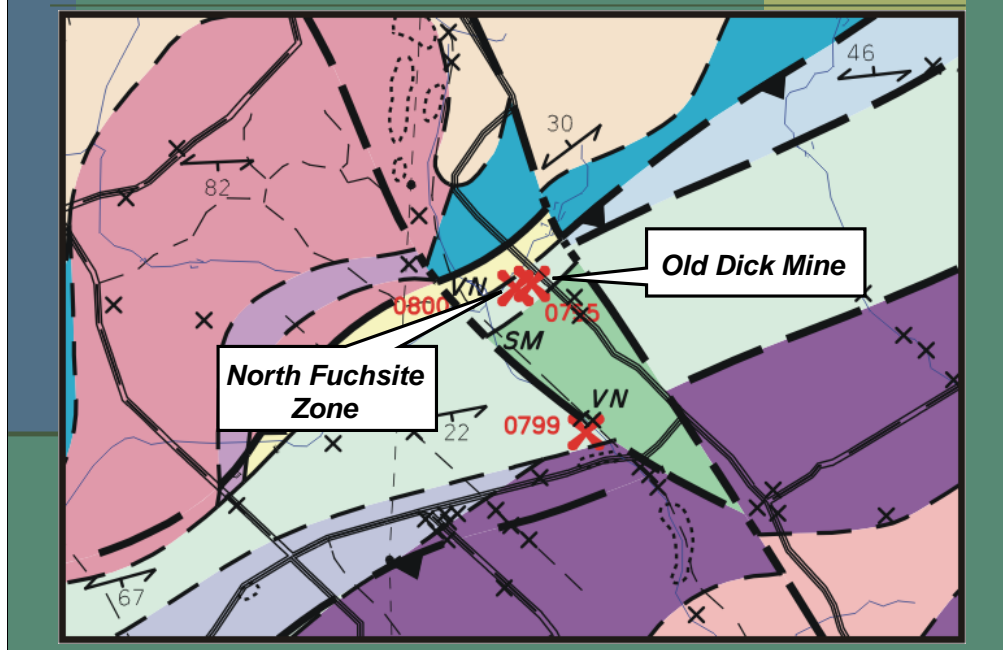
Mafic volcanic + sedimentary host rocks

Qtz + py + cp + minor sph + gn in veins



Mineralized outcrops are exposed in some of the old trenches. Host rocks to the stratiform and quartz-vein hosted copper, silver, lead, and zinc mineralization include mafic volcanic and sedimentary rocks of the East Scotch Settlement Formation. The grade of the mineralization ranges from 2-7% Cu. Very little gold mineralization has been found to date at this location.

North Fuchsite Zone - Au, Ag, Cu, As, Pb



However, approximately 200 m to the west, gold was discovered by Lac Minerals at the North Fuchsite Zone during their 1988 exploration program aimed at testing local Induced Polarization anomalies.

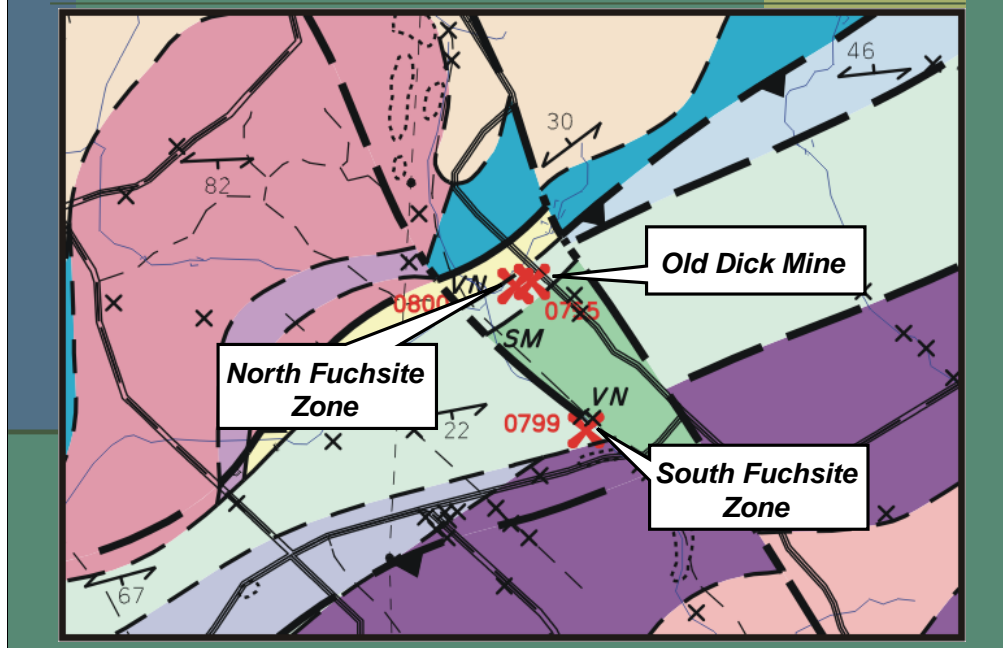
North Fuchsite Zone - Au, Ag, Cu, As, Pb



*DDH AN-88-7:
3.12 g/t Au over 1.52 m
(Lac Minerals, 1988)*

They drilled several holes in the area and discovered a small zone of gold mineralization at the top of drill hole DDH AN-88-7 in a 29 m wide alteration zone within metasediments and volcanics. Mineralization consisted mainly of arsenopyrite and carbonate alteration of metasediments that ran up to 3.12 g/t Au over 1.52 m. Later trenching over the projected site of the mineralized zone was unsuccessful at delineating the mineralized zone due to unstable ground conditions. In 1991, Lac drilled a hole beneath drill hole DDH AN-88-7, but were not able to follow the zone of mineralization at depth.

South Fuchsite Zone - Au, Cu, Ag, Zn, As, Pb

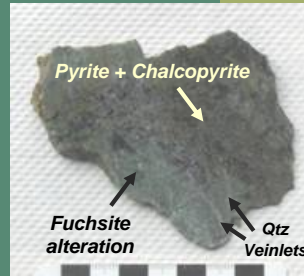
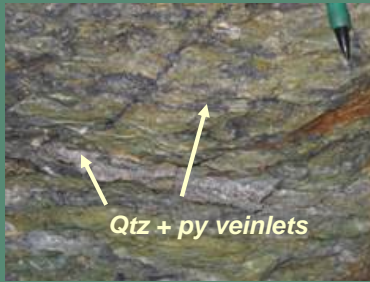


800 km to the south is the South Fuchsite Zone that was initially explored by Cities Services in the early 1970's when they conducted some trenching and drilling. Lac discovered this occurrence in 1983, which consisted of a drill intersection of 1 g/t Au over 1.5 m in conjunction with 15 g/t Ag, 3.52% Zn, 2.16% Pb, and 0.36% Cu in drill hole AN1-83-1 (Lac Minerals, 1984).

South Fuchsite Zone - Au, Cu, Ag, Zn, As, Pb



Drill intersection: 1 g/t Au over 1.5 m (Lac Minerals, 1983)



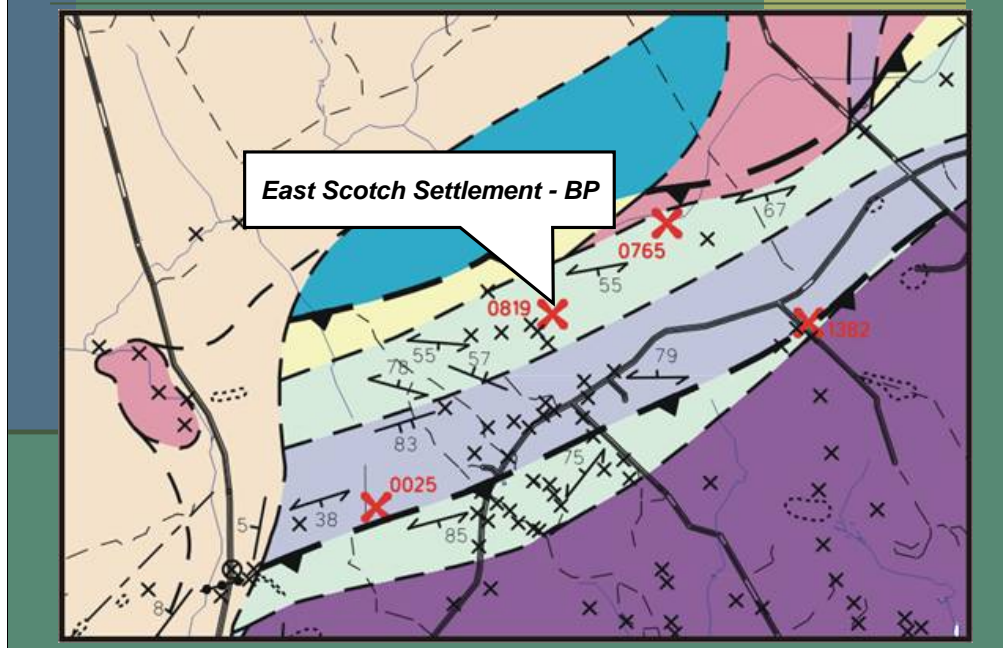
The mineralized area shown here in the photo on the top left is typically rusty and pervasively fuchsite altered mafic volcanics that are extremely deformed and cross-cut with quartz veining. There are several generations of quartz veining, the latest of which appears to have associated sphalerite, galena, and minor chalcopyrite. Investigations have shown that the mafic rocks that host this occurrence are of arc-related origin. In contrast, the mafic rocks in the rest of the belt have within-plate signatures.

East Scotch Settlement (BP) - Au, Cu, Zn, Pb, As



Another significant gold occurrence lies approximately 3.5 km to the southwest of the Annidale area.

East Scotch Settlement (BP) - Au, Cu, Zn, Pb, As



It is referred to as the East Scotch Settlement BP occurrence and is hosted by mafic volcanics of the East Scotch Settlement Formation.

East Scotch Settlement (BP) - Au, Cu, Zn, Pb, As



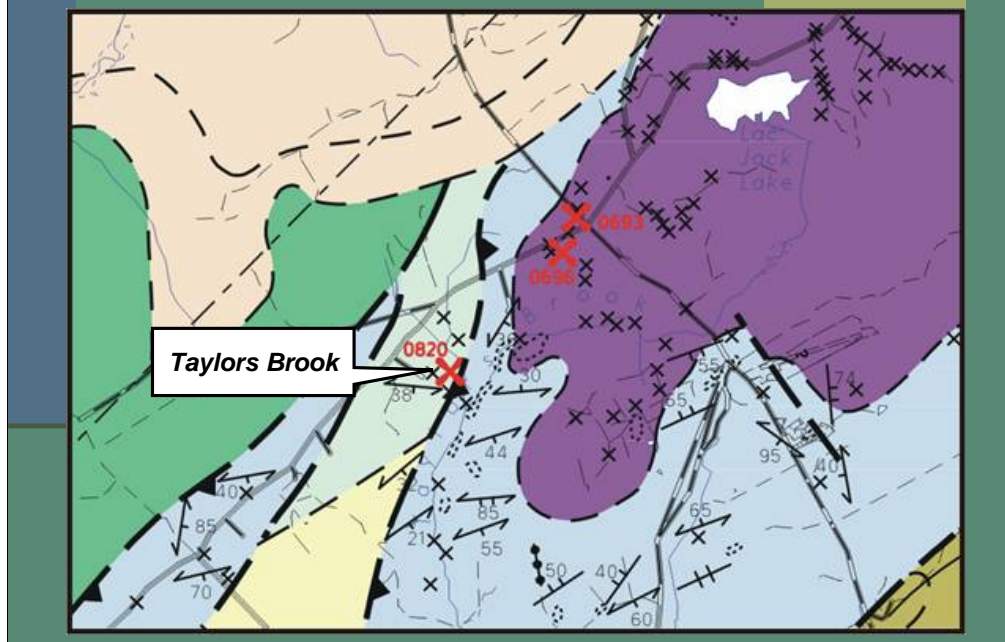
The East Scotch Settlement BP occurrence was discovered during exploration in the area by BP Resources in the late 1980's. Initial discoveries of gold mineralized boulders containing up to 13 g/t Au triggered the onset of an extensive exploration program that consisted of till and soil sampling, trenching and eventually drilling. Trenching in 1989 uncovered two gossan zones that contained up to 4.7 g/t Au and in 1990, a quartz veined shear zone yielded a grab of over an ounce of gold per ton. Results of the drilling were disappointing. Above are a couple of photos showing the typical nature of the mineralized samples with sericite and fuchsite alteration of the host rocks as well as quartz flooding and veining.

Taylor's Brook - Au, Cu, Pb, As



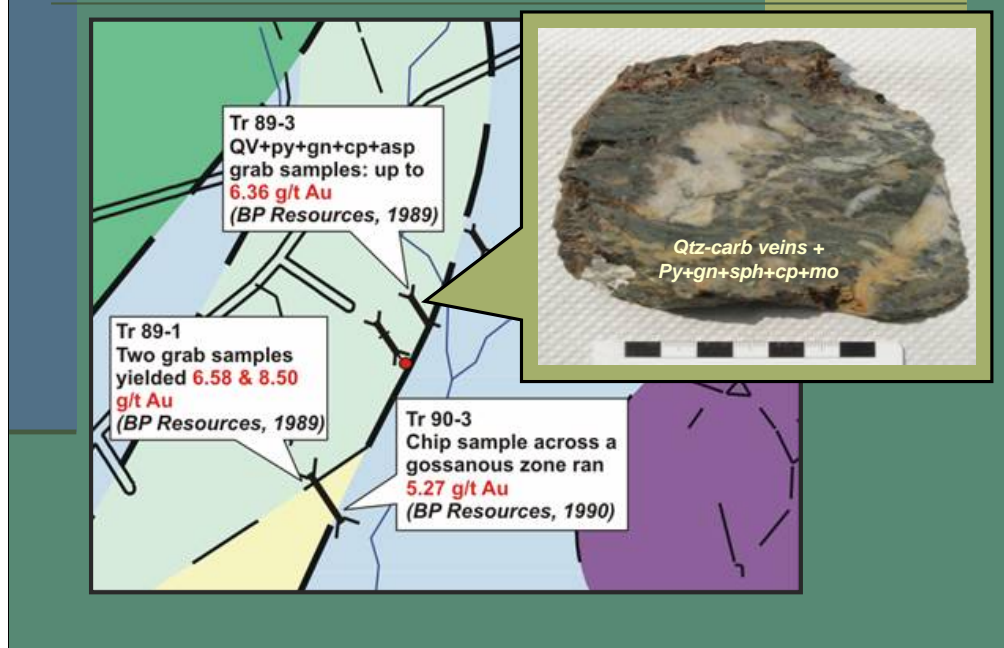
Near Stewarton Corner, some 5 km to the southwest of the BP occurrence, is what is referred to as the Taylor's Brook occurrence.

Taylor's Brook - Au, Cu, Pb, As



This occurrence was also actively explored by BP Resources in the late 1980's to early 1990's.

Taylor's Brook - Au, Cu, Pb, As



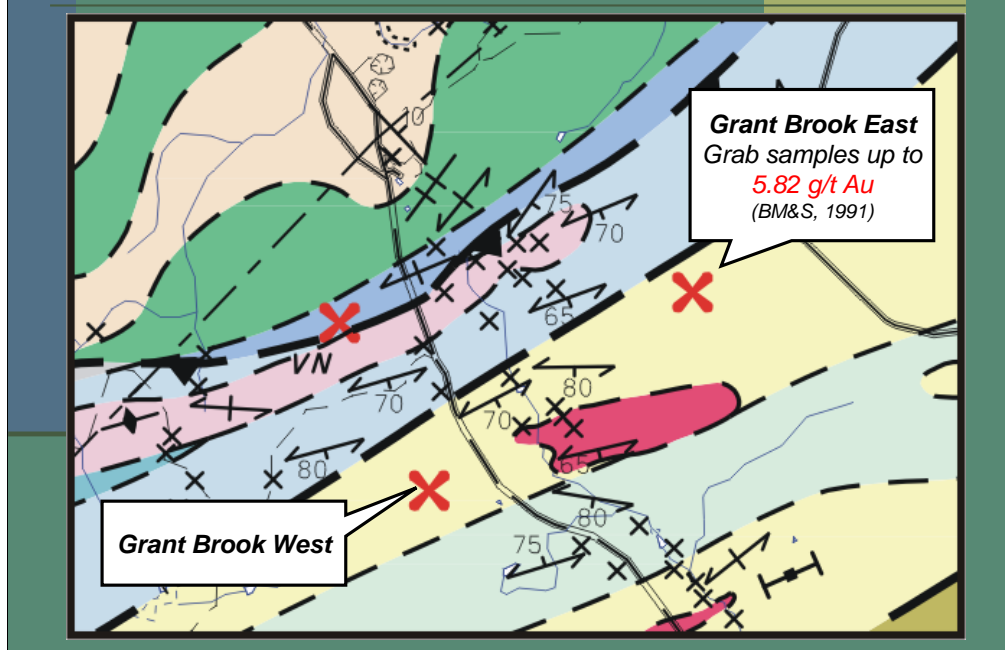
They conducted some trenching and drilling within the East Scotch Settlement Formation and along the thrust contact with the Queen Brook Formation to the east. Grab samples from the various trenches contained gold in the range of between 5 to 8.5 g/t Au, and typically consisted of grey-green metasiltsstones with contorted quartz-carbonate veining containing pyrite, galena, sphalerite, chalcopyrite, and minor molybdenite. BP only drilled one hole at this location and results were disappointing. However, room remains for more exploration in this area.

Grant Brook West - Au, Cu, Ag



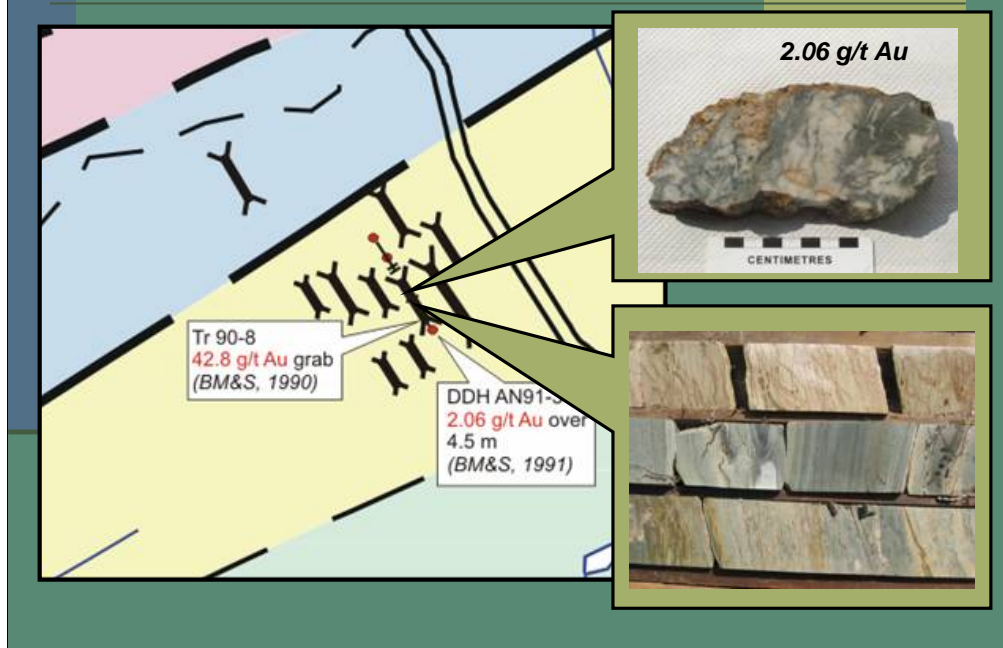
Further to the southwest, near Grant Brook, Brunswick Mining and Smelting conducted an extensive exploration program within the rocks of the East Scotch Settlement and Queen Brook formations.

Grant Brook West - Au, Cu, Ag



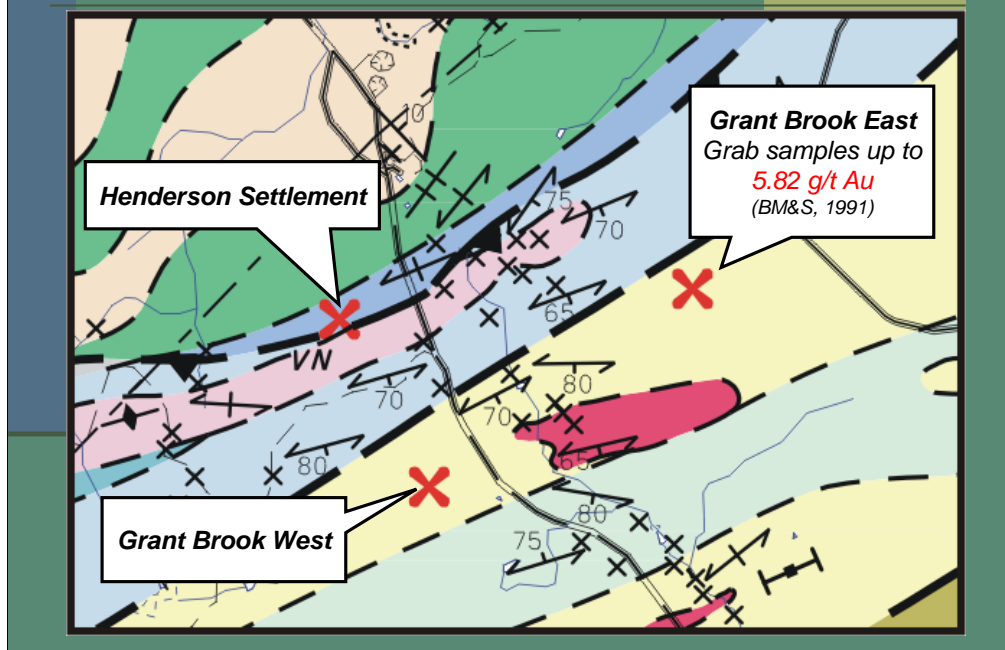
At the Grant Brook East occurrence, they collected grab samples that yielded up to 5.82 g/t Au.

Grant Brook West - Au, Cu, Ag



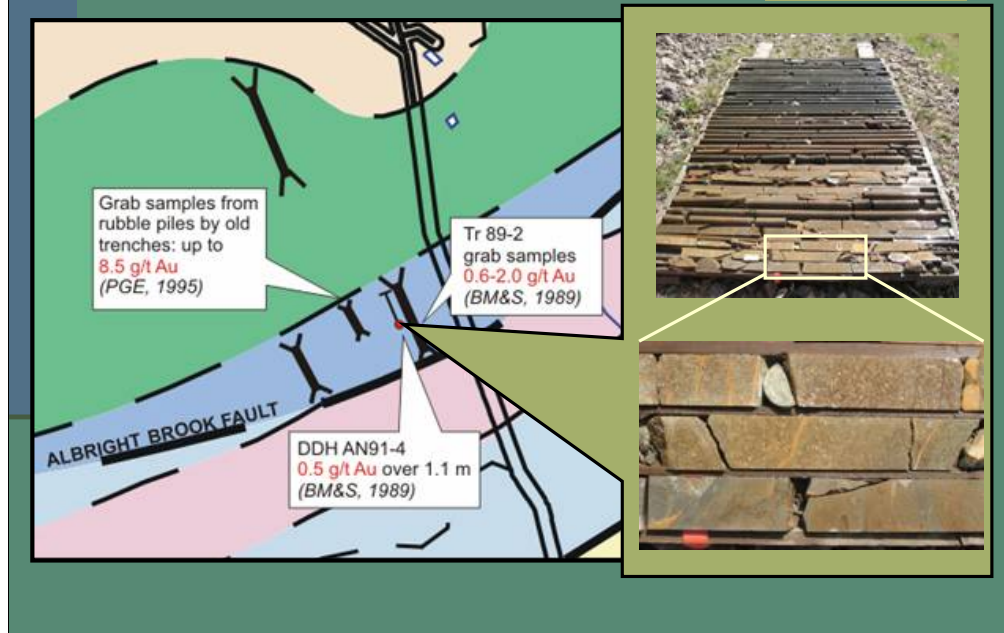
At the Grant Brook West occurrence to the southwest, the company discovered up to 42.8 g/t Au during their initial trenching program. This slab (upper right) of quartz-carbonate veined metasediment that was taken from the rubble piles near trench 90-8 assayed a little over 2 g/t Au. Limited drilling by the same company in 1991, yielded gold values up to 2.06 g/t Au over 4.5 m within sericitized and quartz veined metasediments. The drill core shown in the photo is from a higher grade intersection in drill hole ANN-91-3.

Henderson Settlement - Au, Ag



To the north of the Grant Brook West occurrence, Brunswick Mining and Smelting discovered the Henderson Settlement occurrence.

Henderson Settlement - Au, Ag



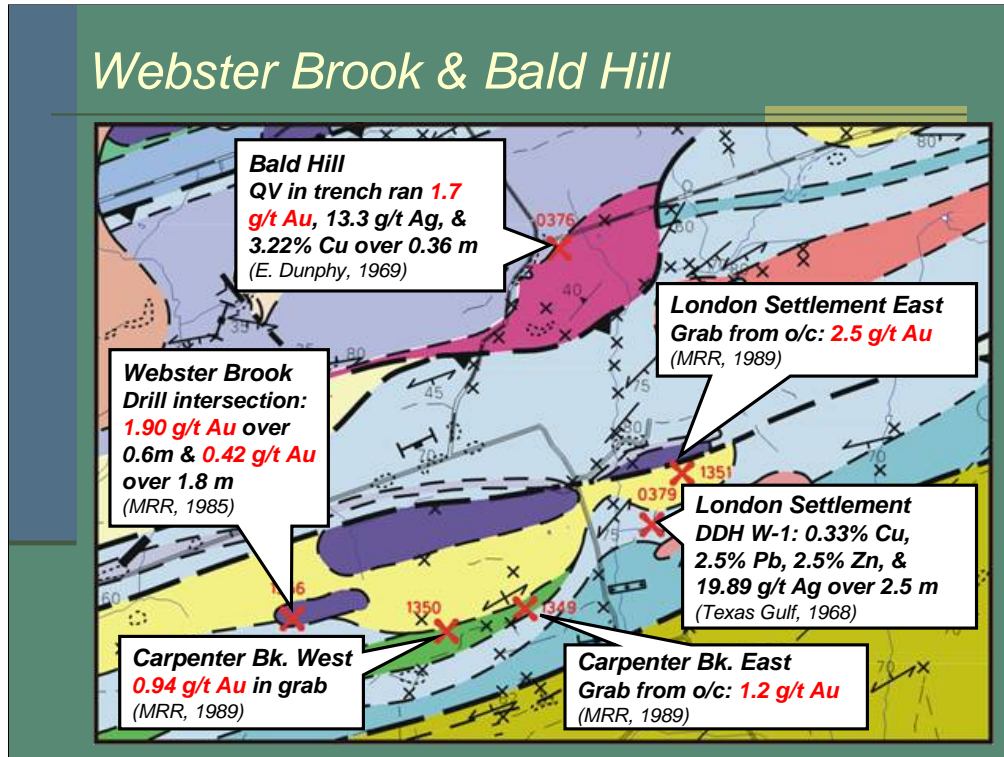
Mineralized subcrop of gabbro or diorite is located just to the north of the Albright Brook thrust fault within the Queen Brook metasediments. In 1982, trenching by Brunswick Mining and Smelting uncovered grab samples that ran between 0.6 and 2.0 g/t Au within a mineralized mafic intrusive. Drilling in 1991 yielded a low grade intercept of 0.5 g/t Au over 1.1 m within volcanics overlying a coarse-grained carbonate, margarite, and fuchsite altered mafic intrusive. Since then, PGE Resources re-examined the old trenches and located grab samples within the rubble piles that assayed up to 8.5 g/t Au.

Webster Brook & Bald Hill



Further to the southwest, but east of the Saint John River, is another area that has numerous gold occurrences, which primarily occur within the Queen Brook Formation.

Webster Brook & Bald Hill



At the London Settlement East occurrence, Maritime Resource Research obtained a grab sample that yielded 2.5 g/t Au. At the London Settlement occurrence and Texas Gulf discovered Cu, Pb, Zn, and Ag mineralization during drilling of an EM conductor. Gold has also been found in outcrop at the Carpenter Brook East occurrence, up to 1.2 g/t Au and a grab sample at Carpenter Brook West had up to 0.94 g/t Au. Of greater importance are the Bald Hill and Webster Brook occurrences. Trenching at Bald Hill in the late 1960's uncovered a mineralized quartz vein within rhyodacite. A sample of wall rock and quartz vein material ran 1.7 g/t Au, 13.3 g/t Ag, and 3.22% Cu over 0.36 m. The Webster Brook occurrence was discovered during drilling by Maritime Resource Research, where they intersected 1.90 g/t Au over 0.6m and 0.42 g/t Au over 1.8 m within a variety of sheared intermediate volcanics and black graphitic shale.

Conclusions

- *Annidale Group rocks are metal-rich*
- *Structurally controlled mineralization*
- *Common characteristics:*
 - *Quartz-carbonate veins*
 - *Cubic pyrite and acicular arsenopyrite*
 - *Alteration: silica, carbonate, fuchsite, and/or leucoxene*
- *Future Work*
 - *Petrographic examination of the various Au occurrences*
 - *Isotopic investigation (S, O, H, C) to establish a source of the fluids; genetic model*

The sedimentary and volcanic rocks of the Annidale Group comprise a distinct belt of metal-rich rocks that are host to a number of gold and/or base metal occurrences that are structurally controlled. These occurrences commonly consist of quartz-carbonate veins that contain cubic pyrite and acicular arsenopyrite. Associated alteration comprises silica, carbonate, fuchsite, and/or leucoxene. Petrographic and isotopic investigations will be ongoing in an effort to establish the source of the fluids and hence, a genetic model.

Selected References

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